

NextGen Workforce Development



Survivor School

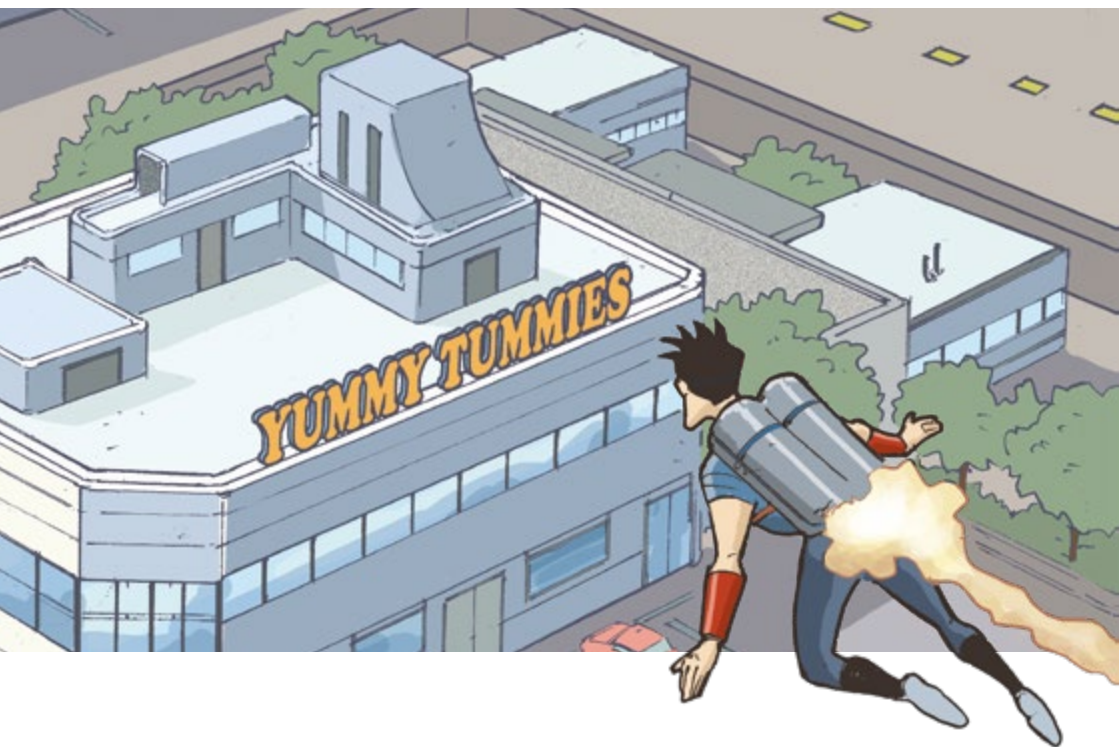
for Infectious Disease Outbreaks

Editors: PL Ooi, S Vasoo, A Henderson



Survivor School

for Infectious Disease Outbreaks



Featuring

EPI-FORCE, URBAN HEALTH ADVENTURES

by Ali Rosledzana, Qi Gao, Steven Ooi, Sonny Liew, Nicholas Liem

This graphic novel series is an educational gift to the world from the National Centre for Infectious Diseases and the Saw Swee Hock School of Public Health, National University of Singapore, for purposes of applied epidemiology training.

Page 89 : *Vigilant Against Threats*

Page 163: *The Bug Stops Here*

Page 237: *Enemies in Our Midst*

Page 311: *Survivors Morphing Heroes*

Survivor School for Infectious Disease Outbreaks

A Creation of

The NCID Academy

in commemoration of 2026 World Field Epidemiology Day

by

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Dedication



To outbreak workforces worldwide, everyday stout-hearted (also light-hearted) people who have chosen to serve on the frontlines of infectious diseases prevention and control in these extraordinary times when health systems are being stressed by pressures from without and within... this is for you!

NextGen Workforce Development Finding Inspiration

At the NCID Academy, we recognise that every individual has a different learning style and learners should pace themselves accordingly. Customisable, interactive educational platforms provide us with the autonomy to explore topics that resonate with each of us, fostering a sense of ownership over our education. By breaking down traditional subject silos and encouraging further reflection, our learners discover their strengths to tackle real-world problems. This is capacity strengthening which promotes transdisciplinary learning, acknowledging that the challenges of the future require synthesis of diverse knowledge areas.

Within the framework of global health partnerships, we are serving as a hub for innovative learning methods, and sharing our experiences in progressive training workshops with countries in the region and around the world. The notion of infusing entertainment into education is called edutainment. Edutainment makes learning fun and engaging, capturing the learner's attention and making it easier to absorb and retain knowledge. It can turn complex or mundane subjects into entertaining and memorable experiences.

We are grateful to our many colleagues, both local and international, whose insights have played an integral role in shaping this handbook. Their dedication to the outbreak epidemiologic sciences for readiness and research, and their collaborative spirit have been instrumental in upholding the high standards of allied training in applied epidemiology. Working together to share 'war' stories has truly been a rewarding experience!

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Foreword

by the
Director-General of Health

*Image retrieved from
National University Health System*

Throughout history, societies have been tested by infectious diseases that challenge not only our health systems, but our resolve, solidarity, and imagination. Each outbreak reminds us that preparedness is not built in moments of crisis alone. It is shaped in the years preceding an outbreak, through learning, practice, and the quiet commitment of people who choose to serve the public good. At the heart of every effective response stands a capable, resilient, and inspired outbreak workforce.

Survivor School for Infectious Disease Outbreaks is grounded in this conviction. It reflects a belief that excellence in outbreak response can be taught, nurtured, and sustained through purposeful education. By blending scientific rigour with experiential learning, real world case studies, and reflective practice, this handbook redefines how applied epidemiology and One Health competencies can be developed for a rapidly changing world.

What distinguishes this work is its recognition that outbreak response is as much about judgement, leadership, and communication as it is about technical skill. The handbook acknowledges the realities faced by practitioners working under pressure, amid uncertainty, and across disciplines. Its modular and stackable approach offers learners multiple pathways to growth—supporting both those at the start of their careers and those seeking to deepen their expertise as they take on greater responsibility.

The creative design of NextGen Workforce Development speaks to the realities faced by health systems across diverse contexts. Its focus on outbreak readiness

and research, global-urban health security, and leadership for risk management mirrors the complex skill sets required of modern public health professionals. Equally important is the emphasis on communication, reflection, and professional judgement. These are capabilities that are often tested most severely during crises.

Importantly, this handbook is conceived as a global public good. Its adaptable design allows it to be used across diverse health systems and contexts, reinforcing the idea that preparedness is a shared endeavour. In strengthening individual capability, we strengthen collective resilience locally, regionally, and globally.

As new health threats emerge and familiar ones evolve, the need for courageous, well-prepared public health professionals will only grow. *Survivor School for Infectious Disease Outbreaks* stands as both a guide and an invitation: to learn continuously, to lead with humility and confidence, and to serve communities with skill, integrity, and purpose. It is my hope that this handbook will inspire the next generation of epidemiologists and public health leaders to rise to these challenges and shape a safer, healthier future for all.

I am pleased at the timely publication of this handbook. As health threats continue to evolve in speed, scale, and complexity, the need for fresh approaches will only grow. This work will be of value to those embarking on careers in public healthcare, to practitioners seeking to deepen their expertise, and to institutions committed to strengthening outbreak readiness through sustainable workforce development. It is an important contribution to the field of outbreak epidemiologic sciences.

Prof (Dr) Kenneth Mak

*Director-General of Health,
Ministry of Health, Singapore*



Preface

*Image retrieved from
National Centre for Infectious Diseases*

DEVELOPING OUR NEXTGEN WORKFORCE

Outbreak epidemiologic sciences education must cope with ever changing infectious disease circumstances. In recent years, I had the privilege to work with the World Bank as a One Health consultant, and with the WHO-FAO-WOAH as a technical advisor on the framework of competencies for One Health field epidemiology. We acknowledged that our next generation workforce must embrace complex threat response. At the same time, we needed a dynamically engaging approach that leverages on the power of media to make education not just accessible but also entertaining. Here is where *Survivor School for Infectious Disease Outbreaks* comes in.

The training landscape is undergoing profound transformation, driven by AI and technology, changing expectations, and the need to be very adaptable in a dynamic world. Traditional education methods are getting outmoded in our modern learning landscape. In the shifting terrain of workforce development, the idea of NextGen was conceived as a novel approach to engage, inspire, and prepare younger learners for life's many challenges and opportunities. This handbook serves as a companion volume to our coursework delivered at the NCID Academy. Edutainment, as we call it, is not about sacrificing substance for style; it's about enhancing the educational experience.

Storytelling, humour and skits have long been used as teaching tools. However, the digital age has ushered in unprecedented demands for entertainment. Educational content can now be delivered through interactive games, engaging

videos, agentic learning and more, making the journey of discovery irresistibly enjoyable. Edutainment does not mean trivialising knowledge but making it more accessible, relatable, and memorable, recognising that our journey should be both fun and fulfilling. We tap into innate human desires such as curiosity, exploration, and play. Experiential learning and immersive storytelling are used to captivate learners and create lasting impressions. This empowers educators to transform complex concepts into digestible, engaging content that sticks with learners long after the lessons end.

Naturally, ours is a work in progress and may not be immediately applicable in all educational contexts. As we continue with partners on this journey, we will be experimenting and delving further into how we can all benefit from the strengths of this approach—examining how it impacts learners from all ages and backgrounds, exploring the various mediums and strategies that are effective to create educational content, and motivating individuals in their quest for education.

As a child growing up with two siblings in Ipoh, Malaysia, playing in the river, limestone caves and nearby jungle brought me very close to One Health long before the concept was introduced. During the 1980s, I began public health work in Singapore when it was transitioning from third world to first under PM Lee Kuan Yew. Crisis after crisis threw up situations whereby institutions, industries, and individuals adjusted to outbreak requirements for lockdowns, remote work and learning, stepped-up hygiene, and measures for business continuity. All the years of perseverance has brought me to this moment which honours my Creator, my parents, my teacher-mentors, my spouse, and my daughter. They have taught me many things.

The time for future-readying is now—it is a vision that bridges the gap between entertainment and enlightenment, making education an enriching and delightful experience for all. Welcome to NextGen Workforce Development.

Assoc Prof (Dr) Steven PL Ooi

*Senior Consultant and Head (Training and Education),
National Centre for Infectious Diseases*



To Our NextGen Workforce

What Global Health Leaders Say...

A SCHOOL FOR GLOBAL HEALTH

Global health stands at the intersection of emerging infections, chronic conditions, and novel health threats. I am pleased, on the occasion of our Centre's 7th anniversary (7 September 2026, also World Field Epidemiology Day), to oversee the launch of NCID Academy with a global health mission to protect populations against pathogens, and keep our modern urban lifestyles safe from infectious disease. The importance of health and well-being has never been more pronounced. In this intricate tapestry, applied epidemiology stands as a sentinel, tirelessly unravelling the threads of disease, uncovering patterns, and ultimately weaving a narrative of prevention and intervention.

Survivor School for Infectious Disease Outbreaks is a journey into the heart of our training on outbreak readiness and research. It is a guide through the corridors of NextGen Workforce Development by our NCID Academy to illuminate the principles, practices, and challenges that define the field, offering a comprehensive exploration of the tools and techniques available to infectious disease clinicians and epidemiologists in their quest to understand and mitigate the impact of diseases on populations. Its narrative unfolds through the lens of those who traverse the frontlines of health crises.

Delving into the One Health approach in deciphering the complex web of factors that influence outbreaks, and the critical role of leadership, chapters within are designed to serve as a resource for anyone with interest in understanding how epidemiologic sciences and liberal arts can blend in education. Whether you are a trainer-mentor seeking an introduction to novel training methods or an experienced professional looking to deepen your knowledge, this book strives to be a companion on your journey into the intricate landscape of outbreak epidemiologic sciences.

This publication is a gift to global health, and a testament to the importance of multisectoral professional collaboration and knowledge sharing. It is an ode to the worldwide outbreak workforce, their unwavering commitment to the pursuit of evidence-based solutions, and their dedication to building a healthier, more resilient global community. It offers readers a tangible sense of the challenges faced by those who navigate the uncertainties of the field.

Assoc Prof (Dr) Shawn Vasoo

Executive Director, National Centre for Infectious Diseases, Singapore

CONNECTING ACROSS THE REGION

This handbook will serve as a valuable resource across the region and beyond, contributing meaningfully to stronger, more resilient health systems worldwide.

Infectious diseases remain a defining challenge for health systems across the region and globally, transcending national boundaries and requiring sustained cooperation between countries, institutions and disciplines. In an era marked by increased connectivity, urbanisation, and emerging biological threats, resources such as this handbook help us to strengthen outbreak preparedness for informed responses to both familiar threats and novel pathogens.

From a health security standpoint, effective infectious disease control depends on the ability to translate scientific evidence into operational guidance that can be consistently applied across diverse health system contexts. This handbook makes an important contribution by bridging clinical practice and public health priorities, supporting policymakers and practitioners alike in aligning frontline decision-making with broader population health objectives.

In strengthening the shared language and understanding between clinicians, public health professionals, and policymakers, this handbook contributes to more coherent governance of infectious disease outbreak threats. It will be a valuable resource for training, education, and strategic planning, supporting health systems in building resilience, maintaining public trust, and safeguarding populations.

Equally important is the role of shared learning in the outbreak epidemiologic sciences. By distilling experience and expertise into an accessible reference, this handbook promotes a common understanding across countries and sectors, strengthening collaboration and mutual accountability. Such resources are essential in supporting capacity building, workforce development and international health collaborations.

I commend the editors and contributors for their innovation in the production of the *Survivor School for Infectious Disease Outbreaks*.

Datuk (Dr) Chong Chee Kheong

*Contributing Scholar, Johns Hopkins Center for Health Security, USA
Senior Health Advisor for the ASEAN Mitigation of Biological Threats Programme
formerly Deputy Director-General of Health (Public Health), Ministry of Health,
Malaysia*

EDUCATING THE NEXT GENERATION

The foundations of NextGen Workforce Development rest on a combination of theoretical knowledge, practical application, and the cultivation of a mindset that thrives in the face of uncertainty. This forms the linchpin in fortifying our collective ability to understand, respond to, and ultimately triumph over the myriad challenges posed by infectious and chronic diseases. As the global community faces an ever-evolving array of health threats, from novel pathogens to the persistent challenges of existing diseases, the need for skilled epidemiologists has never been more acute.

The Lee Kong Chian School of Medicine is working with the National Centre for Infectious Diseases on an academic clinical programme for infectious diseases that is uniquely novel. Through graphic novels, learning road maps, and musings from seasoned epidemiologists, it aims to inspire and equip the next generation of disease detectives.

This handbook demonstrates the pivotal role that skill development plays in preparing the next generation of field epidemiologists. It serves as both a compass for those navigating the complex landscape of epidemiological training and a tribute to the educators and mentors who mould the minds of those dedicated to the science of safeguarding communities. Based on the real-world experiences, case studies and invaluable insights from seasoned field epidemiologists, this book aims to inspire and educate the next generation of disease detectives. It's a handbook for those who wish to venture into the field and take up the mantle of protecting public health.

The journey through the pages of *Survivor School for Infectious Disease Outbreaks* mirrors the dynamic and adaptive nature of applied epidemiology training itself. It is a journey marked by curiosity, resilience, and the unwavering commitment to the well-being of communities. Whether you are a student embarking on your epidemiological education or a seasoned professional seeking to enhance your skills, this book serves as a valuable companion in your quest for knowledge and mastery of the field.

Prof (Dr) Joseph Jao-yiu Sung

*Senior Vice President (Health and Life Sciences), Nanyang Technological University and Dean, Lee Kong Chian School of Medicine, Singapore
formerly President of the Chinese University of Hong Kong, People's Republic of China*

DECIPHERING MYSTERIES OF EPIDEMICS

Survivor School for Infectious Disease Outbreaks is a tribute to Singapore's tireless training efforts, and a guiding light for those who aspire to follow in these footsteps. So, as you flip through its pages, remember that you are not just reading about a profession; you're joining a noble endeavour to safeguard public health, one investigation at a time. It's a journey that's as rewarding as it is challenging, and it is an opportunity to make a difference that transcends borders and generations.

SAFETYNET is a professional network dedicated to strengthening health systems across the Asia-Pacific region. In this fascinating world, there exists a cadre of unsung heroes, silently combating the unseen forces that threaten our well-being. They are the field epidemiologists, otherwise known as disease detectives, who venture into the heart of outbreaks, armed not with magnifying glasses but with knowledge and dedication. This is not merely a discipline; it's a calling, a commitment to safeguarding communities from infectious diseases, environmental hazards, and emergent threats.

As we go through the pages of this book, we engage on a journey through the fascinating realm of NextGen Workforce Development and capacity strengthening. We delve into the art and science of outbreak investigation, contact tracing, data analysis, and public health surveillance. These intrepid professionals learn to decipher the mysteries of epidemics, untangle the web of causation, and make data sing like a symphony. It's a journey that requires not just knowledge but courage, compassion and collaboration.

Enter our world where the pursuit of knowledge is a shield, and the quest for truth is a beacon of hope for healthier communities. Epidemiologists do not just crunch numbers; they provide comfort, convey crucial information to policymakers, and bring solace to affected communities.

Let this handbook be a testament to our collaborative spirit that defines the world of applied epidemiology training. It is an ode to the educators, mentors, and practitioners who dedicate their lives to shaping the next generation of health leaders.

Dr Maria Consorcia Lim-Quizon

Executive Director, SAFETYNET

Asia-Pacific regional training network, headquartered in Manila, Philippines

BEING PREPARED, BEING READY

More than half of the world's population live in urban settings and by 2050, this proportion is expected to increase to two-thirds. With infectious disease threats continuing to emerge, the challenge of pandemics is far from over. Such a serious challenge brings opportunities, and it is our responsibility to strengthen preparedness and resilience before the next outbreak emerges.

At the Communicable Diseases Agency, we recognise that building a prepared and resilient workforce is central to Singapore's ability to detect, prevent and respond to infectious disease threats.

Drawing on Singapore's experience in outbreak response, especially during the COVID-19 pandemic, now is the time to build on the opportunities for epidemiologists to strengthen local and regional partnerships and to envision how we want to shape our future. As our world becomes increasingly interconnected, local communities must be engaged in whole-of-society preparedness planning and readiness. Vulnerable groups must also be better informed and involved. The measure of our preparedness lies in how effectively we advance a multisectoral approach in responding to outbreaks.

As a course companion complementing applied epidemiology training courses, *Survivor School for Infectious Disease Outbreaks* aims to guide learners on a journey to better understand disease determinants in urban settings, and the challenges involved in outbreak readiness and research. It also highlights the importance of engaging various stakeholders such as healthcare providers, national security organisations, private sector partners and local community leaders in strengthening preparedness and response efforts.

Outbreaks, by their very nature, are unpredictable. While scientists and public health experts had warned about the possibility of a novel virus causing a global pandemic, the rapid spread and impact of COVID-19 took the world by surprise. This unpredictability is a stark reminder that we cannot afford to be complacent when it comes to our preparedness for such events. I am confident that this resource will help prepare the next generation of public health professionals for the infectious disease threats of tomorrow.

Prof (Dr) Vernon Lee

*Chief Executive Officer,
Communicable Diseases Agency, Singapore*

THINKING OUTSIDE THE BOX

Congratulations to Singapore for this timely initiative, *Survivor School for Infectious Disease Outbreaks*, thinking outside the box to offer NextGen Workforce Development for the world! Across the globe, we have seen a growing urgency amongst partners and stakeholders to focus on readying for the future—on preparedness, sustainability, ensuring health security, and strengthening health systems.

TEPHINET (Training Programs in Epidemiology and Public Health Interventions Network) is a global network whose primary goal is to build a sustainable, competent field epidemiology workforce to detect and respond to health threats. It has supported the international community in developing and implementing the framework on essential public health functions, and in providing technical advisories to help establish the competencies for One Health field epidemiology for the Quadripartite, WHO-FAO-WOAH-UNEP.

In addition, we are engaging with key partners to highlight strategies for reimagining the global network and coordinating the work of the broader Global Field Epidemiology Partnership to implement its strategy. The strategy will broaden our scope to encompass interactions between field epidemiologists and other stakeholders engaged in public health emergencies to enhance multi-disciplinary approaches, as well as support interventions to maximise employability, deployment and impact of the global public health workforce.

We are dedicated to growing and strengthening our precious global network of public health detectives through workforce development. We work with key partners to drive progress on the new TEPHINET strategic roadmap, supporting countries in growing their programmes, strengthening regional networks, integrating into national health systems, providing accreditation for quality improvement of FETPs, and promoting continuing professional education for alumni to build skills beyond graduation. *Survivor School for Infectious Disease Outbreaks* is a good example of thinking outside the box and unconventional learning to stay relevant and effective amidst change.

Dr Carl Reddy

Director, TEPHINET

Global field epidemiology training network, headquartered in Atlanta, USA

INVESTING IN COOPERATION AND INNOVATION

One of the most profound lessons from epidemic disease is the extent of our global interconnectedness. In a pandemic, the virus quickly transcends borders and continents, affecting virtually every corner of the globe. This interconnectedness highlights the need for international cooperation and a coordinated response to pandemics. No single country can effectively combat a global health crisis alone. We work together to share information, resources, and expertise to address the many challenges.

Emerging infections have emphasised the critical importance of pandemic health preparedness. Early detection, contact tracing, and effective communication are vital tools in controlling the spread of infectious diseases. Public health systems must be strengthened to respond swiftly and efficiently to outbreaks, with a focus on early intervention to prevent widespread transmission. As we emerge from crises, we must not forget these lessons. Instead, we should use them to inform our actions and policies, investing in preparedness, cooperation, and innovation to ensure that we are better equipped to face future pandemics.

Infectious diseases place a strain on healthcare systems worldwide. They underscore the importance of investing in global health infrastructure and building capacity to respond to surges in demand during epidemics. It also highlights the need for effective planning and stockpiling of essential medical supplies. The rapid development of vaccines is a remarkable achievement of science and collaboration. Only by learning from our wake-up call can we hope to build a safer world for generations to come. There is urgency in our need to address these vulnerabilities and shortcomings in our infrastructure and workforce.

Survivor School for Infectious Disease Outbreaks deals with the unpredictable nature of infections, the significance of global interconnectedness, and the importance of pandemic preparedness and resilience. We are heartened to offer Singapore's perspective through this publication which has the support of the National University of Singapore's School of Public Health.

Prof (Dr) Teo Yik Ying

*Vice President (Global Health), National University of Singapore
and Dean, Saw Swee Hock School of Public Health, Singapore*

HONING SKILL WITH HUMAN VALUES

Survivor School for Infectious Disease Outbreaks arrives at a time when the need to reimagine how we prepare the health workforce has never been more urgent. What distinguishes this handbook is its ability to convey serious ideas and concepts and make them accessible to the learner. Through storytelling, reflection, and scenario-based learning, it gets at something we too often leave unspoken: Outbreak response is not solely a technical exercise; it is human work, built on ethics, trust, and the relationships between communities and the institutions meant to serve them.

The authors of this handbook have recognised the importance of building human values into training design; prudence, justice, fortitude, temperance. For the practitioners I have worked alongside in difficult settings, these are not abstract ideals; they are the choices made on a daily basis. By building those values into its design, this handbook helps shape a workforce that is not only skilled but also guided by humanity.

The training landscape is rapidly evolving and requires innovation to meet learners needs. No country or institution can do this work alone. It takes partnerships across borders, universities, training networks, and public health agencies to co-create learning that genuinely adapts to local needs. This handbook is a good example of what that kind of collaboration can achieve, bringing local experience and global knowledge into the same conversation. It also shows that education can do more than inform. At its best, it prepares people not only to respond to outbreaks, but to lead through them.

My hope is that *Survivor School for Infectious Disease Outbreaks* proves useful as a practical guide and, just as much, as a source of inspiration for learners and educators around the world. In holding technical skill and human values together, it captures what global health collaboration is really about: The shared work of building a safer and more equitable future.

Assoc Prof (Dr) Tambri Housen

School of Medicine and Public Health, University of Newcastle

National Centre for Epidemiology and Population Health,

Australian National University

Founding Director, Solidarity in Health

and Quality Committee Member, WHO Academy of the World Health Organization



Caught a bug and you're fighting the blues?



**What Can We Build Together
for Common Cause?**

Survivor School

You're at the Heart of EPI-FORCE!

Our Approach: Applied Outbreak Epidemiology

Our Tools: What We Can Offer

Our Model: Progressive Learning

Our Network: Going Global

Our Experience: Why We Want to Share

Our Invitation: Why We Want You on Board

Face-off with the Rogue Gallery

Emerging, Re-emerging, and High Consequence Infectious Diseases

Your Adventure Begins Here

Embark on an Educational Expedition

The Case for Survivor School

What Exactly is Upskilling?

Learn to Apply Outbreak Epidemiology

EPI-FORCE Begins

Technical and Functional Domains

Competencies for One Health Field Epidemiology

Domains 1-14

How to Use This Handbook

You Select What You Want

Analogy to Gastronomy

Something's Cooking, EPI-SODES

Satisfying, EPI-LOGUE

Glossary of Terms

Survivor School

YOU'RE AT THE HEART OF EPI-FORCE!

You are at the heart of what is a beacon of hope, dreams, and ideals. EPI-FORCE's aspiration is to elevate your professional journey in public healthcare, armed with the ability to back your arguments with well-documented scholarly sources. You yearn for practical insights and immediate relevance in your work. You seek experiential learning, where mistakes are stepping stones, and problem-solving skills hold more value than mere bookish knowledge. You desire intrinsic motivation, a pace tailored to your unique person. So, let's come together and build something extraordinary for a common cause.

The idea of EPI-FORCE started back in 2010 but it was only in 2020, amid the raging COVID-19 pandemic, that we initiated our NextGen Workforce Development. We dedicate ourselves to nurturing a pool of proficient professionals who are capable of acting as field investigators and disease detectives. We are sited at the National Centre for Infectious Diseases (NCID) for practical training with academic support from the National University of Singapore's Saw Swee Hock School of Public Health and Yong Loo Lin School of Medicine, the Nanyang Polytechnic and the Nanyang Technological University's Lee Kong Chian School of Medicine.

OUR APPROACH: APPLIED OUTBREAK EPIDEMIOLOGY

Nestled in Southeast Asia, Singapore is a melting pot of diverse ethnicities. Chinese, Malays, Indians, Eurasians, Europeans and many more coexist in this dynamic city-state, each with their unique cultural traditions. With a thriving economy ranked 30th by size in 2023 globally and a GDP per capita of over USD 80,000, Singapore's nation building from a third-world outpost to a first-world island city state is testament to its determination to progress. Harnessing this transformative power, we are driven to bridge existing gaps with stakeholders in understanding why outbreaks occur in our modern urban lifestyles, and engage them meaningfully to find common ground for disease control. This is multisectoral applied epidemiology.

Today, our training workshops serve some sixteen different agencies, all designed to meet the formidable challenges of outbreak preparedness at every level of disease control and prevention. Applied epidemiology is our watchword, especially when it comes to multisectoral response. We embrace the holistic One Health approach, which melds the expertise of medical and veterinary professionals, environmental scientists, and social science behaviourists. This method enables us to fathom the complex web of health risks and their transmission at the human-animal-environment interface. We dig deep into the sources and dynamics of these risks, incorporating an integrated approach to tackle infectious diseases holistically.

The COVID-19 pandemic has underscored the vulnerability of cities and urban areas to pandemics. Their high population density, bustling commerce, and unparalleled connectivity make them potential hotspots for disease outbreaks. Recognising this, the 75th World Health Assembly of WHO adopted a resolution on strengthening health emergency preparedness and response in cities and urban settings. This resolution advocates for comprehensive urban health emergency preparedness and a whole-of-government approach. As urban populations burgeon and cities grow more complex, it's imperative that local communities have a say in health emergency preparedness. Vulnerable groups also need a more prominent role in decision-making and engagement.

We have unpacked many of these concerns through story-telling in our comic series, *EPI-FORCE*, *Urban Health Adventures*. These graphic novels dive into the essence of urban epidemiology practice, focusing on how various elements in the living environment—from sanitation to housing and mental stress—impact health. By scrutinising the interplay between health and these factors, we aim to unearth health disparities within the community. In close collaboration with the community, we decipher the context and develop culturally sensitive interventions. Our ultimate mission is to craft evidence-based solutions that diminish the risk of infectious diseases and elevate the well-being of individuals living in urban environments.

OUR TOOLS: WHAT WE CAN OFFER

Survivor School shares our domain experience and coverage. We are equipped to provide comprehensive stepwise training programmes that are stackable and adaptable to both onshore and offshore settings without compromising

on quality. We detail some of our knowledge products and training materials, including workshop samplers, in this handbook.

- *One Health Approach to Outbreaks*. This entails the coordination of various facets of outbreak rapid response, from epidemiologic investigation to teamwork, collaborative surveillance, and communications. Swift, concerted action is pivotal, and we advance our multisectoral approach.
- *Global-Urban Health Security*. This is health emergency preparedness in cities and urban settings. We employ community needs assessments and care coordinations to respond to complex threats and utilise the expertise of different sectors to enhance outbreak readiness and research.
- *Epidemic Intelligence Gathering*. This draws on extensive experience in our highly urbanised environment to focus on economic factors, lifestyle choices, and ecosystem limitations to improvise methods that help bolster traditional fieldwork at the human-animal-environment interface.
- *Leadership for Risk Management*. This emphasises the characteristics of good leadership for outbreak events, including chem-bioterrorism and the establishment of robust risk management systems that span the whole of society, including proactive measures for infection prevention and control.

OUR MODEL: PROGRESSIVE LEARNING

Survivor School introduces a progressive epidemiology training model that caters to workforce development in different agencies. This model organises into three Tiers—foundational, intermediate, and advanced practice—to offer clear agency-specific goals. The goals can cover diverse and different areas such as outbreak research, contact tracing, infection prevention and control, food hygiene, vector control, environmental hygiene and sanitation, and veterinary public health. Our tiered training system encourages individuals to master specific areas through a tailored learning process, ensuring that they remain up-to-date with the latest information and techniques.

Epidemiology trainees must complete foundational training before seeking additional competencies from intermediate- to advanced-level training. Pooling graduates from the foundational courses since 2020, an intensive intermediate course offers further training on elementary field epidemiology methods. Supported by our academic partners, advanced trainees get to join university-level Masters modules that provide specific knowledge and skills-building.

At all stages, they are exposed to situations where a wide range of technical and interpersonal skills are needed to lead outbreak response on the ground, perform multidisciplinary investigation, and take an evidence-based holistic approach to risk management.

We describe herein some of our training and education experience.

National Parks Board

In 2020, the National Parks Board entered a partnership with NCID for the conduct of its two-segment applied epidemiology course integrating veterinary-wildlife services with public health practice. Working with the Park's Animal-Veterinary Service, we saw 36 participants in the first two runs of this course comprising veterinarians, zoologists, ecologists, and other scientists. Workshop participants recognised that risk reduction of zoonotic spillovers required collaborative surveillance, improved communications, integrated health systems, and a shift toward preventive actions.

Singapore Food Agency

As the lead agency for food-related matters, the Singapore Food Agency's mission is to ensure and secure a supply of safe food for Singapore. The first three dedicated runs of a customised course from 2021-23 brought the number of staff trained in field epidemiology to 65. The participants learned important lessons from case studies of major foodborne outbreaks of the past and acquired insights into how the One Health epidemiologic approach worked. Interactions focused on some of the challenges faced by the practitioners in ensuring food security, and on risk management of Singapore's farm-to-fork system.

Government Ministries

Establishing the Field Epidemiology Training Programme (FETP) in Singapore, NCID offers workshops in basic outbreak rapid response for public health and medical officers from the Ministry of Health and the Ministry of Defence. In 2020, the Ministry of Manpower began arranging for officers to join in foundational training to help them better oversee migrant worker dormitories. We also worked with their Workplace Safety and Health Council on their document, *Workplace Safety and Health Guidelines – Healthcare*, to revise guidance for the healthcare industry. In 2022, NCID partnered with the Ministry of Social and Family Development to customise their officers training because of

a need for infection prevention and control in welfare homes based on the vulnerability of their populations.

National Preventive Medicine Residency

After the successful 2021 pilot of a specially curated training primer for preventive medicine residents, it was rolled out to cover the essential elements of foundational field epidemiology practice. Since then, many residents have taken part in the FETP and by 2026, five had satisfied prescribed practice requirements in epidemic intelligence gathering. Some also attended master-classes conducted at NCID where they underwent professional development and training with experienced professionals. The preventive medicine residency training is designed to prime young doctors for public health problem solving and field epidemiology practice. By learning epidemiologic principles and practice, they can help prevent disease transmission and manage outbreaks.

Flagship Public Course

Because of high ongoing demand from many agencies, a public run of our FETP foundational course is provided for all frontline and rapid response staff who need grounding in surveillance and epidemiologic investigation. Interest for this public run continues to grow with enquiries from many individuals and occasionally the private sector. Every year since 2020, we have had 30-40 participants from some 16 agencies, including hospitals and nursing staff. Interaction consists of 40 hours of groupwork interspersed with didactics. Participants would acquire basic understanding of surveillance and investigation competencies, with skills to perform applied epidemiology tasks. By 2026, well over 10% of the cohort comprised participants from the private sector as well as from overseas.

OUR NETWORK: GOING GLOBAL

Survivor School focuses on how individual health is influenced by the physical environment, economic and social policies, and modern lifestyles in urban settings. In 2018, WHO's Joint External Evaluation (JEE) accorded Singapore's FETP a full score (5/5) for its applied epidemiology training programme that "uses novel training methods to maintain interest level[s] and engage millennials on subject matter[s]" and noted that essential competencies had been mapped to guide continuous professional development of staff with opportunities

for further career growth. JEE recommended to share our Singapore experience with the wider global health workforce.

We describe herein our progress on the global health front.

Singapore Cooperation Programme

Under the Singapore Cooperation Programme by the Ministry of Foreign Affairs, we successfully hosted three major online workshops on infectious diseases outbreak management and urban pandemic response for cities in 2022-23. Participants from over 20 countries across all six WHO regions were able to acquire an understanding on how to undertake epidemiologic response on the ground for disease surveillance, investigation and control. In 2024, we refined our workshops into a 5-day urban health security course for the Americas, Europe, Africa, Asia and Oceania. The inaugural run saw 27 participants from 19 countries, and the second had 24 participants from 22 countries. Both courses were very well received, and a third run is being organised in 2026.

ASEAN+3 Field Epidemiology Training Network (FETN)

Singapore FETP is a founding member of the ASEAN+3 (China, Japan, South Korea) field epidemiology training network and is represented in its technical expert advisory panel. The Steering Committee comprises FETP directors from the 14 countries and provides strategic oversight and direction in ensuring the network can deliver on its objectives to provide support to strengthen capacity at the national level, facilitate cooperation and collaboration among members, and function as a platform for knowledge and experience sharing, training, and regional capacity building. At the 2022 Steering Committee meeting in Brunei Darussalam, we introduced our progressive learning model. An exciting point which interested members and partners was our junior FETP training and internships for youth in a whole-of-society approach to public health practice.

South Asian Field Epidemiology and Technology Network

Singapore is active in the South Asian Field Epidemiology and Technology Network (SAFETYNET). At its 2022 meeting in Hanoi, Vietnam, a five year strategic plan outlined five priority areas to: develop and foster strong partnerships across sectors and institutions in the Asia Pacific region; promote access to high quality public health workforce equipped to meet future challenges; be recognised as a source of technical capability and excellence; lead innovations

that ensure SAFETYNET remains relevant and responsive to changing needs; and develop a representative and sustainable network of unique value to the region. We served in the scientific committee and made contributions to the SAFETYNET bi-regional scientific conferences in 2023 (Canberra, Australia) and 2025 (Kuala Lumpur, Malaysia).

Other International Collaborations

Singapore became a member of the international Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET) in 2010. Since then, there has been substantive technical cooperation, collaborative projects and outbreak preparedness activities with Brunei, Malaysia, Thailand, Vietnam, India, Japan, China, Australia, the UK, and the USA. One major development was engagement with the US CDC on global health protection and workforce development, involving working with our US counterparts on joint training and curriculum development. We joined the Global Field Epidemiology Partnership in 2025, and have served on the international advisory board of TEPHINET since 2021. From time to time, our experts are drawn upon by international bodies such as the WHO GOARN, the Quadripartite (WHO-FAO-WOAH-UNEP), and the World Bank Group.

OUR EXPERIENCE: WHY WE WANT TO SHARE

As a country, Singapore has benefited from decades of strategic leadership and sound governance. An area where this is most evident is in the health indices of longer life expectancy and reduced infant and maternal mortality. National policies have seen Singapore declared free from many tropical diseases. All of these, and more, have been achieved with reasonable budgets in relation to gross domestic product, and Healthier SG reforms promise to do even more to improve human health and well-being.

Some milestones on our training and education journey include:

1. Professional certification of competency awarded by NUS-NCID to FETP graduates who satisfactorily complete their practice requirements in the training courses.
2. Epidemic Intelligence Service-type training for WHO-GOARN volunteers, infectious disease residents, and the more advanced field epidemiologists at NCID, with the collaboration of the National Parks Board in tackling zoonoses.

3. Bilateral and regional projects and technical advisories to promote health emergencies preparedness and response, currently at a bilateral country level as well as with FETN, SAFETYNET and TEPHINET.
4. Global health protection and workforce development involving: (1) joint training via virtual and live outreach; (2) materials development, including FETP curriculum; (3) professional scientific and programmatic exchanges; (4) capstone projects in Atlanta/Singapore; and (5) non-communicable diseases overlay on infectious disease.
5. Community health transformation; an exciting point which interested FETN countries and partners is our junior FETP for youth in a community tie-up with the Rotary Club of Singapore and the Interact Club of Sembawang as a whole-of-society approach to public health practice.

The beneficiary state that we are wants to give back. Ironically, failing multilateralism presents strategic opportunities for forward-looking countries to forge regional alliances through acts of soft diplomacy, such as in training and education. Workforce development has always been a key activity in global health, in enabling local leadership to set priorities and design sound national policies, or in developing local talent to conduct research and implement health programmes. Helping countries to achieve specific sustainable development goals not only promotes better population health, but also fundamentally achieves greater human productivity and potential, together with the core value of equity.

We have flourished because of the post-war multilateral system. Our economy has prospered from the free flow of global talent, goods and services. Contributing to the health of other countries can be said to be a different aspect of the responsibilities of a good global citizen. It is a win-win situation—by doing its bit to maintain the overall health of the multilateral system, of which it has been a beneficiary, Singapore stands to gain too.

OUR INVITATION: WHY WE WANT YOU ON BOARD

EPI-FORCE believes in the power of win-win synergy. Pandemics have clearly shown that infectious diseases respect no borders. Our invitation to you extends towards promoting NextGen Workforce Development in your country. Survivor School shows you how, but you can modify the suggested regimes.

Health capacity building and strengthening have always been pillars of global health, enabling local leadership, providing sounder policies, and ensuring greater human productivity. Collaborations in training and education can also be a form of soft diplomacy, which you can use to your advantage in growing good relations with others.

The vision is to protect our populations against pathogens, and keep our modern urban lifestyles safe from infectious disease. Survivor School is advancing not just healthier populations but also the values and full potential of humanity!

We invite you now to join us, and be a part of the world's EPI-FORCE!

Face-Off with the Rogue Gallery

EMERGING, RE-EMERGING, AND HIGH CONSEQUENCE INFECTIOUS DISEASES

Welcome to EPI-FORCE, as you participate in the escapades of our avatar heroes who undertake thrilling health adventures! Journey with them to experience exciting encounters with exotic enemies. Face off with selected emerging, re-emerging, and high consequence infectious diseases—just some of the Rogue Gallery members introducing themselves—possibly through imported infections.

1. Viral Haemorrhagic Fevers

Systemic febrile illnesses with vascular leak, coagulopathy, and high mortality.

- Crimean-Congo haemorrhagic fever
- Ebola
- Junin
- Lassa
- Lujo
- Machupo
- Marburg
- Severe fever with thrombocytopenia syndrome
- Yellow fever

2. Respiratory Pathogens

Primarily droplet/airborne transmission with severe pneumonia and respiratory distress.

- Andes hantavirus infection
- Avian influenza (H5N1, H7N9, and others)
- Hantavirus pulmonary syndrome
- MERS
- SARS

3. Viral Encephalitides

Zoonotic infections with prominent neurologic involvement or multi-system disease.

- Herpes B
- Nipah
- Rabies

4. Vesicular Rash Syndromes

Febrile illnesses with characteristic rash and serious or fatal consequences.

- Mpox
- Smallpox

5. Bacterial Sepsis and Toxin-Mediated Syndromes

Rapidly progressive infections requiring urgent antimicrobial or antitoxin therapy.

- Anthrax
- Botulism
- Meningococcus
- Plague
- Tularemia

For quick and easy reference, we have produced a cheat sheet of this Rogue Gallery...

Disease (pathogen)	Geography	Risk factors	Incubation period	Infectious period	Clinical presentation
Andes hantavirus infection (hantavirus)	South America	Rodents, cabins, excreta	1-6 weeks	When symptomatic	Pneumonia, shock
Anthrax (bacteria)	Global	Hides, spores, powder, contact, ingestion	1-7 days, but up to 60 days	Not person-to-person Contaminated environs/spores a concern	Eschar, mediastinitis
Avian influenza (H5N1, H7N9, others)	Global birds, cattle (H5N1)	Birds, poultry, cattle (H5N1), markets	1-10 days (up to 17 days for some strains)	When symptomatic till 7 days post onset	Flu, pneumonia
Botulism (neurotoxin)	Global	Food, toxin, wound	12-72 hours (food) 4-14 days (wound) 12-36 hours (inhaled) up to 30 days (infant)	No	Descending paralysis
Crimean-Congo haemorrhagic fever (nairovirus)	Africa, Asia	Ticks, livestock, blood	1-13 days	When symptomatic	Fever, petechiae
Ebola (filovirus)	West, Central and East Africa	Fluids, burial, HCW, contact	2-21 days	When symptomatic	Fever, gastro-intestinal, bleed
Hantavirus pulmonary syndrome (hantavirus)	North and South America	Rodents, dust, excreta	1-8 weeks	No person-to-person spread	Fever, dyspnoea, shock
Herpes B (herpesvirus)	Asia	Macaque bites, mucosa	2 days-5 weeks	Not typical	Encephalitis, paralysis

	Diagnostic tests	Treatment	Prevention	Notes
	PCR, serology	Supportive Uncertain: Favipiravir/ribavarin?	Isolation PPE, contact/ droplet/airborne rodent control	Only hantavirus is known to have person-to-person spread, mortality 30-50%
	Culture, PCR	Ciprofloxacin/meropenem/penicillin + doxycycline/minocycline Antitoxin: Raxibacumab, obiltoximab, anthrax immunoglobulin	PEP ciprofloxacin/doxycycline (60 days due to spores) + vaccine	Powder concern (consider deliberate event/bioterror), mortality 80-90% (inhalational)
	PCR, subtype	Antivirals (oseltamivir/zanamavir/baloxavir) + support	PPE prophylaxis (oseltamivir) vaccination	Severe flu, up to 50% depending on subtype
	Clinical, toxin	Antitoxin (botulinum antitoxin for adults/paeds or BabyBIG for paeds) + support	Food safety	Descending flaccid paralysis foodborne, iatrogenic (cosmesis), deliberate events/bioterror, mortality 5-10%
	PCR, blood	Supportive Uncertain: Off-label ribavirin given early?	Isolation enhanced PPE, tick control/avoidance, safe livestock handling	Nosocomial risk
	PCR, blood	Supportive, monoclonal antibodies for Zaire strain (inmazeb/ebanga)	Isolation enhanced PPE, ring vaccination (Ervebo or the 2 dose Zabdeno & Mvabea, for Zaire strain—Mvabea is multivalent for Zaire, Sudan, Tai Forest ebolavirus and Marburg), antivirals in development	6 known species: 4 pathogenic in humans—Zaire, Sudan, Bundibugyo, Tai Forest 2 not known to be pathogenic (Reston, Bombali) Outbreaks with human spillover
	PCR, serology	Supportive/ICU Uncertain: Ribavarin?	Rodent control	Consider rodent and droppings exposure history, mortality 30-50%
	Specialist PCR	IV acyclovir	Wash wound, PEP acyclovir	Laboratory/occupational, mortality 70% to 80%

Disease (pathogen)	Geography	Risk factors	Incubation period	Infectious period	Clinical presentation
Junin (arenavirus)	Argentina	Rodents, farms, contact, fluids	1-2 weeks	When symptomatic	Fever, bleed neurologic-haemorrhagic phase: 20-30% enter this phase 8-12 days after onset of symptoms
Lassa (arenavirus)	West Africa	Rodents, HCW, fluids	2-21 days	When symptomatic	Fever, sore throat
Lujo (arenavirus)	Southern Africa	HCW, fluids, contact	7-13 days	When symptomatic	Fever, shock
Machupo (arenavirus)	Bolivia	Rodents, farms, contact, fluids	3-21 days	When symptomatic	Fever, bleed 1/3 progressive neurologic and haemorrhagic syndrome
Marburg (filovirus)	Africa	Bat/cave, fluids, contact	2-21 days	When symptomatic	Fever, gastro-intestinal, bleed
Meningococcus (bacteria)	Global	Crowding, droplets, asplenia	2-10 days	Until 24h effective antibiotics	Meningitis, rash, shock
MERS (coronavirus)	Middle East	Camels, HCW, contact, droplets	1-14 days	When symptomatic	Fever, shortness of breath
Mpox (orthopoxvirus)	Global, Africa	Skin or sexual contact, fomites	5-21 days	Until scabs separate	Lymph nodes, rash, proctitis
Nipah (henipavirus)	South and Southeast Asia	Bats, pigs, palm sap, fluids, droplets	4-14d (up to 8 weeks)	When symptomatic, likely begins during the incubation period until viral shedding ends	Encephalitis, respiratory failure

	Diagnostic tests	Treatment	Prevention	Notes
	Reference laboratory	Supportive, convalescent plasma (3,000 neutralising therapeutic units/kg body weight) within first 8 days of symptom onset	Isolation, enhanced PPE, rodent control	Lack of respiratory symptoms is cardinal, mortality 15-30% (1% with treatment)
	PCR, serology	Ribavirin given early	Isolation, enhanced PPE, rodent control	Endemic and seasonal in places like Nigeria
	Reference PCR	Supportive Uncertain: Off-label ribavirin?	Isolation, enhanced PPE, rodent control	Rare, severe, a single recorded outbreak (in 2008 across Zambia and South Africa); high fatality rate of 80%
	Reference laboratory	Supportive Uncertain: Off-label ribavirin given early?	Isolation, enhanced PPE, rodent control	Mortality 25%
	PCR, blood	Supportive	Isolation, enhanced PPE, vaccines and antivirals in development	Outbreaks with human spillover
	Blood/lumbar puncture PCR	Ceftriaxone	Contact prophylaxis (rifampicin/ciprofloxacin) vaccination	Time-critical, mortality 10-50%
	RT-PCR	Supportive/intensive care Uncertain: Ribavirin with IFN- α or IFN- β ?	Isolation PPE, contact/droplet/airborne Avoid dromedary camels and products (e.g. milk/meat)	Travel trigger, mortality 35%
	Lesion PCR	Tecovirimat, brincidofovir, cidofovir, trifluridine (ocular) Supportive	Post-exposure vaccination	Mortality from recent outbreaks <2.5%
	PCR, serology	Supportive/intensive care Uncertain: Ribavirin?	Isolation PPE, contact/droplet/airborne	Nosocomial spread a concern, mortality 40-75%

Disease (pathogen)	Geography	Risk factors	Incubation period	Infectious period	Clinical presentation
Plague (bacteria)	Global foci	Rodents, close contact, droplets	1-7 days	Throughout duration of illness or until 48 hours after effective therapy	Fever, cough, haemoptysis pneumonia, buboes, sepsis
Rabies (lyssavirus)	Global	Bites (e.g. canines raccoons skunks), bats, mucosa	3-8 weeks but could be several days to years	Saliva near onset	Hydrophobia, encephalitis
SARS (coronavirus)	Historic	Case, HCW, droplets, AGP	2-10 days	After onset of illness and when symptomatic	Fever, pneumonia
Severe fever with thrombocytopaenia syndrome (bandavirus)	East Asia	Ticks, rural work, blood	5-14 days	When symptomatic	Fever, low platelets
Smallpox (orthopoxvirus)	Global eradicated	Case, lab, droplets, contact	7-17 days	Until scabs separate	Fever, synchronous rash
Tularemia (bacteria)	North America, Europe, Asia	Ticks, rabbits, aerosols ingestion, contact (infected tissue)	3-5 days (range 1-21 days)	No	Ulcer, nodes, pneumonia
Yellow fever (flavivirus)	Sub-Saharan Africa, Tropical South America	Mosquitoes	3-6 days	Infectious to mosquitoes shortly before onset of fever to 5 days after onset	Fever, jaundice, renal failure, haemorrhage

AGP=aerosol generating procedures; HCW=health care workers; PPE=personal protection equipment; PEP=post-exposure prophylaxis; RT-PCR=reverse transcription-polymerase chain reaction

	Diagnostic tests	Treatment	Prevention	Notes
	Culture, PCR	Antibiotics gentamicin + fluoroquinolones Others: Streptomycin, chloramphenicol or tetracycline	PEP for close contacts ($< 2m$), sustained contact with patient animal with pneumonic plague or direct contact with infected body fluids or tissues. Given for 7 days: ciprofloxacin/ levofloxacin/ moxifloxacin/ doxycycline	Public health urgent Consider deliberate event/bioterror, mortality 40-60% for bubonic plague and nearly 100% for pneumonic septicaemic types
	Clinical, PCR	None once symptomatic	Wash wound, PEP (rabies immunoglobulin and vaccination)	Medical emergency. Mortality virtually 100% when infection is established. PEP is nearly 100% effective.
	RT-PCR	Supportive Uncertain: Ribavarin?	Isolation PPE, contact/droplet/ airborne	Has not re-emerged since 2004, mortality 10%
	PCR, blood	Supportive Uncertain: Ribavarin or favipiravir? Plasma exchange, IVIG, steroids, tocilizumab?	Isolation PPE, contact/droplet/ airborne tick avoidance	Possible nosocomial spread via body fluids, aerosols, ocular exposure, mortality 6-30%
	Lesion, PCR	Supportive, tecovirimat, brincidofovir, cidofovir, trifluridine (ocular)	Post-exposure vaccination up to 4 days (e.g. ACAM200, Jynneos)	Health emergency, consider deliberate event/bioterror, mortality up to 30-50%
	Serology, PCR, culture	Ciprofloxacin, gentamicin/streptomycin, doxycycline	Tick avoidance ciprofloxacin/ levofloxacin x 7 days doxycycline 10-14 days	Lab alert Consider deliberate event/bioterror, mortality 10-50% (pneumonia and typhoidal)
	Serology, PCR	Supportive	Vaccine, avoid mosquito bites (repellents containing $>20\%$ DEET, long sleeved clothes and long pants, mosquito netting and permethrin- based products)	Valid vaccination certificate required for travellers over 1 year of age traveling to or from endemic countries (SG requirement, even if just airport transit >12 hours)

Your Adventure Begins Here

EMBARK ON AN EDUCATIONAL EXPEDITION

You're about to embark on an educational expedition that will introduce you to the art and science of outbreak readiness and research, all while following the thrilling escapades of a superhero team dedicated to safeguarding people from infectious diseases. Ideally, this handbook should serve as a companion volume to the educational courses you experience at the NCID Academy. Practically, for many, it may have to stand alone. The Survivor School for Infectious Disease Outbreaks is like a mini medical school, offering creative and engaging ways to understand outbreak epidemiology.

What's in store for you? Plenty! It is also our way of creating a social enterprise in the form of a fun and educational guide. It's a learning journey where you grow as a field investigator and disease detective, learning essential skills to even eventually becoming an epidemic intelligence superhero. The best part? You don't need much prior qualification; just bring your enthusiasm, curiosity and willingness to engage actively in your education. Get ready to have fun while honing your problem-solving and communication skills.

THE CASE FOR SURVIVOR SCHOOL

In study of causal factors, we use the terms 'necessary' and 'sufficient' to understand and describe the relationship between cause and effect. A necessary cause is something that must be present for an effect to occur, but it may not be enough on its own. A sufficient cause is something that, if present, guarantees the occurrence of the effect, but there can be multiple sufficient causes.

Understanding whether causal factors are necessary or sufficient is crucial in determining the desired outcomes of specific competence. In our opinion, classical epidemiology which emphasises the scientific approach to community practice is necessary but no longer sufficient to meet our health needs. Over the past

40 years, we introduced tiered One Health training, and even customised it for managers, veterinarians and laboratorians, but needs continue to diverge.

In reflecting upon the essential distinction between 'necessary' and 'sufficient' causation, we argue that while classical epidemiology remains a necessary base, it no longer suffices to meet multifaceted demands. Survivor School offers potential to sufficiently address the intricate challenges of the world which we now live in. And in the spirit of collaboration, we offer this as a shared endeavour to build it together for a common cause.

Society is becoming more complex with a plethora of business and political interests, powerful stakeholders, and modern urban lifestyle choices. An atmosphere of scepticism, fuelled by misinformation and disinformation, also leads to distrust for the health authority. The bewildered field epidemiologist is struggling with urban epidemiology practice and seeks individualised options for upskilling, which is where NextGen Workforce Development comes in.

WHAT EXACTLY IS UPSKILLING?

The term 'upskilling' is often used in the context of workforce development, reflecting a need for individuals to continually learn and adapt to changing environments. Examples include improving communication and leadership skills, finding new epidemiologic tools to do the job, growing proficiency in a field such as artificial intelligence, and acquiring industry-specific certifications. Upskilling is a proactive voyage of personal and professional growth, a means to not only excel in one's current role but also flourish in a swiftly changing work environment.

The rewards of this journey of discovery are tangible. In a fiercely competitive job market, those who continually upskill themselves are more likely to secure and maintain employment. Employers recognise the value of upskilling and often provide training programmes, workshops, and resources to help their workforce stay at the forefront of their field. This newfound versatility opens the doors to career progression, augmenting earning potential and ushering in fresh opportunities.

In terms of personal growth, upskilling can also be fulfilling. A commitment to lifelong learning and acquiring new knowledge can boost self-confidence and contribute to a sense of achievement. Upskilling often involves developing

critical thinking, problem-solving, and decision-making skills, which can be applied to various aspects of personal life.

LEARN TO APPLY OUTBREAK EPIDEMIOLOGY

Through the adventures of EPI-FORCE, you'll explore outbreak scenarios which prepare you to find out the competencies needed for One Health field epidemiology. Epidemiology constitutes an important line of defence for the world against emerging infectious diseases, with over 70 training programmes today existing across five continents. Since 2010, the Singapore FETP has been building the pool of physicians and non-physicians that meets our country's needs in One Health field epidemiology. Operating out of the agencies for fieldwork and NCID for didactics, our network is designed for all aspects of outbreak management. In our bespoke model, agency-specific emphases can be set out clearly so as to provide a checklist for trainees to track progress in an itemised manner.

Foundational Tier – Provided to frontline staff, including rapid response teams, according to the needs of each specific agency in the form of a primer in field epidemiology practice (workshops of up to a week's duration). Interaction consists of approximately 40 hours of stackable didactics interspersed with on-the-job training. The officer acquires basic awareness and understanding of core competencies, with skills to perform field epidemiology objectives under supervision. Successful participants can be accorded joint professional certification by NCID and the National University of Singapore.

Intermediate Tier – Offered to intermediate level medical and public health officers for cross-training on five specific competencies in surveillance, epidemiology and response. Training comprises approximately 120 hours of didactics interspersed with applied on-the-job field epidemiology work. This proficiency level accords the officer essential knowledge and skills so as to be able to operate independently with minimal supervision. Academic components can be pursued as a graduate certificate or as Masters level modules. Successful participants will be entered into the NCID professional rolls.

Advanced Tier – Reserved for trainees who continue after the intermediate tier to seek relevant experiences in epidemic intelligence and global health practice, including exposure to international outbreaks. This level of proficiency

requires an in-depth knowledge of field epidemiology, and sufficient application of knowledge and skills to guide and mentor others. Trainees will be tested for situational field leadership roles, and have options to obtain higher qualifications in applied epidemiology and public health. Successful participants would be accorded fellowship status on the NCID professional rolls.

The curriculum is designed to be stackable, just like building with Lego bricks, to build a solid foundation of practical skills. Here are just some of the exciting outbreak epidemiologic activities you could be mastering:

- Rapid Response Teamwork: How to undertake rapid response on the ground for outbreak alerts, monitoring, investigation, and control.
- Epidemiologic Investigation: How to apply evidence-based scientific approaches when conducting investigation into health events.
- Systems in Surveillance: How to undertake surveillance for bio-risks, disease detection, superspreading events and contact tracing.
- Scientific Risk Analysis: How to apply the principles and practice of epidemiologic risk assessment and management.
- Control of Emergent Threats: How to perform multi-disciplinary investigation and control of epidemics and emergencies.
- Public Health Communication: How to explain transmission dynamics in the emergence of unusual health events and epidemics.
- Stakeholder Engagement: How to advocate a whole-of-society approach in addressing urban health emergencies.
- Global-Urban Health Security: How to control outbreaks with pandemic potential and implications for international health regulations.
- All Hazards Field Approach: How to master a comprehensive bio-psycho-social profiling of hazardous human exposures.
- Leadership Skills Building: How to effectively engage with community leaders, policy makers, partners, and mentees.

We have built on the strong foundations set out by the original 2010 FETP programme, creating a holistic national approach which adopts the three-tiered framework. NextGen Workforce Development caters to all levels where not all staff have to complete the full training of 2-3 years. This flexibility allows trainees at the foundational and intermediate levels to perform competently at their jobs while maintaining an advanced level of training for those willing and able to become subject matter experts.

EPI-FORCE BEGINS

Follow the journey of EPI-MAN, a survivor turned superhero who creates the EPI-FORCE team. Together, they fight for public health and well-being, safeguarding the world from emergent threats. They possess qualities like deep observation, commitment to the public good, and the ability to work under pressure. On the threats side, they face super villains like Salmo Nelli (food-borne disease), Darth Vector (vectorborne disease), Lady Influenza (droplet and airborne disease), Zoo Zombie (zoonotic disease), and the Sinister Disease X (pandemic disease).

Watch how EPI-FORCE grows. Together, the team unlocks the many technical and functional domains of competencies for One Health field epidemiology practice in the fight against infectious diseases. Get ready to also become a disease detective yourself on their thrilling urban health adventures, and master the skills of applied epidemiology. Your journey starts here!

Technical and Functional Domains

COMPETENCIES FOR ONE HEALTH FIELD EPIDEMIOLOGY

A major step forward took place in 2023 when the Quadripartite released its first-ever joint guidance on developing Competencies for One Health field epidemiology (COHFE). NCID contributed as part of the technical advisory group that provided expertise to the World Health Organization, the Food and Agricultural Organization, and the World Organisation for Animal Health.

COHFE defines core competencies across three levels of field epidemiology training—frontline, intermediate, and advanced—to support workforce development for the prevention, preparedness, and response to health threats worldwide. To train professionals across the interconnected domains of human, animal, food and environmental health, this guidance outlines in a standardised approach consisting of 14 domains that are technical (1-10) and functional (11-14).

Source: Competencies for One Health field epidemiology (COHFE) framework. Geneva: World Health Organization, Food and Agriculture Organization of the United Nations and World Organisation for Animal Health; 2024.

Recommended background experience of candidates for One Health field epidemiology training programmes, across training levels and sectors

Sectors			
Frontline		Intermediate	Advanced
Human	- Community or district government public health professionals - Public health epidemiologists - Physicians, dentists, nurses - Other human health professionals or researchers	- District or provincial government public health professionals - Public health epidemiologists - Physicians, dentists, nurses - Other human health professionals or researchers with frontline level experience	- Provincial or national government public health professionals - Public health epidemiologists - Physicians, dentists, nurses - Other human health professionals or researchers with intermediate level experience
Animal	- Community or district government animal health professionals - Veterinarians - Para-veterinarians - Animal husbandry experts - Other animal health professionals or researchers	- District or provincial government animal health professionals - Veterinary epidemiologists - Veterinarians - Para-veterinarians or animal husbandry experts - Other animal health professionals or researchers with frontline level experience	- Provincial or national government animal health professionals - Veterinary epidemiologists - Veterinarians - Advanced para-veterinarians or animal husbandry experts - Other animal health professionals or researchers with intermediate level experience
Environment	- Community or district government environmental health professionals - Wildlife veterinarians - Environmental scientists, biologists, or ecologists - Environment, natural resource or forestry workers - Environmental engineers - Other ecosystem health professionals or researchers	- District or provincial government environmental health professionals - Wildlife veterinarians - Environmental scientists, biologists, or ecologists - Environment, natural resource or forestry managers - Environmental engineers - Other ecosystem health professionals or researchers with frontline level experience	- Provincial or national government environmental health professionals - Wildlife veterinarians - Environmental scientists, biologists, or ecologists - Environment, natural resource or forestry managers - Environmental engineers - Other ecosystem health professionals or researchers with intermediate level experience

DOMAIN 1

Foundational Knowledge and Skills

INTRODUCTION

Experts working in field epidemiology come from very diverse backgrounds and have different professional trajectories. In order to establish a common foundational knowledge relevant to human, animal, and environmental health, a set of topics have been identified that should provide a theoretical basis upon which subsequent domains are developed, in order to build the skills and competencies necessary to work in the field. Depending on the region or country, some of the listed topics might fall under a different section of the health system or be dealt with by a different professional group. In a global context however, theoretical knowledge of all these topics/subdomains constitutes a valuable foundation that enables the applied epidemiologist to fully engage in addressing global health priorities.

At the frontline level, field epidemiologists demonstrate good knowledge about diseases both communicable and non-communicable diseases with the basic knowledge of the causative organisms. They also calculate key indicators at the community level and report it to next admin levels.

At the intermediate level, field epidemiologists have the same knowledge as the frontline and also understand the prioritisation of diseases for actions and the link to relevant stakeholders for better coordination of work.

At the advanced level, field epidemiologists guide the national and subnational system based on policies and standards and apply international standards when these exist.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
7. Preparedness and response;
8. Epidemiological studies;
10. Ecosystem health;
11. Leadership and management; and
12. Communication and community engagement.

SUBDOMAINS

1. History of epidemiology
2. Epidemiology of infectious diseases
3. Epidemiology of noncommunicable diseases
4. Prioritisation of disease and disease burden
5. Policies and standards
6. Maternal and child health: key indicators
7. Demographic data and population dynamics
8. Primary health services: key indicators
9. Systems thinking

DOMAIN 2

Surveillance Systems

INTRODUCTION

The continuous collection of data about the status of our environment and occurrences of specific events therein, including plants, animals and humans, is fundamental for the assessment of health in its broadest term. Epidemiological surveillance is therefore one of the main pillars of One Health. Well-running surveillance systems allow outbreaks to be defined and detected, and alert algorithms to be calculated. Public health and animal health interventions are implemented and evaluated based on surveillance data. It is therefore of utmost importance that a field epidemiologist is empowered to act within the surveillance systems of their area of work. Epidemiologists require good understanding of characteristics of surveillance systems in order to collect, analyse and report surveillance data from community level to national level. They require the competencies to implement, monitor and evaluate surveillance systems. Defined roles and responsibilities for each level with harmonisation and collaboration between all levels and also between human and veterinary services is recommended and needs proper training and focus.

At the frontline level, a surveillance officer appreciates the importance of certain attributes of the system, like timeliness, completeness and data quality, describes how the flow of information is organised, applies algorithms for outbreak detection or alert thresholds, performs simple analysis of the data provided by the system at that level and reports results.

At the intermediate level, the responsible field epidemiologist describes the types of surveillance systems, how surveillance systems are run, and the stakeholders involved, and assesses the source of the data being analysed. Additionally, they perform more elaborate analyses, create visual displays of the results, and report the findings to higher levels within the system. Some of these

responsibilities are also expected from a frontline epidemiologist at animal health.

At the advanced level, a field epidemiologist designs and implements a surveillance system, describes and assesses their attributes, and evaluates a surveillance system against its original objectives. At this level, a field epidemiologist creates actionable science (data for action) and can analyse surveillance data, draw conclusions and make recommendations based on this data, as well as write surveillance reports and publish the results and conclusion of their findings.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
3. Field investigations;
4. Disease management;
5. Laboratory capacity;
7. Preparedness and response;
8. Epidemiological studies;
9. Data management, biostatistics, and informatics;
10. Ecosystem health;
11. Leadership and management;
12. Communication and community engagement;
13. Training; and
14. Ethics.

SUBDOMAINS

1. Characteristics of a functional surveillance system
2. Epidemic intelligence
3. Detection and reporting of cases, clusters, and public health threats
4. Surveillance data collection, analysis and interpretation
5. Surveillance reporting
6. Monitor and assess the quality of surveillance data
7. Surveillance systems design and evaluation

DOMAIN 3

Field Investigations

INTRODUCTION

Public, animal or ecosystem health threats can result from infectious (zoonotic, emerging or re-emerging) or non-infectious (natural disasters, chemicals, radiation, etc.) causes. These health threats or events may be reported as early warning signals, unusual case reports, or disease outbreaks that can cross national and international borders. Field investigations often begin without specific hypotheses about the cause of the disease, source or origin. Responding to these threats requires a range of competencies, including planning, leading, supervising, data collection, data analysis, modelling, forecasting, applying intervention methods, and post-investigation monitoring and evaluation.

At the frontline level, field epidemiologists understand the basic principles of field investigations to support and organise field activities, adhere to standard operating procedures, collect high quality data and samples for testing, support intervention strategies, analyse and interpret data, and communicate findings.

At the intermediate level, the field epidemiologist also plans, communicates, leads, and coordinates field investigations with other sectors; develops case definitions, coordinates data collection, conducts statistical analysis and interpretation of data; trains and supervises frontline staff; recommends and monitors interventions; and organises regular briefings with supervisors and important stakeholders.

At the advanced level, field epidemiologists design, plan, and monitor field investigations, including joint investigations with other

One Health sectors, lead multidisciplinary teams and coordinate with all sectors involved in the investigation. In addition, they write and evaluate SOPs, train field investigation teams and assess the epidemiological situation in light of existing national and international legislations. At this level, an epidemiologist manages complex data sets, uses advanced statistical and modelling methods, interprets results, evaluates intervention methods, and communicates results to the media and the scientific community.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
4. Disease management;
5. Laboratory capacity;
6. Infection prevention and control, biosafety and biosecurity;
7. Preparedness and response;
8. Epidemiological studies;
9. Data management, biostatistics, and informatics;
10. Ecosystem health;
11. Leadership and management;
12. Communication and community engagement;
13. Training; and
14. Ethics.

SUBDOMAINS

1. Field preparation
2. Investigation
3. Data management and analysis
4. Reporting and follow-up interventions

DOMAIN 4

Disease Management

INTRODUCTION

Disease management is an important domain for field epidemiologists at all levels, as it relates to understanding and control of endemic diseases. Specific knowledge, skills and competencies for One Health in the sub-domains of health systems and health service delivery, antimicrobial stewardship, immunisations, infectious and zoonotic diseases, and disease management during travel, mobility and movement are required for epidemiologists trained in One Health principles. Programmes may add optional competencies depending on specialisation and the results of a workforce needs assessment.

At the frontline level, local communities rely on epidemiologists for prevention and control of high priority endemic diseases. Competencies at this level focus on supporting local human and animal health services, promotion of antimicrobial stewardship, implementation of high quality local immunisation programming, application of control programmes for infectious diseases, and managing disease risk in the face of mobility and movement.

At the intermediate level, field epidemiologists have a more developed understanding of antimicrobial resistance (AMR), promote antimicrobial stewardship and the design, implementation and evaluation of immunisation activities at the regional level. They also conduct infectious disease surveillance and investigations and oversee control measures.

At the advanced level, field epidemiologists have a broader knowledge of the regulatory framework and gaps related to human and animal health service delivery. They contribute to developing the knowledge base for AMR. In addition, advanced field epidemiologists advise policy-makers on effective vaccination programming, build capacity for surveillance and investigation of infectious and zoonotic diseases, including food, water-borne and vector-borne diseases, and manage the health risks and mitigation strategies related to cross border movement of humans and animals.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
5. Laboratory capacity;
6. Infection prevention and control, biosafety and biosecurity;
7. Preparedness and response;
10. Ecosystem health;
11. Leadership and management; and
12. Communication and community engagement.

SUBDOMAINS

1. Health systems and health service delivery
2. Antimicrobial stewardship
3. Immunisations
4. Infectious and zoonotic diseases
5. Disease management during travel, mobility and movement

DOMAIN 5

Laboratory Capacity

INTRODUCTION

Laboratory capacity supports the confirmation of disease with epidemiological data generated by field epidemiologists, enabling formulation of a case definition with corresponding confirmatory diagnosis and application of prevention and control measures. It includes four subdomains that encompass: 1) sample/specimen collection, labelling, storage and transport to the laboratory; 2) multisectoral planning and linking of diagnostic laboratory data with field epidemiology data across sectors; 3) multisectoral collaboration; and 4) analysis, interpretation, and reporting of laboratory data. This domain is foundational to a One Health approach for linking across the human-animal-environment interface.

At the frontline level, field epidemiologists should be able to describe and implement risk management plans and standard operating procedures (SOP) to maintain biosafety and biosecurity when implementing necropsies, sample and specimen collection, labelling, handling, transportation and delivery of field samples/specimens to the laboratory, and preserve the cold chain to maintain sample integrity.

At the intermediate level, field epidemiologists monitor and support the frontline level who implement risk management plans and standard operating procedures to maintain biosafety and biosecurity while performing the above-noted duties, in addition to coordinating field sample collection with subnational and national laboratories and across sectors. The intermediate level field epidemiologist is also responsible for assessing basic test performance characteristics for both antigen- and antibody-based tests in relation to gold standard tests.

At the advanced level, a field epidemiologist evaluates, trains and leads the development, implementation and evaluation of risk management plans and SOP for the frontline and intermediate levels. The advanced level also conducts higher level test performance assessments and ensures effective multisectoral collaboration that links laboratory and field epidemiology data. This level is also responsible for analyses of laboratory data (i.e., trend analysis and multivariable analysis of secondary data) and supporting laboratory quality assurance.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
4. Disease management;
6. Infection, prevention and control, biosafety and biosecurity;
7. Preparedness and response;
8. Epidemiological studies; and
9. Data management, biostatistics, and informatics.

SUBDOMAINS

1. Necropsies, sample/specimen collection, labelling, storage and transport
2. Multisectoral planning and data linking
3. Multisectoral coordination
4. Analysis, interpretation and reporting of laboratory data

DOMAIN 6

Infection Prevention and Control, Biosafety and Biosecurity

INTRODUCTION

Infection prevention and control (IPC), biosafety and biosecurity are essential to prevent the transmission of disease pathogens within and among humans, animals and the environment. The health and safety of human and animal health workers includes field epidemiologists and laboratory personnel. IPC is a term adopted by the human health sector and considered equivalent in intent to biosafety and biosecurity, the terms most often used in animal health. However, there may be some differences in how IPC, biosafety and biosecurity are applied in the field or laboratory. For field personnel, effective implementation of IPC, biosafety and biosecurity are essential to incorporate while conducting daily field duties in order to protect human health and prevent transmission of disease pathogens. The field and laboratory worker will maintain awareness of preceding, current and proceeding activities during the course of daily activities to prevent and control unwanted human exposure and disease pathogen transmission. This mindset is referred to as 'situational awareness' and is used by firefighters and emergency responders during an emergency. It can be practised at the level of an individual, a team or a task force during an emergency.

At the frontline level, field epidemiologists possess the necessary competencies and skills to apply IPC, biosafety and biosecurity in their daily work to protect human health and prevent transmission of disease pathogens.

At the intermediate level, field epidemiologists are responsible for applying, coordinating and supporting preparedness, and training on implementation and evaluation of IPC, biosafety and biosecurity to protect human health and prevent the transmission of disease pathogens, including those demonstrating antimicrobial resistance.

At the advanced level, a field epidemiologist is responsible for applying and leading on preparedness, training, implementation and evaluation of IPC, biosafety and biosecurity for the frontline and intermediate levels to protect human health and prevent the transmission of disease pathogens, including those demonstrating antimicrobial resistance.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

- 4. Disease management;
- 5. Laboratory capacity;
- 7. Preparedness and response; and
- 13. Training.

SUBDOMAINS

- 1. Infection prevention and control, biosecurity and biosafety preparedness
- 2. Infection prevention and control, biosecurity and biosafety implementation procedures
- 3. Continuous quality improvement evaluation

DOMAIN 7

Preparedness and Response

INTRODUCTION

Epidemiologists play an integral role in preparing for and responding to emergency disease threats for both humans and animals. Epidemics of novel zoonotic viruses, including recently emergent viruses, such as SARS CoV-2, Ebola, Nipah virus, Avian influenza and HIV, have been linked to human activities such as deforestation, agricultural expansion and intensification, urbanisation, hunting, travel and wildlife trade. To minimise the impact of these incidents, epidemiologists trained in the One Health approach require competencies in the following areas: early detection of disease threats; performance of risk assessments; policy development, adaptation and implementation; cross-sectoral coordination and incident command; and emergency risk communication. They must be prepared to coordinate, cooperate, and collaborate with cross-sector partners and organisations when emergencies occur, regardless of the type, scale, or severity. In addition, some countries may choose to include training in specific types of preparedness and response for mass gatherings, humanitarian crises and natural disasters, or chemical, biological, radiological and nuclear threats (CBRN).

At the frontline level, field epidemiologists understand emergency threats and risks, are aware of policies and plans for emergency response, and follow up on reported events, contribute to cross-sectoral coordination at the local level and deliver emergency risk communication messages.

At the intermediate level, field epidemiologists critically appraise information about potential health threats, participate in risk assessments, provide scientific information for policy development, identify preparedness gaps and solutions, lead cross-sectoral coordination, understand the workings of an emergency operations centre, and help develop emergency risk communication messages.

At the advanced level, field epidemiologists determine when and how to initiate a field investigation to assess a potential emergency health threat. In addition, can determine priority health risks by performing risk assessments, identify policy gaps and advocate for measures to address them, understand the structure and role of an emergency operation centre, assume a leadership role in emergency simulation exercises, and engage appropriately for emergency risk communication to the media and the general public.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
3. Field investigations;
4. Disease management;
5. Laboratory capacity;
6. Infection, prevention and control, biosecurity, and biosafety;
10. Ecosystem health;
11. Leadership and management;
12. Communication and community engagement;
13. Training; and
14. Ethics.

SUBDOMAINS

1. Detection of health threats
2. Risk assessments
3. Policy development, adaptation and implementation
4. Preparedness and response planning
5. Cross-sectoral coordination and incident management
6. Emergency risk communication
7. Mass gatherings
8. Humanitarian crises and natural disasters
9. Chemical, biological, radiological and nuclear emergencies

DOMAIN 8

Epidemiologic Studies

INTRODUCTION

Epidemiological studies include cross-sectional, case control and cohort studies as well as field trials and intervention studies. Epidemiological studies can be applied in two ways. They can be conducted as part of normative public health and animal health observational and experimental field epidemiology studies using a traditional linear hypothesis driven approach, respectively. Alternatively, epidemiological studies may be incorporated as a part of more expansive One Health research across the human-animal-environment interface. Application of epidemiological studies under One Health includes the incorporation of multidisciplinary, systems-based, and mixed-methods (qualitative and quantitative) approaches that include epidemiological, social and economic inputs. Related sector specific studies are also included and can be classified as special studies.

Epidemiologists at the frontline level assist in generating high quality descriptive field data to contribute to observational (cross-sectional, case control, cohort) and experimental studies (field trials and other intervention studies). They also contribute to the development and implementation of case studies and case series. The frontline is a key point of contact with communities through local advocacy and communication to support epidemiological field study, planning, implementation, and reporting.

An intermediate level epidemiologist monitors the quality of descriptive field data and provides preliminary analysis for observational and experimental studies. The intermediate level contributes to and facilitates development and implementation of

epidemiological studies horizontally along sectoral lines and vertically between front-line and advanced levels under a One Health approach.

An advanced epidemiologist leads the design, planning, and implementation of traditional observational and experimental studies, including secondary data analysis. In addition, they lead the design and planning of transdisciplinary One Health studies that also include the environmental sector, social scientists and economists. This level evaluates and coordinates study design, implementation and reporting across the human-animal-environment interface.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
3. Field investigations;
5. Laboratory capacity;
9. Data management, biostatistics, and informatics;
11. Leadership and management;
12. Communication and community engagement; and
14. Ethics.

SUBDOMAINS

1. Types of epidemiological studies
2. Designing and planning epidemiological studies
3. Conducting epidemiological field studies
4. Reporting and publication of study findings

DOMAIN 9

Data Management, Biostatistics, and Informatics

INTRODUCTION

Field epidemiologists at all three levels are expected to handle data in a professional way through the data life cycle: from collection to analysis, presentation, and interpretation for action. Each level also has a role in ensuring that high quality data collected in the field are reported to the higher administration levels. Data standardisation and application of internationally accepted standards is required to facilitate better data analysis and exchange at national or international levels. To be competent at performing analysis, biostatistics skills and the use of statistical methods and tests are also needed at each level. Health information systems and new digital tools support better data collection and automated analysis. These tools are a persistent need for early detection and rapid response in both public health and animal health. Coordination is critical among all levels to collect, analyse and interpret data in a standardised way through the data management cycle. Trainees need to know how to successfully implement health informatics interventions and how to choose the best digital tool as a solution for informatics problems to support decision-making through data retrieval and analysis. This will support countries to generate and use high-quality data to improve their surveillance systems and health information systems to achieve better outcomes.

At the frontline level, field epidemiologists collect and report quality data using paper forms and electronic tools without bias. Knowledge of data standards helps achieve interoperability between systems (e.g., human and animal surveillance systems). Frontline workers also summarise data using simple statistical methods like mean and median. They understand principles of stratification, such as by age or gender.

At the intermediate level, epidemiologists evaluate data coming from lower administration levels and conduct more advanced data analysis. They also use statistical software and create basic maps. The intermediate level understands informatics in order to advocate for better data collection and the acceptance and use of electronic tools.

At the advanced level, epidemiologists perform more complicated biostatistical tasks such as multivariate and time series analysis. They are comfortable using statistical and geospatial analysis software to perform required statistical tests and create graphs, tables and maps. Advanced level epidemiologists also calculate a sample size for epidemiologic studies according to study design. They also understand internationally available standards for One Health sectors to ensure the local systems adapt these standards to achieve easy and smooth interoperability and information exchange inside the country and with neighbouring countries.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
5. Laboratory capacity;
8. Epidemiological studies; and
14. Ethics.

SUBDOMAINS

1. Planning for data collection and analysis
2. Data collection
3. Data analysis
4. Data interpretation and presentation
5. Digital tools

DOMAIN 10

Ecosystem Health

INTRODUCTION

Ecosystem health is an integral part of the One Health approach that has been developing rapidly along with the growing awareness of the impact that anthropogenic drivers have on global environmental change, ecosystem integrity and ecosystem function. Epidemiologists at all levels need to be aware of the impact that these drivers have on human, animal and ecosystem health and disease emergence. Barriers to understanding and management of environmentally driven disease events include the lack of awareness by other sectors and gaps in collaboration, communication and data sharing among human, animal and ecosystem health experts at all levels of governance. Field epidemiologists should have an interoperable set of competencies including a good understanding of the links among sectors and disciplines. The overall aim is to protect the environment and prevent the emergence and spillover of disease pathogens across the human-animal-environment interface by understanding the overall ecosystem's health.

At the frontline level, field epidemiologists have basic knowledge on the importance of biodiversity and ecosystem functions. They provide a description of local ecosystem services and describe the local agencies that oversee plant, animal, and ecosystem health, including those that manage natural resources, monitor air, soil, and water quality. Frontline level epidemiologists are aware of local environmental health threats and their mandate to detect and respond across sectors. They are aware of the impacts of local environmental degradation and the need to collaborate with all environmental stakeholders to monitor and predict threats to ecosystem health that have the potential to drive disease emergence in humans and in animals.

At the intermediate level, field epidemiologists have a more developed understanding of the drivers of biodiversity loss and environmental degradation. They have open and

collaborative relationships with the agencies that manage plant, animal, and ecosystem health at the regional level and awareness of the policies and regulations that are in effect. They recognise the role of the environment on disease emergence and transmission, and food security.

At the advanced level, field epidemiologists are familiar with biodiversity indices and the international regulations and policies, including those related to endangered species protections, wildlife trade, and the environment. They regularly collaborate and exchange data with agencies that manage plant, animal and ecosystem health and promote data sharing and compatibility. They assess how environmental degradation impacts the social and environmental determinants of health for human and animal populations and individuals. Finally, they make recommendations on preventive and responsive policies and regulations that mitigate the risk of disease emergence and support overall sustainability of ecosystems and local societies.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
7. Preparedness and response;
9. Data management, biostatistics, and informatics; and
11. Leadership and management.

SUBDOMAINS

1. Biodiversity and ecosystems
2. Plant, animal and ecosystem health
3. Air, water and soil quality
4. Impacts of environmental degradation on health
5. Anthropogenic, environmental and socioeconomic drivers of emerging health threats

DOMAIN 11

Leadership and Management

INTRODUCTION

Individuals with leadership and management capabilities help organisations meet their goals and inspire team members to perform to their greatest potential. Field epidemiologists at all levels require basic leadership and management skills in order to effectively perform their work functions. This domain describes competencies needed to support One Health policies and their implementation, organisational and project management, finance and budgeting and security in the field.

At the frontline level, field epidemiologists demonstrate an ability to work across sectors and advocate for One Health policies at the local level, demonstrate professionalism, fulfil project requirements and ensure personal security when conducting field work.

At the intermediate level, field epidemiologists contribute to the development of One Health policies, serve in a leadership role within an organisation at the regional level, and ensure the security of the fieldwork team. They participate in the design and implementation of One Health projects including the formulation, management and advocacy for financing and budgets.

At the advanced level, field epidemiologists advocate for One Health policies at the national and international levels, manage

cross disciplinary teams, lead the design, implementation and management of One Health projects, including financing, and mitigate security risks.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
3. Field investigations;
4. Disease management;
7. Preparedness and response;
8. Epidemiological studies;
10. Ecosystem health;
12. Communication and community engagement;
13. Training; and
14. Ethics.

SUBDOMAINS

1. Leadership and One Health
2. Policy development and implementation
3. Organisational management
4. Project management
5. Finance and budgeting
6. Security in the field

DOMAIN 12

Communication and Community Engagement

INTRODUCTION

Communication includes the competencies necessary for conducting exchange of information at the local, regional and national level. Field epidemiologists should have effective oral and written communication between various audiences. They should also be well versed in risk communication strategies related to human, animal and ecosystem health. For field epidemiologists, there are differences in routine communication of field findings compared to emergency communication during outbreaks or pandemics. This distinction for routine communication applies to frontline One Health field epidemiologists compared to emergency communication activities which are handled at the intermediate and advanced levels.

At the frontline level, field epidemiologists demonstrate basic skills in preparing oral presentations and written communication and understand the needs of the audience.

At the intermediate level, field epidemiologists define communication needs for different target audiences and manage messaging related to risk communication.

At the advanced level, field epidemiologists use advanced communication methods for working with individual and stakeholder audiences.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

1. Foundational knowledge and skills;
2. Surveillance systems;
3. Field investigations;
4. Disease management;
7. Preparedness and response;
8. Epidemiologic studies;
10. Ecosystem health;
11. Leadership and management; and
13. Training.

SUBDOMAINS

1. Oral communication to technical and nontechnical audiences
2. Written communication to technical and nontechnical audiences
3. Risk communication
4. Communication for events

DOMAIN 13

Training

INTRODUCTION

Training is a fundamental component of the capacity building process that occurs in both formal and informal settings. Field epidemiologists are called to interact and manage teams at various levels, and knowledge and competency transfer has to be considered as a core responsibility to facilitate the organisational human resources growth and improvement.

This domain defines the competences that field epidemiologists should demonstrate to manage individual and group learning processes, design, deliver and evaluate learning needs' assessment studies, and develop and evaluate residential, virtual or blended training programmes. Competencies are also described for delivering user driven training initiatives, applying residential and blended learning methods for both classroom and virtual training and mentor based training at three levels: trainee, trainer and mentor. One subdomain describes the necessary competencies to develop accurate, relevant and engaging contents for eLearning, while one is dedicated to continuous quality improvement and risk management principles in the training context.

At the frontline level, field epidemiologists demonstrate engagement and support in learning processes and dynamics, understanding of learning needs' assessments, participation in training delivery and eLearning development and capacity to apply quality standards and risk management measures.

At the intermediate level, field epidemiologists facilitate learning processes to develop safe learning environments, develop and use learning needs' assessments, design, develop,

carry out and assess training programmes, design and develop educational contents for eLearning and adopt quality standards and risk management measures.

At the advanced level, field epidemiologists lead learning processes to enable safe learning environments, lead learning needs' assessments, training design, delivery and assessment, support research and innovation in the field, provide scientific coordination to eLearning initiatives, and promote and transfer competencies on quality standards and risk management.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
4. Disease management;
5. Laboratory capacity;
6. Infection prevention and control, biosafety and biosecurity;
7. Preparedness and response;
8. Epidemiological studies;
10. Ecosystem Health,
11. Leadership and management;
12. Communication and community engagement; and
14. Ethics.

SUBDOMAINS

1. Learning processes
2. Learning needs assessment, training programme design, development and assessment
3. Training delivery
4. eLearning
5. Quality and risk management in training

DOMAIN 14

Ethics

INTRODUCTION

Professional ethics are based on human moral, cultural and religious values which guide human behaviour governance systems. The field epidemiologist is responsible for maintaining professional ethical standards and norms in order to engender societal trust. This trust is prerequisite to enable field epidemiologists to perform their field duties and protect communities and populations. Ethics applies to the manner in which field activities, including investigation and surveillance, research, data management and reporting are conducted. In addition, ethical codes of practice include gender and discrimination issues.

Sector specific differences exist at all three levels, specifically related to use of human subjects, animal welfare and ethical field challenges including potential conflicts of interest. One Welfare includes the interconnections between social, human and animal welfare and the integrity of the environment. This includes environmental ethics related to environmental stewardship, biodiversity, air, water, and soil resources sustainability and pollution prevention. At all levels, the ethical code of practice includes gender and discrimination issues.

At the frontline and intermediate level, field epidemiologists avoid conflicts of interest and apply ethical principles and practices daily to gain and maintain public trust, in the performance of duties including investigation and surveillance, research, data management and reporting.

At the advanced level, field epidemiologists lead and support the resolution of ethical conflicts and apply ethical principles and

practices daily to gain and maintain public trust, in the performance of duties including investigation and surveillance, research, data management and reporting. The advanced level will collaborate in situations dealing with conflict resolution at the local and national levels.

CROSS-REFERENCES

Knowledge, skills and competencies within this domain can be cross-referenced with the following domains:

2. Surveillance systems;
3. Field investigations;
4. Disease management;
5. Laboratory capacity;
6. Infection prevention and control, biosafety and biosecurity;
7. Preparedness and response;
8. Epidemiologic studies;
9. Data management, biostatistics, and informatics;
10. Ecosystem health;
11. Leadership and management;
12. Communication and community engagement; and
13. Training.

SUBDOMAINS

1. Ethics and its role related to health
2. Ethical issues related to field epidemiology
3. Moral challenges related to ethical decision-making
4. Legal and regulatory ethical frameworks
5. The five step process for ethical decision-making

How To Use This Handbook

YOU SELECT WHAT YOU WANT

The prime advantage of our stackable, progressive learning model is its ability to navigate the uncharted waters of evolving circumstances and shifting paradigms—an area where classical training often falls short. An agency might require modules on rapid response teamwork, epidemiologic investigation, and systematic surveillance as an introduction to applied epidemiology. The foundational course immerses participants in individual upskilling experiences through case studies and innovative training methods. This journey of discovery commences with the fundamentals of One Health epidemiology for outbreak preparedness, then advances with add-ons to amplify skills and address the dynamic demands of outbreak readiness and research.

As time progresses, new building blocks are added. It ensures an ongoing process of improvement and adaptation, much like adding more pieces to create a more intricate and resilient structure. It empowers industry, individuals and institutions to tailor their training to meet evolving tastes and adapt to ever-changing circumstances. Similar to constructing with Lego, NextGen Workforce Development becomes customisable, adaptable to achieve any desired outcome. Living in a world of constant flux, we believe this approach works. It is ideal for constantly shifting mission situations where practice evolves to meet novel demands.

ANALOGY TO GASTRONOMY

Grounded on the COHFE framework, the NCID Academy has specially crafted the *Survivor School for Infectious Disease Outbreaks* handbook almost like a cookbook. A mentor once said that epidemiology is not just about getting good ingredients. It is also about good cooking. And getting good recipes.

Good Ingredients

Applied epidemiology is about gathering information much like gathering food ingredients. It relies on a blend of probability, statistics and sound causal reasoning. A well-rounded story needs to answer the who, where, when, why and how. Think of it as understanding the nuances of exactly when and how much to add an ingredient in the cooking process. Hypotheses testing grounded in the sciences relies on many such essential ingredients.

Good Cooking

Just as culinary masters show their skills in cooking, we offer you skillsbuilding through a compilation of field notes on key concepts, a workshop sampler for technical content in an intensive course, and workshop musings on specific socio-behavioural themes. From the seasoning wisdom of hero masterchefs, real-life experiences provide lessons in making decisions, cultivating relationships, and growing in service—the science and art of outbreaks.

Good Recipes

At the back of this handbook, our three Guided Learning Road Maps are akin to good recipes providing time-tested techniques for epidemiology training. They document explicitly what is needed for coursework, guided by trainer-mentors. They also contain formulas for the secret sauce behind communications and reporting, good signature projects, and proficient epidemic intelligence. Think of them as the refined recipes that chefs rely on, ensuring consistently amazing results.

SOMETHING'S COOKING: EPI-SODES

In the realm of gastronomy, crafting exceptional mouth-watering dishes hinges on the fusion of high-quality ingredients and skilful cooking techniques. We all know how to enjoy a fine dining experience. The same applies for good epidemiology training and we draw our analogy with the creation of culinary masterpieces. Picture “EPI-FORCE, Urban Health Adventures” as your culinary guide, leading you through four enticing courses of outbreak escapades, each presented as a captivating graphic novel.

The four EPI-SODES are your four courses in this gastronomic adventure. Like the courses in a meal, they each serve a unique purpose and blend together tastefully!

One Health Approach to Outbreaks

Think of this as the appetiser. It's the perfect start, offering insights into how outbreaks provide opportunities to uncover vital information about health threats. It's about understanding the ingredients of an outbreak and the skills required to dissect it.

This EPI-sode equips individuals to work as frontline managers and executives requiring rapid response to unexpected events such as outbreaks. You can be called upon at any moment during a public health crisis to perform surprising tasks and be the jack-of-all-trades, doing everything, everywhere, all at once. You must then operate urgently to navigate data uncertainty, apply causal reasoning through hypothesis formulation and testing, and manage risk communications. Under stressful conditions, you need also to develop the cross-cutting skills of teamwork and report writing.

Here, One Health field epidemiology methods are introduced to handle situations swiftly—identifying, quantifying, and addressing emergent threats—while considering their socio-economic and other impacts. Integrating the biological, environmental and behavioural sciences, our syllabus blends epidemiologic principles with urban and community practices, helping frontliners to think critically before instituting prevention and control measures.

Learning Outcomes:

1. Apply epidemiology in surveillance and investigation to identify and assess unusual occurrences and manage the associated risks.
2. Evaluate the systems for disease surveillance, early alerts, contact tracing and emergency response to superspreading events.
3. Explain the transmission dynamics and risk factors involved in outbreaks, including communications to stakeholders and the public.
4. Demonstrate teamwork to swiftly formulate and implement management strategies and vigilance against emerging health threats.

Global-Urban Health Security

Your soup and salad. Just as it's essential to have a well-balanced diet, this episode delves into the intricate interactions that define health security. Like a complex recipe, it involves understanding the interplay between external agents, susceptible hosts, and the environment.

This EPI-sode equips individuals to practice outbreak epidemiology effectively, especially for cities and urban settings which serve as trade and travel hubs. Appreciating the natural biosphere and man-made technosphere becomes paramount. You develop the skills and understanding of health emergencies prevention and protection, as well as perspectives crucial for communications.

Coming from painful experiences of past outbreaks are insights into policy making, socio-behavioural nudges, and outbreak management systems that can avert widespread morbidity and mortality. Emphasising disease control in the community, our syllabus integrates the clinical and epidemiologic tools with the environmental and laboratory tools to anticipate and handle crisis situations confidently and effectively.

Learning Outcomes:

1. Demonstrate understanding of readiness issues that require surveillance, management, and communications strategies.
2. Apply the epidemiologic triad of host-agent-environment to comprehensively prepare outbreak countermeasures, including vaccines.
3. Formulate systematic measures for health protection incorporating applied epidemiology to inform multisectoral actions.
4. Develop skills for community engagement, negotiation, and advocacy to promote whole-of-society supports.

Epidemic Intelligence Gathering

Time for the main course. Think of this as the perfect accompaniment to your meal, shedding light on the ever-evolving ecosystem in field epidemiology. It's akin to a deep dive understanding of the relationships between ingredients that make a dish special.

This EPI-sode equips individuals to manage health emergency situations using field epidemiologic methods at the human-animal-food-environment interface to address concerns of practitioners in various One Health agencies. You delve into health emergencies and pandemic preparedness amidst climate change, economic, and lifestyle challenges. The training acquaints you with collaborative partnerships which, when effectively managed, lead to impactful societal actions and foster intelligence gathering, stakeholder engagement, and community participation.

An outbreak event occurs whenever there is introduction of a pathogen into the susceptible population of a specific place and time. Drawing insights from training which integrates an all-hazards model into the ecosystems framework, our syllabus utilises real-life case studies and scenario gaming. Collaborative skills are honed alongside proficiencies for scientific investigation and intervention.

Learning Outcomes:

1. Apply field epidemiologic methods to identify the source of infection and mode of transmission in outbreaks and other events.
2. Design collaborative systems for comprehensive epidemic intelligence gathering from sources at the human-animal-food-environment interface.
3. Demonstrate the ability to coordinate and execute responses that tackle climate change and biopsychosocial concerns holistically.
4. Evaluate components of the all-hazards framework to enhance prevention and control in the context of healing environments.

Leadership for Risk Management

The dessert course, providing closure to our meal. Just as a great dessert balances flavours, this episode explores the leadership needed to understand the impact of external factors on health. It's about the grand finale of our culinary masterpiece.

This EPI-sode equips professionals with leadership and mentoring skills to excel in complex environments, fostering collaboration across healthcare, government, and community sectors. At the intersection of differing interests, risk management becomes important with difficult trade-offs. While traditional epidemiology training is still necessary, it is no longer sufficient to meet modern geopolitical demands. Leadership with new understanding is crucial due to societal complexities involving misinformation, powerful stakeholders, and the politicisation of issues.

This course addresses that gap by enhancing skills for stakeholder engagement, policy making, and capacity strengthening to tackle shared challenges. Our syllabus prepares professionals to navigate and succeed in dynamic and challenging scenarios. Emphasising science and health diplomacy, interactive sessions focus on identity, wholeness, and purpose, enhancing workforce readiness to meet emerging threats and challenges.

Learning Outcomes:

1. Demonstrate leadership to negotiate and build consensus across sectors, working with influencers, policy makers, and community leaders.
2. Apply knowledge in the epidemiology of emerging threats for disease control and prevention across diverse sectors and communities.
3. Develop a comprehensive biopsychosocial approach that promotes resilience in the context of infectious threats to modern lifestyle practices.
4. Foster business continuity planning for industry and the population for mutually beneficial outcomes.

SATISFYING, EPI-LOGUE

Your culinary journey concludes with EPI-logue, akin to post-dinner coffee (COHFE) with a sampling platter of courtesy and wisdom. This is our way of sharing the philosophy of NextGen Workforce Development with budding Trainer-Mentors. COHFE defined the core competencies and training domains to support workforce development. Survivor School has augmented this journey of discovery by introducing applied sciences with comics, field notes, a workshop sampler, and master classes. By sharing in the urban health adventures of our superhero avatars, EPI-MAN and his EPI-FORCE team, we too would have undergone learning in a series of Operations (Prudence, Justice, Fortitude, Temperance) intended to be fun and exciting.

Look out for surprises that pop up anywhere along the way and enjoy. It's also in your after-dinner conversation, where experts share a little more insight than everyone else in the room. To train professionals across the interconnected domains of human, animal, food and environmental health, participants of the entire Survivor School experience typically go through a rookie *Survivor Track* first before moving on a year or two later into the *Hero Track*. This Handbook is your guide to eventually becoming an expert in the world of applied outbreak epidemiology. If there's any way we can improve the taste, your feedback will be the little special extra that we crave!

Bon appétit. 😊

Glossary of Terms

Acceptable risk. The level of risk that is tolerated or accepted. Defining acceptable risk should take into account informed consent, and that 'acceptability' is likely to vary markedly between different stakeholders, populations and locations, and may be culturally specific.

Acute health event. Any event that may have negative consequences for human health, including events that have not yet lead to disease in humans but have the potential to cause human disease through exposure to infected or contaminated food, water, animals, manufactured products or environments.

Agent. A factor such as a microbe or chemical whose presence is essential for the occurrence of disease.

Air cleaning. An indoor air quality control strategy to remove various airborne particulates and/or gases from the air. The three types of air cleaning most used are particulate filtration, electrostatic precipitation, and gas sorption.

Alert. The first notification that a public health event with adverse consequences may occur or may be occurring.

All-hazards approach. An approach to emergency management that takes into consideration all possible hazards, including chem-bioterrorism, based on the recognition that there are common elements and common capacities required.

Antibiotic. A substance or compound (also called chemotherapeutic agent) that kills or inhibits the growth of bacteria. Antibiotics belong to the group of antimicrobial compounds used to treat infections caused by microbes.

Arthropod. Insect or other invertebrate animal of the phylum Arthropoda characterised by jointed limbs, segmented body, and exoskeleton.

Artificial intelligence (AI). The use of algorithms or models to perform tasks and exhibits behaviours such as learning, making decisions and making predictions. Machine learning is the subset of Artificial Intelligence that allows computer algorithms to learn through data, without being explicitly programmed to perform a task.

Attitude. A person's feelings, values and beliefs, which influence their behaviour and the performance of tasks.

Behaviour. Observable conduct towards other people or tasks that expresses a competency. Behaviours are measurable in the performance of tasks.

Bias. The systematic deviation of results or inferences that distort the view of what is actually occurring.

Biodiversity. The variety of species of microorganisms, plants, and animals in a natural community, of communities and cultures within a particular environment, and of genetic variation within a species, all of which are important for the stability of ecosystems.

Biological transmission. Transmission of an infectious agent that involves a biological process (e.g., stage of development) in an intermediate host.

Biosphere. Our global ecological system that integrates every living being in a relationship with one another.

Bioterrorism. Terrorism by intentional release of microbial agents that may be in naturally occurring or human-modified form.

Building-related illness. A discrete, identifiable disease or illness that can be traced to a specific pollutant or source within a building.

Built environment. Man-made surroundings that provide the human activity setting, including urban infrastructure such as buildings, transport, sanitation, water supply, and green areas for living, working and playing.

Capability. The potential and capacity of an individual to perform specific tasks. Capability involves adaptability, judgement and future-focused thinking.

Carrier. Person harbouring an infectious agent in the absence of disease but serving as a potential source of infection.

Case. An infected and sick person.

Case-control study. In an outbreak, a case-control study is an observational method comparing people with the illness (cases) to similar people without it (controls) to look backward (retrospectively) for past exposures (like contaminated food, travel) to find common risk factors, helping identify the source or cause of the outbreak.

Cluster. The aggregation of relatively uncommon events or disease in space and time.

Collaborative surveillance. The systematic strengthening of capacity and collaboration among diverse stakeholders, both within and beyond the health sector, with the ultimate goal of enhancing public health intelligence and improving evidence for decision-making.

Competency. The ability of a person to integrate knowledge, skills and abilities in their performance of tasks in each context. Competencies are durable, trainable and measurable. Competencies are the measures of how an individual performs a capability.

Competency framework. An organised and structured representation of a set of interrelated and purposeful competencies that are needed to perform a job well.

Confidence. Confidence describes the certainty or uncertainty around an estimate. Even with perfect information (i.e. no 'uncertainty'), natural variation ('variability') still exists.

Confirmation. The process of seeking evidence to confirm the accuracy of information. Also, the conclusion of such a process (i.e. the state when information has been verified).

Consequences. The downstream effects that result from an action or condition that may be negative or positive. Consequences may include social, technical and scientific, economic, environmental, ethical, or policy and political effects.

Contact. A person who has been in contact with an infected person or contaminated environment.

Context. Assessing the environment in which the event is taking place.

Control measures. Interventions put into place to reduce the effect of a hazard on the exposed population.

Core. A required knowledge, skill or competency for a specific level of training for One Health field epidemiologists. A core competency is the minimum level of competency expected to be achieved by the participants in a training programme.

Detection. A process by which signals of potential public health concern are identified, recorded and preliminarily assessed.

Differential diagnosis. A systematic method for attaining a diagnosis through consideration of health and vital statistics according to age, sex, or some other factor.

Disinfection. The destruction of pathogens or their toxins by direct exposure to chemical or physical agents.

Domain. A broad topic or subject area that is divided into subdomains consisting of knowledge, skills, and competencies.

Droplet nuclei. Particles implicated in spread of airborne infection; the dried residue formed by evaporation of droplets coughed or sneezed into the air or by aerosolisation of infective material.

Droplet transmission. The direct dissemination of a pathogen from a reservoir to a susceptible host's conjunctiva, nose or mouth, by spray with relatively large, short-ranged (within a metre) aerosols produced by sneezing, coughing or talking.

Ecology. Study of the relationships among living organisms and their environment; the comprehensive science of the relation of the organism to the environment.

Ecosystem. The fundamental unit in ecology, comprising the living organisms and the nonliving elements that interact in a defined region which may be of any size, from a drop of pondwater to the entire biosphere; edges of ecosystems are seldom clearly defined.

Emerging infectious disease. Diseases recently identified to pose an increased risk of infection (including old diseases experiencing a resurgence) because of changed host-agent-environment conditions.

Endemic. The habitual presence, or the usual prevalence, of a disease within a given population or geographic area.

Environment. All that which is external to the individual human host. Can be divided into physical, biological, social, cultural, etc., any or all of which can influence the health of populations.

Epidemic. The occurrence in a community of cases of a disease clearly more than normal expectancy.

Epidemic Intelligence. Early warning, alert and response; an organised process to rapidly detect and respond to signals during acute public health events of any origin.

Epidemiologist. A professional who strives to study and control the factors that influence the occurrence of disease in defined populations and societies, and is knowledgeable about public health and causal inferences in health.

Epidemiology. The study of the distribution and determinants of health-related states in specific populations, and the application of this knowledge to control health problems.

Event. A manifestation of disease or an occurrence that creates a potential for disease. It may include events of infectious, zoonotic, food safety, chemical, radiological or nuclear origin; and that may be transmitted by persons, vectors, animals, goods, food, or through the environment.

Event-based surveillance. The organised collection, monitoring, assessment and interpretation of mainly unstructured, ad hoc information regarding events or hazards that may represent an acute threat to human health. Event-based surveillance supports public health intelligence by feeding signals from diverse sources into the intelligence process.

Exfiltration. A gradual escape of air or other fluid through a wall, window, door or membrane.

Fomites. Articles that convey infection to others because they have been contaminated by pathogenic organisms.

Food-borne illness. A general term often used to describe any disease or illness caused by eating contaminated food or drink.

Food contact surfaces. The surfaces of equipment with which food normally comes in contact, and those surfaces from which food may drain, drip or splash back onto other surfaces in contact with food.

Food preparation. The manipulation of foods intended for human consumption by such means as washing, slicing, peeling, chipping, shucking, scooping and/or portioning, and activities involving temperature change.

Genetic epidemiology. Component of epidemiology that studies genetic factors and their interaction with the environment in the occurrence of disease.

Genomic surveillance. Public health practice that involves the monitoring and analysis of the genetic information (genomes) of pathogens, such as viruses, bacteria, and other microorganisms, to track their spread, evolution, and response to interventions.

Global public health security. The activities required, both proactive and reactive, to minimise the danger and impact of acute public health events that endanger people's health across geographical regions and international boundaries.

Hazard. An agent that has potential to cause adverse health effects in exposed populations. Hazard focuses on the source of the harm rather than its likelihood.

Health. A state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity.

Host. A person or living animal, including birds and arthropods, that affords subsistence or lodgement to an infectious microbial agent under natural conditions. Some parasites pass successive stages in alternate hosts of different species, known as definitive and intermediate hosts.

Host factors. Biological, social, behavioural characteristics relevant to the health of a group or population.

Human ecology. Study of human groups as influenced by environmental factors, including social and behavioural factors. A macro-level holistic approach to the study of human organisation.

Hygiene. The principles governing preservation of health and their practical application in procedures and techniques conducive to good health.

Immunity. A state of altered responsiveness to a specific substance acquired through immunisation or natural infection; for certain diseases, this protection lasts for the life of the individual.

Immunisation. The artificial induction of active immunity by introducing the specific antigen of a pathogenic organism into a vulnerable host, for the protection of susceptible individuals.

Incubation period. The incubation period refers to the time between exposure to an infectious pathogen (such as a virus or bacterium) and the onset of signs or symptoms of illness.

Indicator-based surveillance. The routine collection of pre-defined information about diseases using case definitions (e.g. weekly surveillance of cases of acute flaccid paralysis). There are often predetermined outbreak thresholds for alert and response.

Infectious disease. A disease caused by a specific infectious agent or its toxic products that arises through transmission of that agent or its products from an infected person, animal or reservoir to a susceptible host.

Infectiousness. The comparative ease with which the disease is transmitted to other hosts.

Infectivity. The ability of a microbial agent to enter, survive and multiply in the host.

International Health Regulations. A legal instrument of international law that is legally binding on the 194 WHO Member States. The Regulations aim to help the international community prevent and respond to acute public health threats that have the potential to cross borders and threaten people worldwide.

Knowledge. Assimilation of information through learning. Knowledge is the body of facts, principles, theories, and practices related to a field of work or study. It is described as theoretical and factual.

Learning objective. The aim that should be achieved by the end of a learning experience. Learning objectives reflect change towards a specified standard or level. Course learning objectives capture the knowledge, skills and abilities related to the subject matter of the course.

Likelihood. The probability of an event occurring.

One Health. An integrated, unifying approach that aims to sustainably balance and optimise the health of humans, animals, plants and ecosystems, recognising that the health

of humans, domestic and wild animals, plants and the wider ecosystems are closely linked and interdependent.

Microbial agent. Very tiny forms of life that include bacteria, fungi, and protozoan parasites, and are best visualised under a microscope.

Molecular epidemiology. A component of epidemiology that studies the molecular mechanisms involved in the pathology and causation of disease.

Multifactorial causation. The concept that a given health state may have more than one cause.

Outbreak. The aggregation of disease in space and time that can be attributed to a single source; an epidemic limited to localised increase in the incidence of a disease.

P-value. The probability of seeing your results if there's no real effect (the null hypothesis is true). The lower the p-value, the less likely your results are due to random chance, providing stronger evidence against the null hypothesis, suggesting a real effect or relationship exists. Typically, $p < 0.05$ is the cutoff for "statistically significant", meaning you reject the null hypothesis.

Pandemic. An epidemic occurring worldwide, crossing international boundaries, and usually affecting large numbers of people.

Pathogen. Any microorganism capable of producing disease.

Pathogenicity. The property of an infectious agent that determines the extent to which overt disease is produced in an infected population; mechanisms by which an agent produces disease, literally, causing a pathological process.

Philosophy. Humanities subject dealing with the most basic beliefs, concepts, and attitudes of an individual or population groups.

Postulate. An assertion or assumption offered as the basis of a theory.

Public health. Health programmes and services characterised by planning and intervening for better health in populations, including understanding and reducing the risks of disease, disability and death.

Public health medicine. The practice of medicine concerned with health and disease as a function of group living in the community.

Public health intelligence. A core public health function responsible for identifying, collecting, connecting, synthesising, analysing, assessing, interpreting, and generating a

wide range of information for actionable insights and disseminating these for informed and effective decision-making to protect and improve the health of populations.

Public health social measures. A broad array of nonpharmaceutical interventions implemented by individuals, communities and governments to reduce the risk and scale of transmission of epidemic- and pandemic-prone infectious diseases.

Quantitative epidemiology. Component of epidemiology that studies the science of collecting, summarising and analysing quantitative data.

Randomised controlled trial. Experiment in which the subjects are randomly distributed into groups, which either are subjected to an interventional procedure or which serve as controls for comparison.

Reliability. The degree of stability of results exhibited when a measurement is repeated under identical conditions.

Reservoir of infection. The natural habitat of an infectious agent; a continuous source of infectious disease that can be found in the natural ecology (people, animals, arthropods, soil, water, substance or any combination of these environments).

Risk. The likelihood or probability of a specific event occurring within a given time if a person is exposed to a threat or hazard. Risk is a quantifiable concept that often reflects the likelihood of a negative event, such as death or disease.

Risk assessment. A continuous process of gathering, assessing and documenting information to estimate the nature and probability to adverse effects in humans, animals or the environment following an event or exposure to a hazard. A risk assessment provides the basis to inform the actions to reduce the negative consequences of public health events through preparedness and response activities.

Risk communication. The real-time exchange of information, advice and opinions among experts, community leaders or officials, and the people who are at risk or who have a direct influence on risk mitigation due to their practices or behaviour. Risk communication ensures people and communities are aware of current threats and can be used to promote behaviours to reduce risks.

Risk management. The process of weighing policy options in the light of a risk assessment and, if required, selecting and implementing appropriate intervention options, including regulatory measures. With respect to acute public health events, risk management is the process by which appropriate actions are taken to manage and reduce the negative consequences of acute public health risks.

Safe temperatures. For perishable food which can support rapid and progressive growth of infectious or toxigenic microorganisms, this means temperatures of 10°C or below, or 60°C or above.

Sanitation. The establishment of conditions favourable to health, especially with respect to infectious diseases. Includes disposal of infective materials (especially carcasses), discharges and excrement, application of disinfectants and general cleaning to make disinfection effective, isolation of infective animals and improvement in ventilation of buildings, and improving feeding and watering arrangements to avoid fecal and urinary contamination of food and water.

Sensitivity. The proportion of actual positives that are correctly identified by a test (e.g. the percentage of sick people who are correctly identified as having a condition).

Septicaemia. Invasion of the bloodstream by virulent microbes from a focus of infection that results in blood poisoning.

Sick building syndrome. Symptoms that affect building occupants during the time they spend in the building, and diminish or go away during periods when they leave the building.

Signal. The initial detection of a potential public health event, prior to verification. Signals can be raw, not yet assessed, in verification, or verified. A verified signal transitions into an event.

Skill. Ability to apply knowledge and to complete tasks and solve problems. Skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools, and instruments).

Sociology. Humanities subject dealing with the development, structure, interaction and collective behaviour of organised population groups.

Surveillance. The systematic and ongoing collection, collation and analysis of data for public health purposes, and the timely dissemination of public health information for assessment and public health response, as necessary.

Syndrome. A group of clinical signs and symptoms that consistently occur together, or a condition characterised by a set of associated clinical signs and symptoms.

Technosphere. The part of the physical environment affected through building or modification by humans.

Threat. A person, place, thing, or development, or a combination of these, that can harm health security, either as a real or perceived danger (e.g., antimicrobial resistance, climate change, chem-bioterrorism).

Triage. The process of determining if an event or alert detected by a surveillance system is a potential risk to public health and prioritising it for action.

Triangulation of data. The process of combining and analysing public health data from multiple sources to generate a more comprehensive and accurate understanding of public health signals. This technique helps to cross-verify findings, reduce bias and identify patterns or trends that might not be evident when relying on a single data source.

Vaccination. The use of vaccines to prevent specific diseases.

Vaccine. Immunobiological substance used for active immunisation by introducing into the body a live, modified, attenuated or killed inactivated infectious microorganism or its toxin; originally applied to the serum from a cow infected with vaccinia (cowpox) virus, but now used for all immunising agents.

Vector. An insect or animal that transmits a pathogen from one organism or source to another.

Vector-borne infection. Infections transmitted by an insect or animal vector. The vector may merely be a passive carrier of the infectious agent, but many kinds of infectious agents undergo a stage in biologic development in the vector that is essential to the survival of the infectious agent.

Ventilation air. Defined as the total air, which is a combination of the air brought inside from outdoors and the air that is being re-circulated within the building.

Verification. Confirming the authenticity, completeness and accuracy of the data, and eliminating hoaxes, false rumours and artefacts. Verification involves double-checking the primary source, integration and comparison with data from other sources, comparing with specified parameters and indicators, or performing field investigations.

Vermin. Troublesome insect or animal.

Virulence. Measure of the severity of the disease after infection occurs.

Viruses. Microbial agents composed of genetic material (RNA or DNA) surrounded by a protein coat. To replicate, they must infect a living cell: viruses can reproduce only by entering a host cell and using the translational system of the cell to initiate the synthesis of viral proteins and to undergo replication.

Vulnerability. The characteristics and circumstances (physical, social, economic, and environmental factors or processes) of an individual, community, system or asset that make it susceptible to the effects of a hazard.

Zoonosis. Infectious disease transmissible under natural conditions from vertebrate animals to humans.



**EPI-sode 1:
One Health Approach
to Outbreaks**

Our Longest Day...

(Tune: The Longest Day)

Verse 1

Epi team, came here as rookies,
Epi team, will pass this way;
Epi team, don't count the hours,
As they live, public health days!

Verse 2

Epi team, though tired and weary,
Epi team, are here to stay;
Epi team, won't stop at sunset,
When it ends, outbreaks at bay!

Chorus

Public health days, the longest days,
This life's price, we gladly pay;
Filled with hopes but not with fears,
Filled with toil but not with tears!

Verse 3

Epi team, build up to thousands,
Epi team, to victory;
Marching on right into battle,
Public health, making history!

Perspective on Outbreak Readiness

INTRODUCTION

One Health is an integrated, unifying approach that aims to sustainably balance and optimise the health of people, animals, and ecosystems. At this interface sits emerging, infectious diseases (EIDs) that have caused pandemics and outbreaks throughout the world. The most obvious threats are the links which comprise:

- Novel contagion with pandemic potential, e.g. Avian influenza, Nipah virus infection, SARS, MERS, COVID-19
- Mosquito-borne diseases, e.g. Japanese encephalitis, Zika virus infection
- Mammalian vectors, e.g. hantavirus infection, leptospirosis, rabies
- Food safety and security issues, e.g. E Coli O157, Group B streptococcal infection
- Abuse of antibiotics, especially with livestock and fish farming, which develop antimicrobial resistance and give rise to the emergence of multidrug-resistant organisms

More than 60 per cent of all EIDs are zoonotic in origin, and these will continue to challenge health systems in our countries for years to come. Global hotspot maps of spatial variation in zoonotic risk index have shown that the East Asia and ASEAN region geolocate with high estimated EID risks. Our region is at the centre of global attention regarding EIDs after the emergence of COVID-19, SARS, Nipah virus, and recombinants of the influenza virus, the pathogen which causes the avian and swine flus.¹

The One Health approach to prevent the next pandemic is a collaborative, multidisciplinary strategy recognising that human, animal, food and environmental health are interconnected. It involves experts from these sectors working together in rapid response teamwork to prevent, detect and respond to diseases—particularly zoonotic spillovers—to improve health security and manage threats effectively.^{2,3}

The community and economic challenges of EIDs in our region include potential outbreaks of Avian influenza, hantavirus, Japanese encephalitis, leptospirosis, Nipah virus, rabies and coronavirus infections. Ecosystems maintain healthy populations, but when mismanaged or rapidly altered by humans, they end up being associated with outbreaks. They underscore an urgent need to engage various stakeholders at the human-animal-ecosystem interface on preventive measures, and to improve EID risk management and communications.

In a war, the commander, with his generals, would conduct battle a risk assessment prior to, during, and after the battle to assess the circumstances, troop readiness and resources. The same goes for public health responders where a risk assessment would form the basis to formulate plans in order to effectively carry out interventions to curb the spread of a pathogen. Understanding the 'terrain' (i.e. operating context and climate) is key to informing the implementation of control measures. Referring to the classic quote from Sun Tzu's Art of War, "If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle."⁴

Digging deeper, we realise that risk assessment is a systematic process which serves to elucidate the readiness and resources needed to respond to an emergency. Integral to the risk management process are monitoring and keeping check of the resources available to you. These include the expertise of professionals, readiness of responders, available equipment and access to countermeasures (e.g. medications, vaccines). Having these resources is already halfway to winning the battle during a crisis.

An integral part of the process is the communication of outputs to the relevant stakeholders and leadership to ensure alignment of goals. Understanding the risks of exposure provides us with a basic understanding on the type of control measures to implement in order to curb transmission, mitigate its severity and reduce the impact on the population and healthcare system. This is likened to communicating via sounds and smoke during battle to issue commands as described in the Art of War!

ONE HEALTH APPROACH TO RISK

In order to appreciate what the One Health approach is, we need to first understand the following terms: 'risk assessment', 'risk management' and 'risk communications'. Although these three terms are commonly used, they tend to also be misunderstood. All three overlap in their outputs and contributions to each other but they each serve distinct purposes. To help distinguish the three terms from each other, we need to understand how these terms are interconnected (Fig. 1).

In a nutshell, risk assessment involving surveillance and epidemiologic investigation provides evidence for decisions on risk management and risk communications. It surfaces the results directly to management for their decision-making. Thus, risk assessment functions best within governmental structures that support risk management and risk communication by engaging decision-makers and policy-makers from relevant sectors. The entire process is simply referring to the study and understanding of risks involved, applying the appropriate measures or actions to prepare for and mitigate the consequences of the risks, and observing the need to communicate so that the benefits of the measures or actions taken can be amplified through actions by the masses.

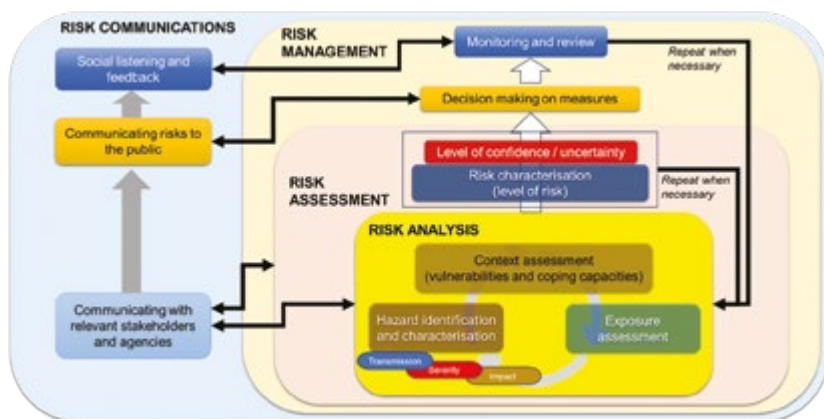


Figure 1: Conceptual framework in field epidemiology to understand risk management and communication

Based on the definition of 'risk', we come to understand that the word tends to have a negative connotation. However, in the Oriental context, it is depicted as a double-edged sword. The origin of the word 'risk' or '风险 (fēng xiǎn)' remains largely unknown but it likely originated from fishing villages. Traditional fishermen would pray for calm sailing winds and a bountiful catch, yet bearing in mind the perils of sailing out far into the sea to achieve the outcome. The prospect of seizing a bountiful catch despite the perils and dangers involved presents an exciting window of opportunity. Likewise, for us, risk is not just something bad that we need to deal with, but it also poses as an opportunity where we can further improve the community.

MITIGATING OUTBREAK RISKS

Using the earlier example of fishermen going out to sea, they would consider the probability of stormy bad weather conditions occurring as a hazard. The impact of the hazard on their catch would be disastrous should their boat capsize or suffer damage that reduces the carrying capacity. The fishermen would also have to deal with various uncertainties such as visibility, locating schools of fishes, fish nets tearing, even down to fetching a good price for their catch. In order to mitigate the risks involved, an individual fisherman would have to carry out risk assessment and risk management. However, as a group, they may wish to carry out an overall risk management and come up with a sound risk communications strategy to fetch a good price at the market. This is equivalent to mitigating outbreak risks.

Mitigating outbreak risks can be very subjective in many contexts; based on expert opinions, and relying on currently available knowledge which is usually incomplete or difficult to validate, so much so that reports always include an indication of uncertainty about the level of risk in the outcomes.^{5,6} Uncertainty depends on the quality and detail of information available at the time of assessment. In the next iteration of the risk assessment, when new information becomes available to inform and improve results, the level of uncertainty decreases. The systematic process of assessing risk allows us to better identify the strengths, weaknesses, opportunities and threats while devising counter-measures to prevent, prepare for, and reduce the potential negative consequences.

In situations where we are unable to eliminate the hazard or break the chain of transmission, we can only focus on reducing the vulnerability and exposure,

while raising the resilience to reduce the overall risk.⁷ In dealing with health risks, considerations around hazards, vulnerability and exposure are generally referring to the pathogen's transmissibility, severity and its impact on the population, healthcare, diagnostics, treatment and vaccine effectiveness. During past pandemics, understanding these elements became a cornerstone in assessing outbreaks and advising public health social measures.⁸

Most One Health practitioners define 'risk' as the likelihood of the occurrence and the likely magnitude of the consequences (i.e. impact) of an adverse event during a specified period, with each element including a degree of uncertainty. In general, any situation which leads to increased contact between humans, livestock and previously separated wildlife species, is a potential zoonotic risk situation. Contributing factors are changing demographics, land use, economics and lifestyles, and global developments such as climate change and microbial adaptation. In the last few decades, large scale changes in our ecology, including human encroachment on wildlife habitats and an increase in wildlife trade, have spurred the increased emergence of such zoonotic spillover situations.

GLOBAL HEALTH THREAT IMPACT

At the global level, the World Health Organization recognises the importance of reducing the risk of global-urban outbreaks and their impact on societies, especially under-privileged communities. To this end, advocacy for global-urban health security has been one of the major themes alongside universal health coverage, which was outlined in the Asia Pacific strategy for emerging diseases and public health emergencies.⁹ Mitigating risks and health threats requires more than just enhancing capacities and responding when threats come. It requires a shift in thinking towards adopting a One Health systems-based approach.

We need to adopt a multifaceted, interdisciplinary and whole-of-society response because the impact involves not only lives, but also livelihoods on an unprecedented scale. This impact has led to revisions made to the state party assessment tool and joint external evaluation tool to reflect pandemic lessons and adopt a more holistic view.¹⁰ It is also in line with developing a new health security action framework that focuses not only on the health threats, but also takes on other dimensions such as the risks posed by climate change and antimicrobial resistance. The complexity of these challenges requires us to adopt One Health when assessing the situation and addressing global health threats.

Today, the One Health EID framework for managing zoonotic spillover situations can address complex, interdisciplinary issues that remain crucial for effective disease control in an emergency. The key to combating EIDs is integrated response involving activities across several sectors, such as community development, health, education, agriculture, and infrastructure. Bio-surveillance and threat mitigation are often used in the context of whole-of-society initiatives and involves collaboration among different government departments and other stakeholders from a variety of sectors, such as civil society organisations, the private sector, and community groups. By working together, parties can create healthier and more sustainable solutions.

CONCLUSION

In tackling outbreaks, the One Health approach requires coordinated efforts and also essential operational processes that lie in social-community dimensions, in understanding the eco-system context, and, most importantly, in accepting the uncertainty, urgency and public anxiety that comes with it. As humans, we fear the unknown, but it is this uncertainty that makes us undertake the systematic steps to elucidate the threat, assess global health impact, and deploy resources into mitigating outbreak risks.

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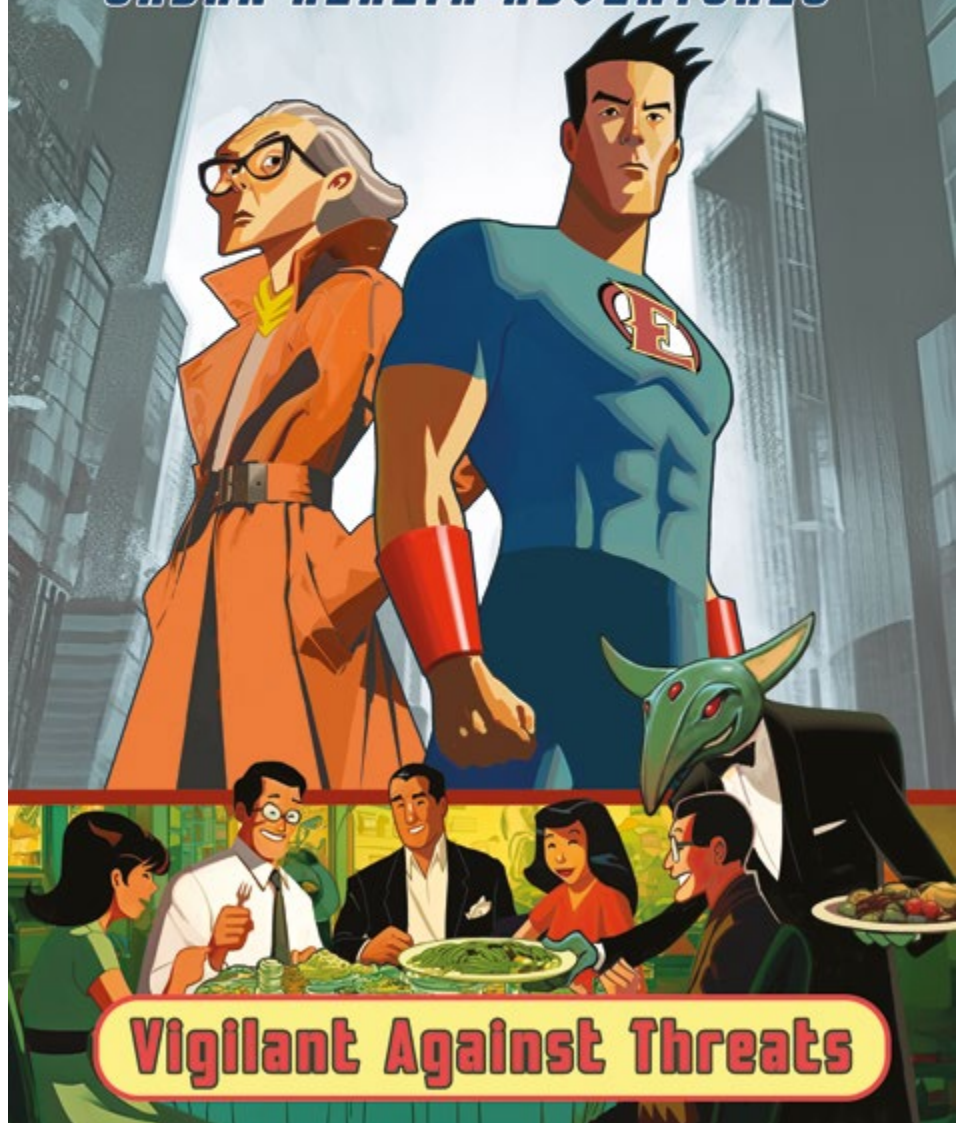
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EPI-FORCE

URBAN HEALTH ADVENTURES



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Written by

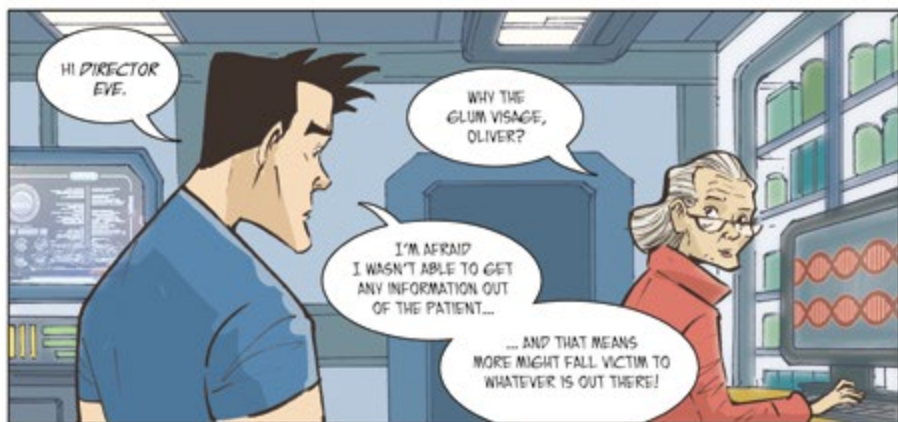
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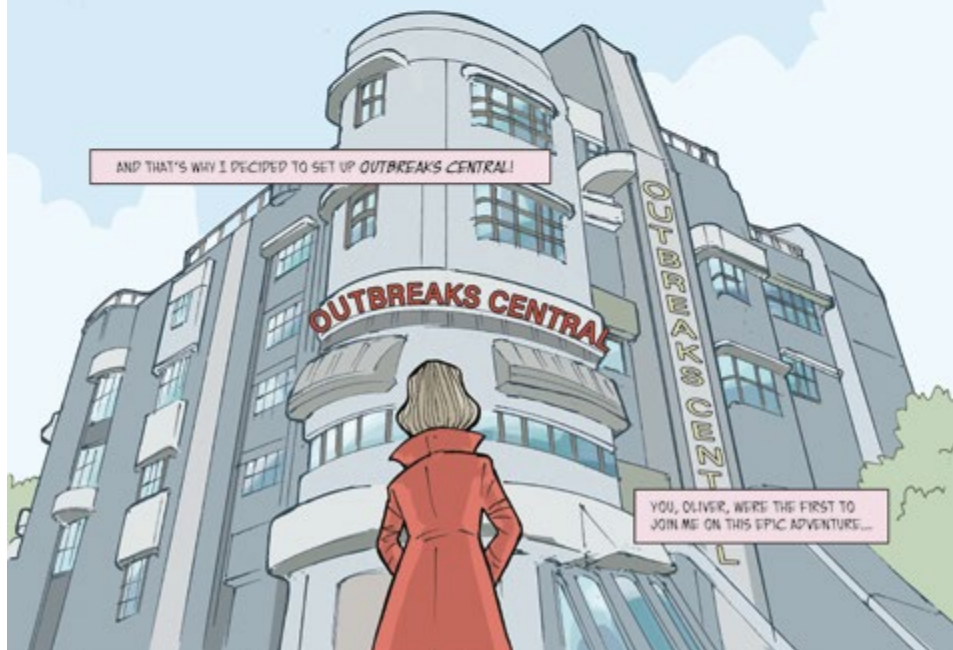
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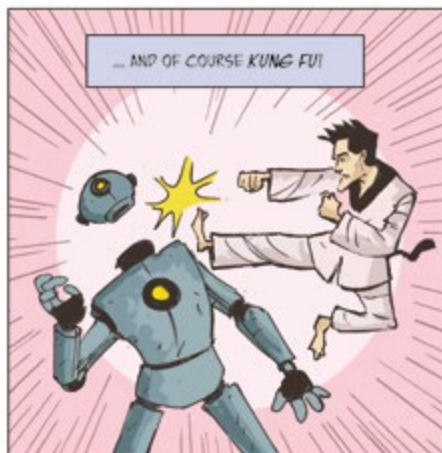
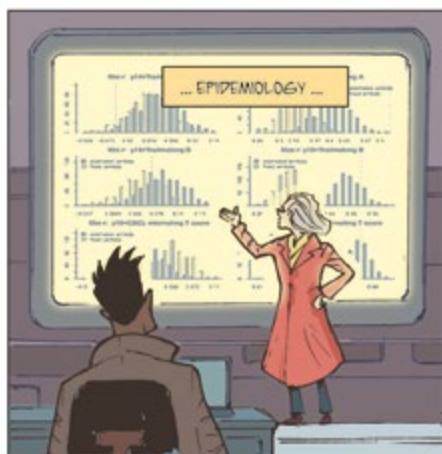


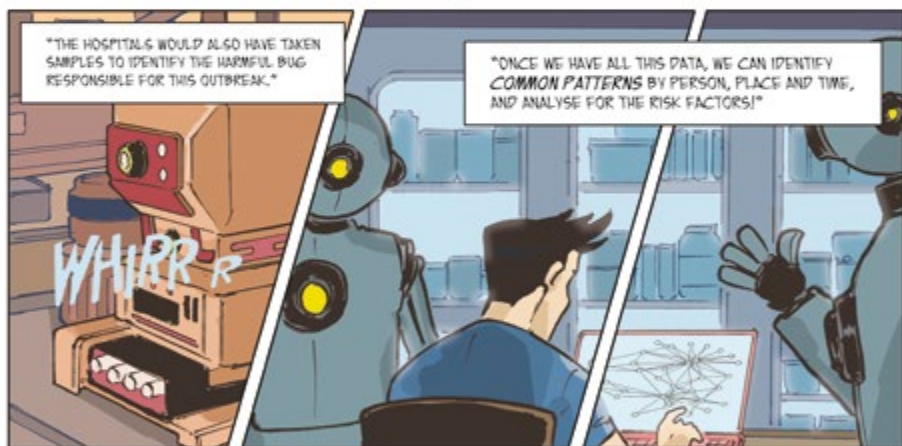




















Field Notes

**Outbreak epidemiologic sciences based on
the graphic novel, Vigilant Against Threats**

*Experience makes the difference!
The One Health approach to outbreaks
involves a number of scientific and
practical skillsets which are stackable
like Lego in any configuration that
makes most sense for responding
to infectious disease...*

Vigilant Against Threats
Conducting Epidemiologic Studies
Detection and Investigation
Hygiene Matters
Collecting Field Specimens
Working with the Laboratory
Generating Outbreak Hypotheses
Instituting Disease Control
Communicating Causation
Rapid Response Teamwork

Why did the surveillance specialist at the food safety agency not get rich? Because he only wanted to keep an eye on the dough!

Vigilance against bio-risk threats is a coordinated effort among multiple organisations, agencies, and stakeholders to monitor and gather information about various aspects of public health. It involves different groups working together to collect, analyse, and share data related to disease outbreaks, health trends, environmental hazards, and other factors that can impact the well-being of a community or even the whole population.

We call the people and organisations involved in this form of vigilance our collaborative partners. They're stakeholders in the One Health story, including health and veterinary professionals, scientists, community representatives, and even government officials. They're important because they both provide and use the health information we collect.

The key components for monitoring bio-risks include:

1. **Information Sharing:** Various entities share data and information about health-related issues. This can include government health agencies, healthcare providers, research institutions, and more.
2. **Data Collection and Analysis:** Data is collected from multiple sources and then analysed to identify trends, detect outbreaks, and assess the health of a population.
3. **Communication:** Effective communication channels are established to ensure that relevant information is shared in a timely manner. This is crucial in responding to health emergencies.
4. **Cooperation:** Different organisations and stakeholders work together to address public health challenges. This can involve joint investigations, resource sharing, and cooperative research efforts.
5. **Resource Allocation:** Resources, such as funding, personnel and equipment, are allocated based on the needs identified through surveillance.
6. **Response Planning:** Collaborative surveillance helps in the development of response plans for various health scenarios. This includes strategies for controlling disease outbreaks and mitigating health risks.
7. **Continuous Improvement:** The surveillance process is continually evaluated and refined to enhance its effectiveness in protecting public health.

Overall, vigilance plays a crucial role in early detection and rapid response to threats, and the overall promotion of public health. It leverages the strengths and expertise of multiple stakeholders to ensure a more comprehensive and effective approach to safeguarding community well-being. This is like a league of health heroes working together to safeguard the well-being of the entire world. It's all about teamwork, information sharing, and a commitment to keeping us all healthy and safe.

CONDUCTING EPIDEMIOLOGIC STUDIES (Refer to graphic novel pp.92-93)

EPI-FORCE studies may sound as exciting as watching paint dry, but fear not, because we're about to turn these data-driven adventures into a hilarious journey through the world of health and disease. Picture us in our deerstalker hats and magnifying glasses, dramatically deducing who did it and how they did it, but instead of a murder, we're solving the mystery of why people are getting sick.

Descriptive Studies

We start with the 'who' part, just like a game of *Guess Who?*. We're looking for patterns—are men or women getting sick more often? What about age groups? Maybe it's the hipsters or grandmas? Then we move on to 'where' the action is happening. We might discover that the fast-food chains in a particular town are secretly ruled by pizza-loving aliens. And, of course, 'when'—when did they fall victim to an invisible ninja virus or a sinister diet?

Analytical Studies

Case control studies are like a game of *Cluedo*, but instead of Colonel Mustard in the library with a candlestick, it's Miss Scarlet in the kitchen with a cheeseburger. We're talking to people who've gotten sick (the 'cases') and those who haven't (the 'controls'). We're looking for exposures, like Miss Scarlet's soiled glove, to identify risk factors. Did her careless habits of preparing food lead her down a treacherous path to food poisoning? In cohort studies, we follow a band of brave adventurers prospectively through the wild lands of health risk factors. We're basically doing the *Lord of the Rings* journey, but instead of a ring, we're trying to see who ends up getting the mysterious illness.

Interventional Studies

Now, we're in the lab, designing randomised controlled trials. Think of a mad scientist's paradise, but instead of creating monsters, we're experimenting with

lifestyle interventions. We might be brewing a potion of broccoli smoothies to see if it turns townsfolk into health-conscious athletes. Or perhaps we're conducting the 'Chocoholic Olympics,' where contestants must eat chocolate bars the size of surfboards. We're here to find out what really makes people tick, or in this case, not tick.

Meta-Analysis

Finally, we're diving into the mystical realm of meta-analysis. It's like being a wizard collecting magical spell studies from all over the world. Instead of summoning dragons, we're combining the powers of different studies to create the ultimate guidebook for health. It's like having a spell for eternal life, but instead, it's a guide to living a healthier and longer life.

In the world of epidemiologic studies, we're disease detectives unraveling the mysterious and sometimes absurd stories hidden in the numbers, all in the name of better health. So, put on your deerstalker, grab your magnifying glass, and join us on this epic journey through the outbreak epidemiologic sciences.

DETECTION AND INVESTIGATION (Refer to graphic novel pp.94-95)

In the graphic novel, the epidemiologist at Outbreaks Central is both scientist and detective rolled into one! Ever tried your hand at epidemiologic investigation during a health emergency? When an outbreak strikes, we need to put on our thinking caps and come up with educated guesses about what's causing the chaos. Time is of the essence. Think of it as a high-stakes game of *Cluedo* where urgency, uncertainty and anxiety reigns.

First, we gather all sorts of data—epidemiologic, clinical and laboratory—and create a neat little list. Then comes the fun part—hypothesis generation. We scour the literature, chat up experts, and even conduct open-ended interviews with those affected. It's like a crash course in becoming a human encyclopaedia of infectious disease.

Once we've soaked up all that info, we craft specific hypotheses. It's like brainstorming ideas for a mystery novel, except instead of suspects, we're looking at microbes and modes of transmission. But here's the twist—outbreaks can be sneaky. Sometimes, they're caused by entirely new agents or new transmission modes, like the surprise ending of a thriller movie.

To fuel our hypothesis generator, we dive into textbooks, websites, and PubMed searches. For example, if we're dealing with a salmonellosis outbreak, we become salmonellosis experts, learning about its quirky habits and favourite hiding spots. We also need to keep an open mind. No two outbreaks are ever the same. Each outbreak is like a unique snowflake (only less pretty), and it might throw us a curveball even if it involves a familiar culprit.

Now, when would we consider using open-ended interviews or focus groups? Well, when the usual data just won't cut it. These interviews are like our secret weapon, helping us get hints about the culprit to pinpoint the infection source and transmission mode. Sure, they take more time and effort, but sometimes, we need to go the extra mile. It's all about urgency, uncertainty, and anxiety. It's like deciding whether to go for a leisurely stroll or sprint in a marathon—you choose based on the situation.

So, there you have it, the thrilling world of epidemiologic investigation, where every outbreak is a puzzle waiting to be solved. Just remember, the game's afoot, my dear epidemiologists!

HYGIENE MATTERS (Refer to graphic novel p.95)

Ingredients:

- A cup of Common Sense (Infectious Disease Knowledge)
- A pinch of Cleanliness (Environmental Health)
- A dash of Hygiene (Epidemiology)
- A sprinkle of Food Wisdom (Communications)
- A dollop of Kung Fu (Responsibility)

Instructions:

1. **Choose foods processed for safety:** Start your culinary journey by selecting ingredients that are as safe as a vault at Fort Knox. Those suspicious-looking stuff? When in doubt, throw it out! Opt for items that say, 'I'm pathogen-free.'
2. **Cook food thoroughly:** Fire up those stovetops and ovens, my fellow chefs! Make sure your food is cooked to perfection, leaving no room for pesky pathogens to survive. Say goodbye to undercooked mysteries.
3. **Eat cooked foods immediately:** Once your masterpiece is plated, don't let it get cold. Devour it while it's hot and fresh, and those germs won't stand a chance.

4. **Store cooked foods carefully:** Leftovers deserve some love too. Pop them in airtight containers and send them off to a cosy spot in the fridge. No room for freeloaders in this culinary kingdom!
5. **Reheat cooked foods thoroughly:** When you're ready for round two, give those leftovers a spin in the microwave or a dance in the oven. Make sure they're piping hot and ready to rock.
6. **Avoid contact between raw foods and cooked foods:** Imagine your kitchen as a high-stakes poker game. Raw foods? Keep 'em in one corner. Cooked foods? They're sitting pretty on the other side. No cheating allowed!
7. **Keep all kitchen surfaces meticulously clean:** Grab that apron, don your superhero cape, and start scrubbing! Cleanliness is your sidekick in this food safety saga. Show those germs who's boss!
8. **Protect foods from insects, rodents, and other animals:** We're cooking for humans, not critters. Seal up your food fortress, so only you and your family get to enjoy the feast.
9. **Use safe water:** Don't let contaminated water crash the party. Ensure your drinking water is as pure as the mountain springs. No surprises allowed in your drinks!
10. **Wash hands repeatedly:** This is the ultimate secret ingredient—hand-washing. Scrub those hands like you're prepping for surgery. It's the best defence against sneaky germs trying to hitch a ride.

COLLECTING FIELD SPECIMENS (Refer to graphic novel p.96)

During the outbreak, our EPI-FORCE detectives morph into specimen-collecting superheroes, ready to chase down the villains in a microbial safari adventure, where the specimens are the exotic creatures of the outbreak jungle!

Now, there are two main categories of specimens to collect—hospital (biological) and environmental (food, water, etc.). It's like playing a high-stakes game of 'What's in Your Backpack?'—except instead of snacks and gadgets, you're packing stool, vomit, blood, remnant food, water samples and environmental swabs. The stomach-turning version of backpack contents, if you will. These are like the forensic evidence of the outbreak world. They are highly sought after because they hold the secrets to the microbial crime scene.

And let's not forget the animal world. When investigators suspect that animals might be involved in a zoonotic disease outbreak, they're like the animal

whisperers of public health, collecting specimens from our furry and feathered friends. A real challenge comes with vector-borne outbreaks and collecting mosquito specimens—you need special techniques to get the job done.

Then there's the paperwork. Proper labelling and documentation are essential, much like filing a case report for each specimen. Imagine a detective's notebook filled with clues—only these are in the form of labelled specimen containers. Lastly, specimen storage and transport is like handling precious artifacts in a museum. You wouldn't leave the *Mona Lisa* in direct sunlight, right? Similarly, specimens must be provided the right conditions to preserve their microbial integrity.

Time is of the essence in field sampling, like trying to catch a fleeting moment in a fast-paced action movie. Specimens need to be collected ASAP once an outbreak is detected. It's like trying to grab the villain before they vanish into thin air. So, there you have it—the thrilling work of field sampling by public health detectives, the unsung heroes preserving our health, one specimen at a time!

WORKING WITH THE LABORATORY (Refer to graphic novel p.96)

Take a light-hearted look into the world of laboratory techniques, where scientists play detective with microorganisms, cultures, and genetic fingerprints. Who knew science could be so mysteriously entertaining?

Microscopy: Imagine a lab technician squinting down a microscope, like a detective inspecting a tiny crime scene. “Aha! It's bacteria!” they declare, as if they've just cracked the case of the microscopic crime. And don't forget the dramatic ‘stain’ they apply. Think of it as the world's tiniest art class, where bacteria become tiny Picassos.

Culture: In the lab, it's like we're playing matchmaker for pathogens. We set up a cosy environment with the perfect temperature, moisture, and nutrients. “Hey, pathogen, meet this culture. Let's see if you two hit it off!” It's like a microbiological dating show, but with fewer roses and more petri dishes.

Serology: If someone's been exposed to a pathogen, their immune system produces antibodies. These are like little soldiers preparing for battle. Scientists

can detect these antibodies in a person's blood. If they find the early recruits in the first blood sample and the fully trained soldiers in the second, it's like finding footprints at the crime scene. You know someone's been there, and they've left a trace of their battle with the pathogen.

Antigen Detection: In the lab, it's like a treasure hunt for antigens. We're sifting through samples, separating the good stuff from the junk, hoping to find that one elusive antigen. It's like panning for gold in a river of microorganisms—and when we strike antigen, it's like hitting the microbiological jackpot.

Phage Typing: Phages are like the James Bonds of the bacterial world, each with their own target. It's a game of 'Guess the Bacterium'. The phage drops onto the grid, and if there's a clear, circular region, it's like the phage just left its calling card. "Yep, I've been here, and I took out the bad guys!" If there are no plaques, it's like the phage missed its mark—maybe it's time to look elsewhere? But just as elusive as James Bond is, phage typing has largely been replaced by molecular techniques.

Molecular Techniques: Think of this as genetic detective work. We're looking for the unique DNA fingerprints of bacteria and viruses, like microscopic mugshots. "DNA, you can't hide from us!" It's like *CSI: Microbiology Edition*. Whole genome sequencing? And next generation sequencing? That's like reading the pathogen's autobiography cover to cover—every twist and turn of its genetic plot.

GENERATING OUTBREAK HYPOTHESES (Refer to graphic novel pp.96-97)

A scientific deep dive into the behaviours, environment and dynamics of disease transmission is known as hypothesis generation. This isn't your run-of-the-mill descriptive epidemiology work; it's a targeted investigation. Outbreaks often stem from bad behaviour—not the 'staying up too late' kind, but from poor hygiene and lapses in good practice. We focus on the specific issue, whether it's cross-contamination of a food item or a questionable manufacturing practice.

Goals? We've got two: To point to the source of infection and how the nasty stuff grew, and to assess conditions which favoured their mode of transmission. Contamination happens when icky stuff like microbes or toxins

sneak in. Sources range from tainted ingredients to dirty hands, and poor storage doesn't help either. Survival is about microbes refusing to die. Maybe something was sterilised improperly, reheated inadequately, or lacked preservatives. Growth is when bacteria throw a party and multiply. Conditions that aid this bacterial bash include bad refrigeration and extended storage with unwanted fermentation. Viruses prefer to party in hosts, though.

Two key takeaways: First, even if a problem-causing factor exists, it might not necessarily cause trouble if later steps in production or use handle it. This is the food safety 'critical control point' concept. Second, it's not enough to spot contamination, survival, and growth points. We need to find the 'antecedents', the reasons behind these issues. Was it a lack of training, profit-seeking tradeoffs or cultural beliefs? Fixing these is key to preventing future outbreaks.

Hypothesis generation should be guided by descriptive information gained from the investigation combined with lessons learned from past outbreaks. However, it is important to keep an open mind. Even when an investigation seems straightforward, it is important to be receptive to alternative explanations. How do we do it? We gather information from product details, policies, observations, interviews, and lab tests. It depends on the agent, suspected vehicle and setting. We even collect clinical specimens from affected people.

Generating hypotheses is a creative process that requires a careful balance between maintaining an open mind, and following scientifically sound leads to minimise the use of limited human and financial resources. This is not always an easy task, but being aware of the importance of hypothesis generation and the resources available for it help immensely.

These assessments uncover the nitty-gritty of an outbreak—the mishaps, system flaws, and just plain 'oops' moments. They help us identify where to intervene and stop the problem, armed with insights from the outbreak epidemiologic sciences.

In the end, it's like completing a jigsaw puzzle of an outbreak. We put together the host, agent, and environment pieces to implement speedy, effective control measures. It's outbreak-solving 101, and it's how we roll in the world of outbreaks!

Well, well, well, it seems like we're living in a world where outbreaks occasionally pop up like unexpected guests at a party. But fear not, because we've got professional party planners who handle everything that is unruly. They're like the maestros of 'Disaster Symphony', conducting a harmonious blend of good food and personal hygiene, and environmental sanitation. And they leave a calling card for future One Health emergencies.

One Health is dealing with the worldwide comeback tour of infectious diseases, complete with exotic new infections which have their own Instagram pages. It's like infectious diseases got tired of being underrated and decided to make a viral comeback. And as if that's not enough, experts are now worried about deliberate attacks with biological weapons. There is also the concern for the misuse of artificial intelligence to these nefarious ends. It's like James Bond meets *Contagion*. Coming soon to a theatre near you—'Bio-Terror'!

Contact tracing is the process of quickly identifying, assessing, and managing people who have been exposed to a disease to prevent additional transmission. In this tech-driven world, remember that we're not just riding the technology wave; we're surfing it with style, fighting diseases one line of code at a time. Because in the end, the only thing more contagious than germs is the excitement of tech enthusiasts exploring new horizons!

Electronic and digital technologies can work to our advantage in One Health surveillance and outbreak control, facilitating the capture and manipulation of all kinds of data. Geographical information systems and wastewater surveillance offer potential in providing real-time analysis of spatial and temporal dynamics, displaying disease distribution and characterising populations at risk. Public health informatics can be made readily accessible for good use online.

The challenge for us today is to identify and deploy appropriate applications that can serve our ever-changing operational needs. These include joint information management systems to improve data linkage and processing of information, and electronic capabilities to disseminate intelligence information. We should also explore regional information retrieval and reporting systems for emerging diseases of common concern.

Protecting the population's health is getting crazier by the day. Scientists blame it on climate change, overpopulation, and worldwide animal and food product trafficking. In the midst of all this chaos, remember that epidemiology folks are the unsung heroes, fighting diseases we've never even heard of before. They're like the health version of superheroes, keeping our surroundings clean, our food safe, and our sanity intact.

And the moral of the story? In this ever-changing world, we've got to stay versatile and ready to adapt. Because in this battle, there are no sacred cows—only well-cooked burgers and sanitised surfaces!

COMMUNICATING CAUSATION (Refer to graphic novel p.99)

Ah, the joy of telling people they should pay attention to the cause of an outbreak! This is like the EPI-phany (pun intended) of the public health world, helping us figure out whodunit in the disease game. But hey, let's make this communication a bit more entertaining:

- **Strength of Association** – Imagine the size of the association is like Hulk's strength, and the stronger the association, the more likely it's the real deal. Like, when you see Hulk-level correlations between high sodium diets and hypertension, you know it's a match made in salty heaven.
- **Consistency of Association** – If it's causal, you'll find it happening over and over again, just like that song you can't get out of your head. For example, it took so many studies on smoking and cancer that by the end, researchers were probably having nightmares about chain-smoking chimneys.
- **Specificity of Association** – Sometimes, a single cause leads to a very specific effect, like dropping an anvil always makes the same 'splat.' But don't worry, if there's no specificity, it's not the end of the world—outcomes are like a recipe with a bunch of ingredients.
- **Temporal Relation** – To be the culprit, the exposure has to happen before the outcome. It's like saying time travelers can't commit crimes in the past because they're not even there yet.
- **Dose-Response Relation** – If more exposure means a higher risk, it's like saying, "Eating more ice cream increases your risk of brain freeze." But don't fret; not all relationships have to follow the 'more is scarier' rule.

- **Plausibility** – Our association should make sense, just like a mystery should have a logical resolution. No one wants to read a detective story where bananas cause dog catcher shortages—that’s just bananas! However, we have to keep our minds open to what we don’t already know, and seek to prove real associations if we find them.
- **Coherence** – It’s all about fitting our findings in with what we already know. Think of it like a puzzle piece—if it fits smoothly into the picture, great! But, if it’s a misfit, it’s like throwing a wrench into the gears.
- **Experiment** – If you can tinker with the cause and see the effect change, it’s like saying, “Turn down the thermostat, and let’s see if it’s too hot in here.” Experiments are like DIY health investigations.
- **Reasoning by Analogy** – You’re transferring knowledge from one situation to another, kind of like saying, “Well, if cats hate water, maybe tigers do too!” It’s like drawing comparisons between apples and oranges to find out they’re both fruit.

So there you have it—the EPI-FORCE’s toolkit for nailing down those health culprits, making epidemiology a bit more like an adventurous crime thriller!

RAPID RESPONSE TEAMWORK (Refer to graphic novel p.100)

Welcome to the rapid response team—our very own Avengers of epidemiology! They’re like a well-oiled machine, or dare I say, a single, well-coordinated organism (pardon the word). Picture this: the outbreak team, EPI-FORCE, gathering trusty sidekicks for the battle against infectious foes.

First up, we’ve got the team leader, the epidemiologist extraordinaire. This person is the maestro of our symphony, conducting a cacophony of data assimilation and role-assigning. The Steve Rogers of outbreak response, minus the Captain America suit. Then there are the public health officers, the unsung heroes behind the scenes. They’re the ones helping to define cases, craft questionnaires, and analyse data. Basically, they’re like Sherlock Holmes solving the mysteries of disease spread.

Let’s not overlook the clinicians, our medical wizards diagnosing disease in patients and their biological specimens. They’re like the Tony Stark of the team, guiding us through the awesome tunnels of medical information. And labora-

torians who do microbiological testing, because nothing says ‘fighting germs’ like a good old lab report. They’re like the *CSI* team, only with petri dishes instead of crime scenes.

For those pesky zoonotic outbreaks, we’ve got veterinarians, wildlife scientists, and entomologists—our own personal Bug Whisperers. Of course, we can’t forget about the environmental health folks, ensuring cleanliness and sanity amid chaos. They’re like the cleanliness freaks who show up at your place unexpectedly, but in a good way.

But wait, there’s more! Trained interviewers, the underdogs who can go from zero to hero in contact tracing with just a bit of basic training. They’re like the interns who suddenly find themselves saving the day. And finally, the social scientist, making sure the public gets the right message. They’re the PR experts of the group, keeping the masses calm and informed. Think of them as the outbreak’s spin doctors.

In the end, it’s all about teamwork, like a sports team where everyone plays their part. Communication is key, just like passing the ball in a soccer match. And remember, every outbreak is a group effort. It’s like a potluck dinner of expertise, where everyone brings their own dish to the table.

So, there you have it—the outbreak team, a bunch of unlikely heroes coming together to save the day, one virus at a time. It’s like a *Marvel* movie, only with more lab coats and less spandex.



Operation Prudence

**A workshop sampler on One Health
Approach to Outbreaks**

Basic Outbreak Rapid Response

SAMPLE STORYBOARD TO SET THE STAGE FOR THE WORKSHOP

Our Longest Day...

This is an interactive public healthcare workshop introducing participants to the One Health approach in infectious disease outbreak response. Through a scenario-based storyboard, participants investigate a food-borne disease outbreak linked to improper personal and food hygiene as well as environmental sanitation. Exercising prudence, they learn about detection and investigation, hygiene matters, collecting field specimens, working with the laboratory, conducting epidemiologic studies, generating outbreak hypotheses, instituting disease control, communicating causation, and rapid response teamwork.

Learning throughout *Our Longest Day*, no two outbreaks are ever alike. This workshop emphasises multisectoral collaboration, early detection, crisis communication, and evidence-based decision-making during rapidly evolving outbreak situations. Interactive activities include rapid risk assessments, incident coordination briefings, contact tracing exercises and stakeholder communication simulations. By the end of the workshop, participants will better understand how coordinated One Health strategies strengthen outbreak response and public health resilience.

- Fun theme: Project C.S.I.* – Vigilant Against Threats!
- Coverage: Rapid Response Teamwork, Steps in Field Investigation, Systems for Surveillance
- Your hosts: Outbreaks Central, with Homer Simpson, Dr Zhuge Liang, Professor Indiana Jones, and more
- Storyboard: *Operation Prudence* progresses with *Epi@The Movies* (EPI-FORCE Meets Netflix), and *Our Longest Day*
- Finale: *EPI-FORCE Next Steps in Field Epidemiology*

*Comics Sciences Institute

One Health Approach to Outbreaks

Workshop Day 1	
Operation Prudence: Outbreak Readiness	
09:00–09:30	Day's Overview Welcome and Curriculum
09:30–11:00	Field Epidemiology @ Work Applied Epidemiology and Rapid Response By the end of this session, participants should be able to: • Describe the field epidemiology approach to problem solving • Apply epidemiologic skills in outbreak scenarios • Interpret basic epidemic curves
11:00–13:00	Emerging Disease Master Class Comparing Peoples Statistically By the end of this session, participants should be able to: • Notice you belong to a population—starting small • Identify the uses of biostatistics in comparing populations • Outline the steps to apply quantitative methods
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Detection and Investigation: One Health epidemiology-laboratory teamwork, collaborative practice, engagement and communication Part 1 of Project: Your Project Skit

Workshop Day 2	
Operation Prudence: Outbreak Readiness	
09:00–09:30	Day's Overview On-boarding with Ops
09:30–11:00	Field Epidemiology @ Work Outbreak Epidemiologic Investigations By the end of this session, participants should be able to: • Describe basic concepts in epidemiology and statistics • Perform hypothesis generation and testing • Describe the process of investigating outbreaks
11:00–13:00	Emerging Disease Master Class Modelling Literacy and Impact By the end of this session, participant should be able to: • Connect for the long haul—staying glued • Describe international health regulations and concerns • Outline the steps to address international health issues
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Generating Outbreak Hypotheses: Groupwork whereby participants discuss proposals, considerations and options to undertake given a hypothetical disease scenario Part 2 of Project: Visit to a City Gallery

Workshop Day 3	
Operation Prudence: Outbreak Readiness	
09:00–09:30	Day's Overview Systems for Surveillance
09:30–11:00	Field Epidemiology @ Work One Health Surveillance Essentials By the end of this session, participants should be able to: • Describe the uses and attributes of surveillance systems • Describe the techniques to improve surveillance • Interpret disease surveillance graphs and summary data
11:00–13:00	Emerging Disease Master Class One Health Social Measures By the end of this session, participants should be able to: • Differentiating reality vs truth—digging deep • Describe the social roots to health and wellbeing • Outline the steps to improve social determinants
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Instituting Disease Control: Converting fieldwork into administrative, public and scientific reporting, and disease control Part 3 of Project: One Health Exercise

Workshop Day 4	
Operation Prudence: Outbreak Readiness	
09:00–09:30	Day's Overview Steps in Investigation
09:30–11:00	Field Epidemiology @ Work Evidence-Gathering Field Studies By the end of this session, participants should be able to: • Describe the types of epidemiologic study • Explain the issues involved in designing a study • Critique scientific literature
11:00–13:00	Emerging Disease Master Class Seeking Answers and Safeguards By the end of this session, participant should be able to: • Move towards improvements—acting fast • Describe how lifestyle affects public health • Outline the steps to improve lifestyle habits
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Communicating Causation: Engaging stakeholders with infectious disease intelligence and risk communication Part 4 of Project: EPI-FORCE Prologue

Workshop Day 5	
Operation Prudence: Outbreak Readiness	
09:00–09:30	Day's Overview Risk and Crisis Communications
09:30–11:00	Field Epidemiology @ Work Communicating Cause and Effect By the end of this session, participant should be able to: • Distinguish between associations that are causal and non-causal • Describe the criteria for inferring causation • Describe the social and environmental contributions to disease causation
11:00–13:00	Emerging Disease Master Class Next Steps in Field Epidemiology By the end of this session, participant should be able to: • Give to others with empathy—thinking big • Model and cultivate professional traits • Outline steps to become more of a professional
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Rapid Response Teamwork: Perspectives on epidemic intelligence in scenario role-plays by course participants as experts and stakeholders Part 5 of Project: Survivors Morphing Heroes

Operation Prudence: Self-Reflection for Trainees

Prudence is also known as the early warning system of the soul. Prudence falls somewhere between recklessness and indiscretion on one hand and fearfulness on the other. Like all the virtues, it sits between two vices, the happy medium between extremes. How often we are tempted to face life situations without prudence; either too timid and fearful, or too reckless and unmindful of consequences?

Prudence Reflection and Sharing

As you progress in your learning journey, this section may be used for personal reflection and for group sharing of views. In a personal reflection, what stirs your heart? Remain with it for a while. You may reflect on one or more of the following questions according to your context. In a group context, allow enough time to reflect in a safe space and for everyone to respond.

Questions on Prudence

- i. How would you define prudence in your own words, and has that definition evolved over time?
- ii. How has the concept of prudence influenced your decision-making in terms of moderation or restraint in various areas of your life?
- iii. Can you recall a time when you struggled with maintaining prudence? What did you learn from that experience?
- iv. In what ways can you foster practice of prudence in your professional environment?
- v. How does prudence contribute to your physical, mental and social well-being?
- vi. Can you identify any specific habits or behaviours that you need to exercise prudence?
- vii. How does prudence affect your relationships with others, both positively and negatively?
- viii. Does practicing prudence align with your personal values and beliefs?

- ix. How do external factors, such as societal norms or peer pressure, influence your ability to maintain prudence?
- x. How can you continue to grow in the virtue of prudence, and what steps can you take to do so?

Suggestions for Reflection

Four cardinal virtues form the basis of ethics first described by Plato (427-348 BC) and elaborated by Aristotle (384-322 BC). They are:

1. **Prudence:** Practical wisdom and right judgement; the virtue that disposes the practical reason to discern in every circumstance our true good and the right means for achieving it.
2. **Justice:** Righteousness and fairness; the virtue that consists in the firm and constant will to respect the rights of each and give to others their due.
3. **Fortitude:** Courage and steadfastness; the virtue that ensures firmness in difficulties to overcome obstacles and constancy in the pursuit of the good.
4. **Temperance:** Self-control and healthy-minded sobriety; the virtue that moderates the attraction of the pleasures of the senses and provides balance in the use of created goods.

Cardinal virtues are a habitual and firm disposition for one to do good and become the best version of oneself to attain happiness and well-being. They grow through education, deliberate acts, and perseverance in struggle, and enable our experience of ease, self-mastery, and joy.

Prudence is the virtue that disposes practical reason to discern our true good in every circumstance and to choose the right means of achieving it. The prudent person looks where she or he is going.

Since prudence is not a choice but rather something that governs our choices, it is a more difficult virtue to acquire. Still, it is not impossible and below are three ways to become a more prudent person.

Learn from your mistakes: Many times in life, we make painful or humiliating choices. When this happens, we can either feel sorry for ourselves, or we can learn from our mistakes and gain wisdom. If we choose to learn from our

mistakes, our deposit of knowledge builds up over time, providing us with a reservoir of experience that we can use to make prudent choices.

Learn from others: If there's one lesson that prudence seeks to drive home, it is the importance of learning from those who are wiser than we are. This takes humility, but if we can borrow the experience of others to fill our prudential reservoir, it will save us from many painful lessons.

Consider carefully: Some of us tend to be rash and hasty in judgement, whereas others tend to be more careful and cautious. Sometimes our impulsiveness for risk-taking can be a good thing, but most of the time it is not. When faced with a choice, we need to control our desire to leap into action, and instead carefully consider the ramifications of our choices.

Prudence is a virtue that takes time to acquire, but because it governs the other virtues, it is one of the most important virtues we can possess. Choose to learn from our mistakes, learn from others, and patiently consider our choices, and before you know it, we will be well on your way to prudent personhood.



Workshop Musings



Featuring a comics-style collection of applied epidemiology hints on how to survive in the built environment...

Welcome to our Biosphere!

#1-How microbes zap you and how you can zap back

#2-How not to kill the earth

#3-Wash your hands to save your life

#4-Remember ten keys to safer food at home

#5-Safeguard your loved ones from mosquitoes

#6-What you can do to protect your preschooler

#7-How to prevent illness in the built environment

#8-Travel health advice for you and your family

#9-You can prevent antimicrobial resistance

#10-Tips for your general wellbeing

Bonus: Field Operative's Guide to Staying Alive!

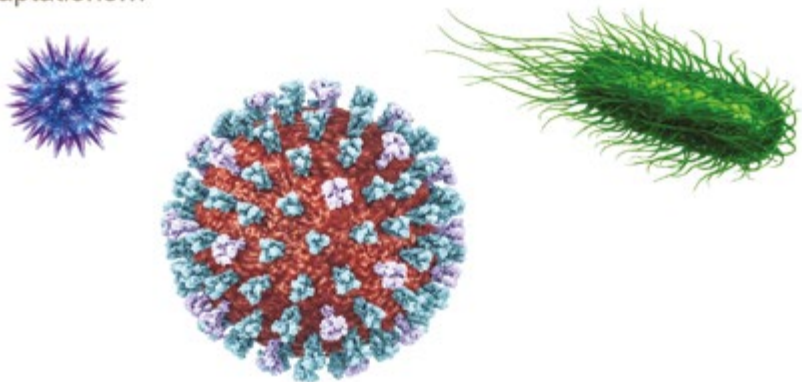
Survivor Ecology

Welcome to our Biosphere!

We are on Planet Earth, part of the Solar System, in the Milky Way Galaxy, a member of the Local Group of the Virgo Super Cluster, amidst our Observable Universe.

By now, you must have familiarised yourself with our beautiful planet's attributes: landmasses, oceans, and weather patterns. Biodiversity abounds, made from stardust. The global ecological system integrates every living being in a relationship with one another and is known as our *Biosphere*. Life squirms out of every niche, including the rainforest, the rain shower, and your toilet... this we learn in field epidemiology.

We are the new kids on the block, for better or for worse. If the chronology of all life on this planet were compressed into a year, humanity would have come onto the scene only at the final minute. Our ancestors were initially decimated by outbreak after outbreak. To survive among all that competition, and thrive, we succeeded in making a series of crucial adaptations...



With the advent of agriculture and livestock ownership, nomadic tribes invented sleeping in, and established permanent villages for this purpose. Successful villages grew into cities, which banded together into nation-states, where trade and culture flourished alongside crime, squalor, faeces and pests.

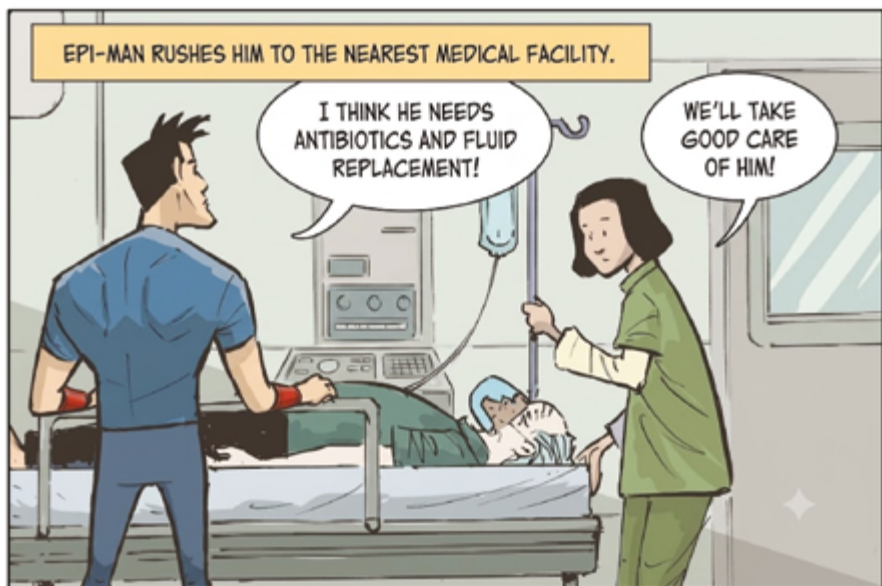
Living in groups allowed us to improve the built environment for easier access, hygiene and comfort. These man-made urban surroundings today provide the setting for modern life, work and play. But our increasing connectivity also makes us ever more vulnerable to large outbreaks.

Right now, our competitors are fighting a fierce battle with humanity to stay alive and they may win. We found antibiotics to kill bacteria, at which point they began figuring out a way to become resistant to the antibiotics. We tried to eradicate mosquitoes, and they changed their breeding habitats around our homes multiple times.

Living amidst outbreaks, for our own good, a little more respect for survivor ecology is in order...



How microbes zap you and how you can zap back



You can find them on surfaces, on food, on plants and on animals, as well as in the air, in the soil and in the water. Most microbes will not harm you. However, some microbes do.

There is a difference between infection and disease. Infection, often the first step, occurs when bacteria, viruses or other microbes enter your body and begin to multiply. In response to infection, your immune system springs into action. An army of white blood cells, antibodies and other mechanisms goes to work to rid your body of whatever is causing the infection.

Disease occurs only when the cells in your body are damaged as a result of the infection, and signs and symptoms of an illness appear. For instance, in fighting off the common cold, your body might react with fever, coughing and sneezing.

What's the best way to stay disease-free? Prevent infections from happening in the first place! You can prevent infection through eight simple tactics:

- Wash your hands often, especially after being outside, or going to the bathroom
- Cover your mouth and nose with a tissue when you sneeze or cough
- If you blow your nose, throw the tissues away into a proper receptacle immediately
- Avoid touching your eyes, nose or mouth
- Avoid large public gatherings wherever possible
- Avoid close contact with people who are sick with the flu
- Stay at home when you are sick; rest, take medicine, and drink plenty of fluids
- Stay informed of any infectious disease developments!



How not to kill the earth



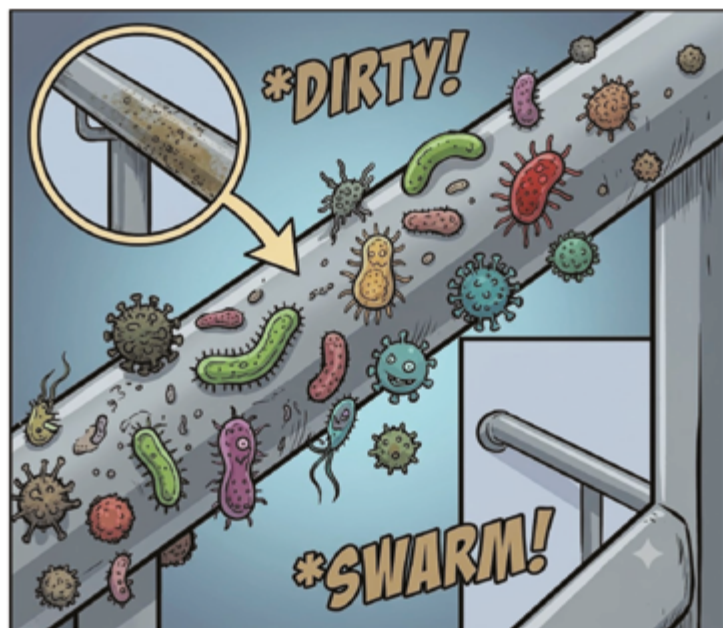
Health exists when there is a balanced relationship of the body, mind and spirit in complete adaptation to the biosphere and our built environment, which is the aggregate of surrounding things, conditions or influences.

Our environmental milieu provides the life support systems which are essential for life on earth, including the air, water, food and shelter. It can also suffer ecological imbalances resulting in disastrous diseases. In a circular relationship, we change our environment through urban development, and this in turn can lead to emerging hazards which affect us.



Reading story after story of how we have exploited the earth beyond its sustainable carrying capacity, you soon get the picture how bad this is going. Here are some things we can do to help:

- Reduce indiscriminate use of plastic
- Bring your own environmentally friendly cloth bags
- Get rid of your electric pot that keeps boiling the water, so as to conserve energy as a precious resource
- Turn off the lights and other electric items when not in use; use rechargeable batteries
- Use fans instead of air conditioners; use less hot water
- If the journey is not inconvenient, use public transport, ride your bike or walk
- Use recycled or old papers, and keep recycling them
- Avoid products that are used once to be thrown away
- Buy products with little or no packaging, and recycled items
- Do not waste products, and do not build a Death Star!



Wash your hands to save your life

Hand washing is a simple habit, something most people do without thinking. Yet hand washing, when done properly, is one of the best ways to avoid getting sick. Despite the proven health benefits of hand washing, many people do not practice this habit as often as they should—even after using the toilet. Throughout the day you accumulate microbes on your hands from a variety of sources, such as direct contact with people, contaminated surfaces, foods, even animals and animal waste. If you do not wash your hands frequently enough, you can infect yourself by touching your eyes, nose or mouth. And you can spread these microbes to others by touching them or by touching surfaces that they also touch, such as doorknobs.

When should you wash your hands? Before preparing or eating food. After going to the bathroom. After changing diapers or cleaning up a child who has gone to the bathroom. Before and after tending to someone who is sick.

More? After blowing your nose, coughing, or sneezing. After handling an animal or animal waste. After handling garbage. Before and after treating a cut or wound. The list goes on but you get the drift.

Keeping hands clean is one of the most important steps we can take to avoid becoming a case or a contact. It is best to wash your hands with soap and clean running water for 20 seconds.

When washing hands with soap and water, follow these steps:

- Wet your hands with clean, running water and apply soap
- Rub hands together to make a lather and scrub all surfaces
- Keep rubbing your hands vigorously for 15 to 20 seconds
- Scrub all surfaces, including the backs of your hands, wrists, between your fingers and under your fingernails
- Rinse well under running water
- Dry your hands with a disposable paper towel
- Use the paper towel to press open the door on your way out
- Dispose the paper towel properly in a bin
- Mind what your hands touch!



Remember ten keys to safer food at home

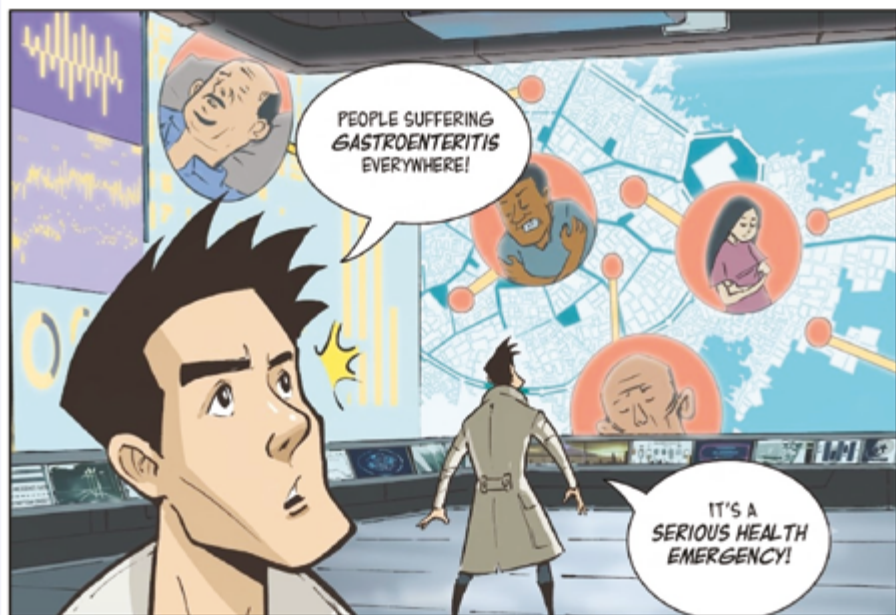


Studies show that only a small number of factors related to food handling are responsible for a large proportion of food-borne disease outbreaks and illness episodes.

Common errors include: Preparation of food several hours prior to consumption, combined with its storage at temperatures that favour growth of pathogenic bacteria and/or formation of toxins; insufficient cooking or reheating of food to reduce or eliminate pathogens; cross contamination; and poor personal hygiene handling the food.

The golden rules of food safety respond to these errors, offering advice that can reduce the risk that food-borne pathogens contaminate, survive or multiply. Users are therefore encouraged to adapt these rules by bringing home messages that are specific to their food preparation habits:

- Choose foods processed for safety
- Cook foods thoroughly
- Eat cooked foods immediately
- Store cooked foods carefully
- Reheat cooked foods thoroughly
- Avoid contact between raw foods and cooked foods
- Keep all kitchen surfaces meticulously clean
- Protect foods from insects, rodents and other animals
- Use safe water
- Wash hands repeatedly!





Safeguard your loved ones from mosquitoes



To prevent the spread of dengue fever, you must first prevent the breeding of its vector, the *Aedes* mosquito. The *Aedes* mosquito is easily identifiable by its distinctive black and white stripes on their body. It prefers to breed in clean, stagnant water easily found in our homes. You can get rid of the *Aedes* mosquito by frequently checking and removing stagnant water in your premises.

The guidelines below will give you an overview of how you can prevent the *Aedes* mosquito from breeding:

- Turn pails and water cans over and store them under shelter
- Remove water in plant pot plates; clean and scrub the plate thoroughly to remove mosquito eggs; avoid the use of plant pot plates if possible.
- Loosen soil from potted plants to prevent the accumulation of stagnant water on the surface of the hardened soil.
- Do not block the flow of water in scupper drains along common corridors in HDB estates; avoid placing potted plants and other paraphernalia over the scupper drains.
- Cover rarely used gully traps; replace the gully trap with non-perforated ones and install anti-mosquito valves.
- Cover bamboo pole holders after use; rainwater can potentially accumulate in these bamboo pole holders if they are uncovered and create a habitat.
- No tray should be placed beneath any air-conditioning unit
- Be a hero to help search and destroy mosquito breeding habitats in your locality!



What you can do to protect your preschooler



Infectious diseases in preschools are usually a great concern for parents and those caring for young children. It is often the case that a child presents with the first signs and symptoms of illness while attending day care or preschool. Therefore, it is especially important for care givers at the facility to take measures to prevent the spread of infections.



How can childcare providers prevent the spread of infections among preschool children? Here are four basic rules...

- **Handwashing:** All children and staff must wash their hands frequently and thoroughly between activities, and before meals.
- **Hygiene:** Ensure the preschool promotes good personal, food and environmental hygiene practices, with a proper diaper changing area. Bath towels must not be shared.
- **Sanitation:** A clean environment must be routinely maintained, including regular cleaning and disinfection of all fomites (toys, surfaces, shared items) using bleach.
- **Exclusions due to illness:** Children should be checked daily upon arrival—any child who is unwell must be immediately separated in an isolation bay, and parents informed to bring him/her to a clinic or home!

How to prevent illness in the built environment

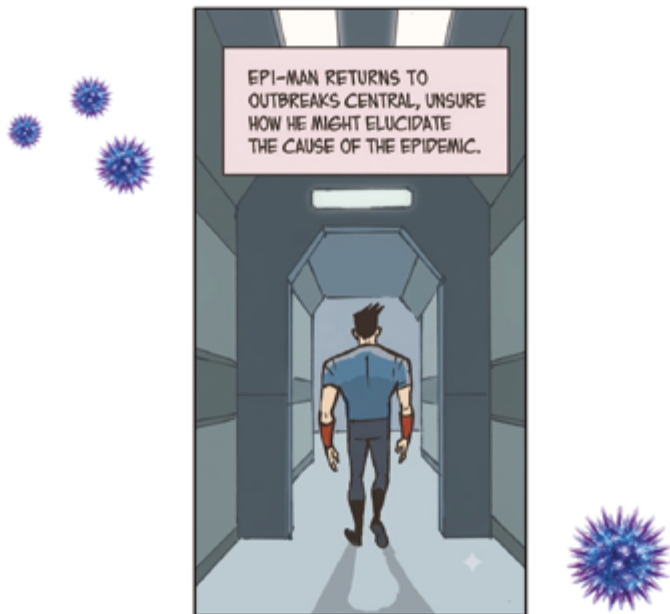


The built environment (technosphere) refers to the human-made surroundings that provide the setting for human activity, ranging in scale from buildings and parks or green spaces to neighbourhoods and communities, including their supporting infrastructure such as water supplies, energy networks, and transport systems.

This environment is a material, spatial and cultural product of human labour that has been described as the human-made space in which people live, work, and recreate on a day-to-day basis. So what are the general principles by which we can abide to safeguard our health in the built environment?

Seven areas where you can take simple steps to prevent illness:

- Respiratory etiquette: Wear a mask when having a respiratory illness. Do not litter used tissues!
- Food hygiene: Purchase food items only from clean stalls and vendors that exhibit good hygienic practices.
- Toilet sanitation: Use non-touch technique as much as possible in public toilets. Wash your hands after that with plenty of soap. Do not use a public towel.
- Work stations: Reduce clutter and dust collection at work. Keep your desk surface cleanable, and allow cleaners to vacuum your cubicle.
- Office equipment: Avoid exposure to emissions from new fixtures, equipment and stationery. Sit further away from the photocopier, printer and fax machine.
- Ventilation: Ensure adequate ventilation and thermal comfort. Identify and remove damp indoor spaces and mould growth.
- Common areas: Store away unused items/furniture properly. Get rid of vermin infestation!





Complement your journey with protection. See a travel clinic.

Travel health advice for you and your family

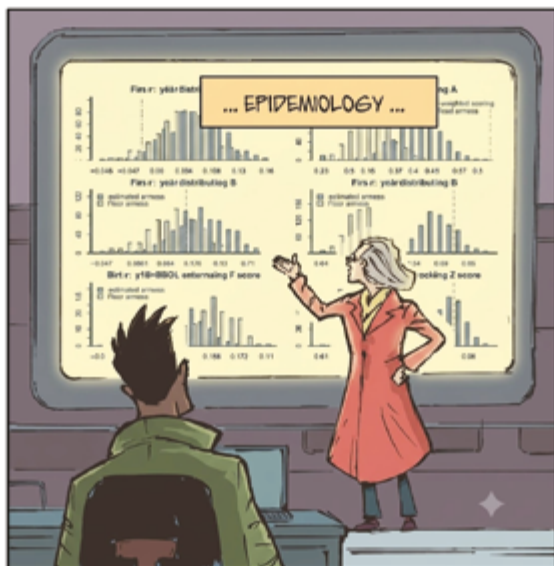
Before you go, plan well. When you travel, there is always the danger of bringing back imported infections. If you need any vaccinations, it is best to see a travel clinic doctor at least six weeks before you leave.

What can you do about jet lag? Get plenty of sleep before you leave! Do not drink too much alcohol. Eat well-balanced meals. Avoid overeating. Exercise as much as you can on your trip. Melatonin may help but how long it can be used safely is unclear.

To improve plane travel, carry enough of all your medicines in your carry-on luggage. Bring enough medicine to last your whole trip. Take extra medicine with you in case your return trip is delayed. Remember to bring along the names and dosages of all of your medicines. The air in the plane is dry, so drink water to avoid becoming dehydrated.

Once you are there, observe good personal hygiene. Wash your hands often and avoid crowded places. Eat steaming hot, well-cooked foods and peel fruits yourself. Drink water from commercially sealed bottles. Avoid ice. Use bottled water when brushing teeth. For malarious areas, the first line of defence is protection against mosquito bites. Avoid outdoor activities where there are mosquitoes, apply insect repellent, wear protective clothing, sleep under mosquito nets and use coils/vapour mats. In risky areas, use malaria prophylaxis—remember to start taking your medicine before you leave on your trip, take it during your travels, and keep taking it as prescribed after you get home!





You can prevent antimicrobial resistance



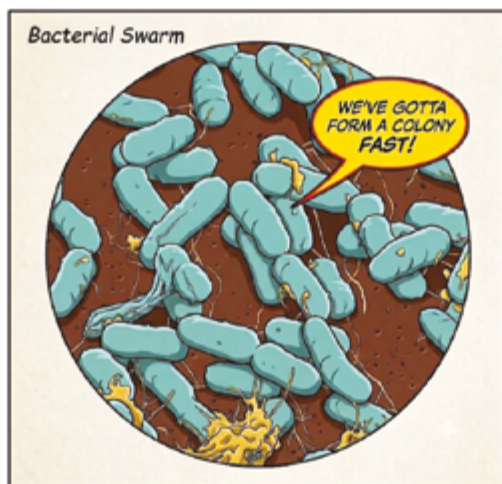
While antimicrobials can save lives, their misuse or overuse has resulted in microbes becoming resistant to almost every drug treatment available. For example, the tuberculosis mycobacterium has become resistant to rifampicin which was previously a treatment of choice. The same phenomenon is happening to the malaria parasite and many other microbes.

In this era of increasing antimicrobial resistance, doctors no longer prescribe antimicrobials blindly but focus more on improving the immunity and nutrition of the individual patient. It used to be a routine prescription to treat ear infections or flu symptoms, but it is better now to adopt a wait and watch policy. Antimicrobials are prescribed only if symptoms persist.

While it can be annoying to go back to the doctor if symptoms do not improve, a little inconvenience now might save us from worse things in the future. Strains of bacteria resistant to many antimicrobials are proving a big challenge to fight.

Here is how you can play your part:

- Take the full prescribed course of the antimicrobials. Even if you get better before completion of your course. If treatment is stopped prematurely, resistant bacteria might survive and spread.
- Take antimicrobials at the prescribed dose. Do not save any for the next time you get sick. Never switch to another antimicrobial without prescription.
- Discard any leftover medication. Never take antimicrobials prescribed for someone else or for a previous illness because they may not be appropriate.
- Do not mindlessly use products containing nanosilver or other microbicides in the home.
- Avoid taking antimicrobials without proper medical advice because they will not help in a viral infection. If your doctor tells you that you do not need an antimicrobial, never demand for one!



Tips for your general wellbeing



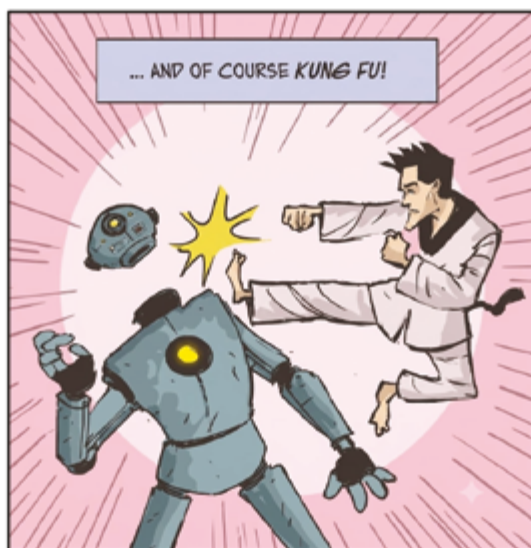
No one can predict the future. Stress, illness, pandemic. Some simple suggestions can make the difference, for years to come. By bringing it all together, you can safeguard your general wellbeing whatever the future may throw at you. Below are the time-tested tips for you to stay healthy in *any* environment.

Build up your body's immune defenses. Eat a well-balanced diet, do not overeat. Take your vitamins. Drink enough water, replace cups of coffee or tea with green tea. Exercise on a regular basis, walk thirty minutes daily. Get adequate rest, sleep 6 to 8 hours at night. Take frequent breaks. Do not smoke, do not pollute your body in any other way. Remember to pee regularly.

Practice good personal and food hygiene. Wash hands with soap and water frequently and whenever soiled. Cover your mouth and nose when you cough or sneeze. Throw used tissues into a covered bin. Wear a mask when needed, stay at home when ill to protect others. Keep a distance away from others who are ill. Follow the golden rules of food safety.

Avoid environmental hazards. Retool your ergonomics, know the dangers of your job. Respect the power of the sun, watch out for sunburn and skin cancer. Always protect against mosquito bites, never breed vectors at home. Use pesticides judiciously in the home and elsewhere to prevent contamination. Pay attention to indoor air contaminants. Observe travel precautions to avoid bringing back unwanted agents.

Get back harmony in your life. Meditate and reflect daily, rebalance your work commitments. See your problems in perspective to the earth's long natural history. Appreciate the diversity of life. Practice self improvement in one area of need. Carve out time for your family. Do something for others, quietly.





Field operative's guide to you staying alive!

Notice...

Start small. Know yourself, that you are a person of integrity. Connect with the true source of your happiness.

Change your attitude—get used to rejection, and do not complain. Increase your awareness. Know why you do those things that you do. Accept yourself and your limitations, adopt a positive attitude!

Learn...

Dig deep. Be curious for truth, thirsty for knowledge, and continue to stimulate your thinking throughout life. Seek insights. Learn life's lessons from people around you, your social circumstances, and the mistakes that you make!

YOU DEMONSTRATED THE RIGHT MIX OF QUALITIES TO BE AN EPI-MAN.



Move...

Act fast. Actively commit towards improvements of your situation. Acknowledge uncertainty and seek flexible solutions that adapt to the moment. Work as a team and be collegial. Be resilient by bouncing back from adversity quickly!



Give...

Think big. Consider others with empathy. Be grateful for what you have and uphold a cause larger than yourself. Do good quietly and take on inequity without judging others. With empathy, be generous by giving a little more than you take!



Connect...

Stay glued. Realise we are in for the long haul. Be socially mindful, celebrate differences, and take time to energise each other. Seek others who share your dreams and values. Cultivate ties that bind. Build relationships with authentic appreciation for others!

Hence, EPI-FORCE thinking for your health and wellbeing. Keep calm and hero on!



Living Amidst Outbreaks is a product of
Survivor School



**EPI-sode 2:
Global-Urban Health
Security**

The Great Detective Escape...

(Tune: The Great Escape)

Verse 1

Able, I may be able,
To keep the situation stable,
I'm feeling crazy, and in a tizzy,
Keep calm, I must hero on...

Pickle, we're in a pickle,
Answers come slowly in a trickle,
Disease a looming, investigating,
Keep calm, we just hero on!

Chorus

In great detective times, life can be very nice,
And epidemics, bring us enough of spice,
We care for health by sharing our EPI-FORCE,
Never fear, and the bug stops here!

Verse 2

Scary, I need to carry,
Tools that I can utilise fairly,
That will not hinder, nor turn to cinder,
Keep calm, I must hero on...

Pickle, although a pickle,
It costs a dollar and a nickel,
But with field epi, I can be happy,
Keep calm, we just hero on!

Perspective on Signals, Solutions, Security

INTRODUCTION

Global-urban health security refers to how cities prepare for, respond to, and recover from health threats affecting dense populations—combining public health, urban planning and emergency systems; it involves disease surveillance and early warning systems to detect outbreaks, resilient healthcare capacity with adequate hospitals and supply chains, strong infrastructure such as sanitation, water and air quality management, coordinated governance among local authorities and global bodies like the World Health Organization, and active community engagement to ensure public compliance and trust.

The COVID-19 pandemic revealed many insights about the world today and lessons on how it could have been better prepared for health emergencies. The virus was first detected in the city of Wuhan, China, before subsequently spreading to other countries. The latter happened primarily through points of entry at major cities, spreading rapidly within these urban areas, and then seeding other parts of the country. By July 2020, the United Nations Secretary General called urban areas Ground Zero, with these areas representing 90 per cent of reported cases.¹

The crisis has revealed globalisation and urbanisation writ large. Cities and urban areas are densely populated with highly mobile populations. As trade and travel hubs, they hold more migrants and tend to be more heterogeneous in composition. Some have communities that are also more vulnerable, such as people living in crowded slums and informal settlements where hygiene remains subpar. At the same time, cities hold opportunities for disease prevention, detection and control. Their local authorities have a rich knowledge of the ground and often a wealth of untapped data and information. They are also centres of commerce, innovation, and have tertiary healthcare and public health services that also support surrounding regions.

HEALTH SECURITY CONCERNS

Singapore, as a city state, lived the experience of global-urban health security during the pandemic. We saw early outbreaks at migrant dormitories and implemented a “circuit breaker” lockdown.² Despite cautiously relaxing measures in August 2021, cases rose quickly, leading to the large Delta variant wave. Thereafter, the speed of local introduction of the Omicron variant and its subsequent derivatives by travelers in 2022 highlighted how connected we have become to the world, in part no surprise given Singapore’s status as a renowned hub.³ Once in mitigation, a good part of our vaccine differentiated safe management measures centered around protecting unvaccinated persons from crowded public places where they had a higher risk of being infected. Finally, public transport, with volumes rising closer to pre-pandemic levels, remained one of the last settings where face masks were still required.⁴

Mistakes were made along the way that had to be rectified on the fly because every urbanised society required slightly different solutions depending on the context. To help address such concerns, Singapore and the World Health Organization held a series of technical working group meetings in 2021 on “*Advancing health emergency preparedness in cities and urban settings in COVID-19 and beyond*”.¹ This brought together member states (including city representatives), partners and international organisations; and culminated in the publication of a framework, guidance for national and local authorities, and a resolution at the World Health Assembly in May 2022.⁵⁻⁸

What would a prepared city look like? It would have governance and financing frameworks that facilitate local preparedness and response mechanisms. It demands coordination across levels of government, from national policymakers to local authorities. It taps on the strengths of multiple sectors, including communities and their leaders, clearly communicating risks and empowering its people. It identifies and protects vulnerable groups at risk of poorer outcomes. It uses evidence, data and information to guide public health policy. It works with commerce and industry partners to develop local solutions. It organises its health and essential services in an equitable and resilient manner.

URBAN VS CLASSICAL EPIDEMIOLOGY

Classical outbreak epidemiology is shaped by community-based public health practice. In contrast, urban outbreak epidemiology unfolds within dense, mobile

and socioeconomically diverse populations, interacting with complex, built environments and fragmented health systems. The core epidemiologic principles remain the same—surveillance, investigation, and control measures—but how they are applied differs because the environment changes everything: Population density, mobility, health systems and social structures.

Key differentiating factors

Dimension	Urban context	Classic community context
<i>Population density and mixing</i>	High density, continuous movement, overlapping contact networks; rapid transmission potential.	Low density, limited contact networks; outbreaks remain localised.
<i>Infrastructure and environment</i>	Shared housing, sanitation, water, and transport systems can lead to environmental transmission that affects many.	Smaller, discrete systems (e.g., a single well or event).
<i>Health system landscape</i>	Multiple providers (public, private, informal); multisectoral surveillance and reporting.	Fewer points of care; easier case tracking.
<i>Socioeconomic heterogeneity</i>	Extreme variation within short distances; marginalised populations often most exposed.	More uniform communities; differences mainly by geography.
<i>Governance and coordination</i>	Multi-jurisdictional, requires engagement beyond health (housing, water, waste, transport).	More typically under one administrative or health authority.
<i>Risk communication</i>	Multiple languages, digital platforms, misinformation risks; need for tailored, coordinated messaging.	Localised communication via community leaders or radio.

Hence, urban outbreak epidemiology is not a separate science, but a necessary adaptation of classical field epidemiology to the realities of urban life. Urban poor and informal settlements frequently bear disproportionate outbreak burdens due to overcrowding, inadequate sanitation, and limited healthcare

access. Addressing these disparities is integral to outbreak control and resilience-building. As global urbanisation accelerates, strengthening urban outbreak epidemiology will be important for effective epidemic preparedness and response.

MODELS FOR URBAN RESILIENCE

The relative success of Singapore through the pandemic reflects some of these elements in action. Admittedly helped by having a flat governance structure, the Homefront Crisis Executive Group and Multi-Ministry Taskforce were stood up to coordinate actions across government agencies and community partners.⁹ Public education campaigns encouraged people to take steps to protect themselves and others, including the simplified “Protocols 1-2-3”.¹⁰ An Assurance, Care and Engagement (ACE) Group was created under the Ministry of Manpower to address the needs of migrant workers living in dormitories.¹¹ Hotels and other businesses leaned in to help house and provide for travellers and close contacts under quarantine, as well as cases requiring isolation.¹² As case ascertainment fell, disease surveillance systems were set up to monitor the force of infection and circulating variants, including collaborations between the Ministry of Health and the National Environment Agency on the testing and sequencing of wastewater samples for COVID-19.¹³

Nevertheless, Singapore is not perfect, and we need to build on the experiences and lessons learnt over the past three years to be better prepared for the next outbreak. As a case in point, even during our multiple COVID-19 waves in 2022, the global outbreak of mpox made its appearance in Singapore too.¹⁴ The next epidemic is thus not a matter of if, but when. As a highly urbanised country, we need to invest in maintaining the public health and clinical capabilities in surveillance and data analytics that have allowed us to be nimble in our policies and in managing surges in healthcare demand. We should regularly review our multisectoral preparedness plans and stress-test them to avoid scrambling in a crisis. We must build strong technical links with global and regional counterparts, especially with countries and cities with higher connectivity to us.

Doing the above will help us to become a resilient health system, population, city and country in an increasingly globalised and urbanised world. By integrating health security into urban governance and planning, the world can move

towards more resilient, inclusive, and sustainable futures capable of withstanding future pandemics. Governments, health organisations and communities must work together to strengthen public health infrastructure, promote scientific research, and foster public trust. Some areas to consider are (1) bio-threats and biosecurity risk reduction; (2) emergency coordination for epidemic intelligence and contact tracing; and (3) how to influence powerful stakeholders. Cities, as engines of globalisation and innovation, have a unique opportunity to lead this transformation.

HEALTH AND THE CITY

Urban areas accelerate disease spread because cities are home to dense populations, high mobility, and complex social networks that support disease transmission. Pandemics have emerged as one of the most pressing challenges to global health security in the 21st century. With international travel, trade and migration linking every continent, a health crisis in one region can quickly escalate into a global emergency.

Urban surveillance must integrate disease notifications with diverse data sources from One Health agencies, hospital admissions, laboratory reports, private providers and various other information sources. Because background incidence can be high, signal detection depends more on advanced analytics and early-warning systems.

Control measures often extend beyond the health sector. Effective response may depend on collaboration with municipal agencies responsible for water, sanitation, housing, waste management and transport. Some interventions such as mobility restrictions carry substantial social and economic costs, requiring careful risk-benefit assessment. With varying levels of trust in government, risk communication strategies must be multilingual, culturally attuned and multi-platform—combining social media, community networks and traditional media to maintain public confidence and compliance.

Equity issues are a central concern in global-urban health security. During pandemics, marginalised communities—such as low-income households, migrants and informal workers—often face the greatest risks. They are more likely to live in crowded housing, lack access to healthcare, and depend on daily wages disrupted by lockdowns. Addressing these disparities requires

inclusive urban policies that integrate social protection, affordable healthcare and targeted public health interventions. Health security must therefore be understood as both a medical and a social issue.

CONCLUSION

Global-urban health security focuses on strengthening resilience within cities to prevent, detect, and respond to infectious disease outbreaks. This concept integrates public health, urban planning, and disaster risk management to create safer living environments. Key components include improving access to healthcare, ensuring water and sanitation infrastructure, and promoting health literacy among urban populations. Investing in these areas not only protects cities from pandemics but also enhances overall well-being and sustainable development.

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EPI-FORCE

URBAN HEALTH ADVENTURES



The Bug Stops Here

EPI-FORCE

URBAN HEALTH ADVENTURES

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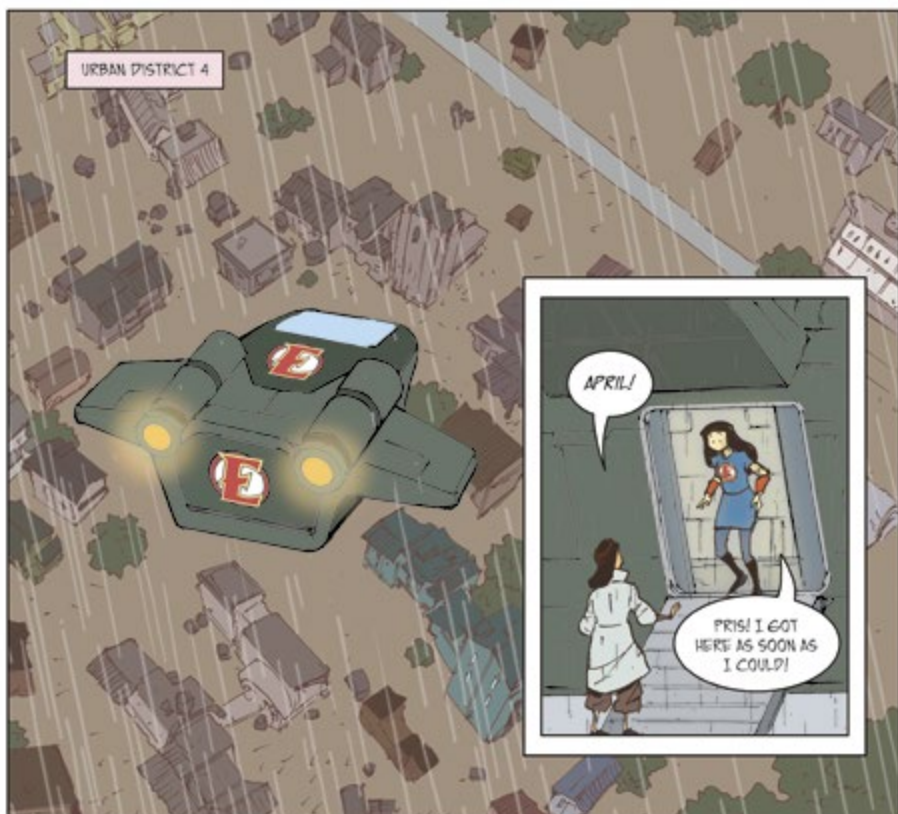








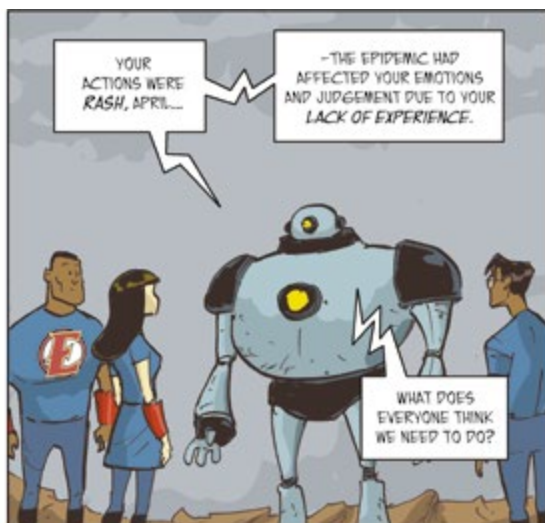














Field Notes

**Outbreak epidemiologic sciences based on
the graphic novel, The Bug Stops Here**

Cities are on the frontline! Global-urban health security protection involves a number of scientific and practical skillsets which are stackable like Lego in any configuration that makes most sense for responding to infectious disease...

The Bug Stops Here
Global-Urban Health Security
Harnessing Artificial Intelligence
Complex Threat Response
Training for Outbreak Readiness
Mental Health and Well-Being
Population Needs Assessment
Addressing Resource Inequity
Environmental Disease Vectors
Community Care Coordination

It all starts with the Reservoir of Infection, where bugs hang out and party. It could be in humans, animals, food or even the jungle. The reservoir is like the clubhouse, and the germs are the wild members. In a highly dense ecosystem such as our urban built environment, picture the chain of transmission as a relay race, but instead of runners passing a baton, germs are playing a game of tag.

From the Reservoir, bugs are the escape artists. They use the Portal of Exit to sneak out of their hiding spots. Some germs exit through the mouth, like when you cough or sneeze (achoo!). Others may choose the gut, like when you have diarrhoea or vomiting, while yet others might choose the skin, like when you have chickenpox vesicles. Some even take the elevator and exit via the blood, like those sneaky malaria parasites borne by mozzies. They can travel through direct contact, like high-fives or hugs, or take the 'droplet express' as tiny particles suspended in air or landing on surfaces—causing contamination and indirect contact. Whatever the case, bugs need a ride to reach their next victim.

Tag, you're it! Bugs enter their new host through a Portal of Entry. The same door they used to exit often becomes their entrance. For instance, the flu germ leaves one person's respiratory tract and enters another's the same way. Some bugs might opt for the stomach entrance if they've been swimming in, well, not-so-clean food or water. The game continues as bugs tag new players as hosts, making them 'it'.

But not everyone gets sick; it depends on some of the bug's characteristic effects on people. Infectivity refers to the proportion of exposed persons who become infected. Pathogenicity refers to the proportion of infected individuals who develop clinically apparent disease. Virulence refers to the proportion of clinically apparent cases that are severe or fatal.

Some folks just don't get it. They carry bugs but don't show any symptoms. These people are Carriers who unknowingly spread the germs to others. Disease transmission is like a game of tag where bugs, the sneaky players, travel from one host to another in a relay race, leaving a trail of infections behind. It's a game we can all win by understanding transmission and breaking the chain.

Artificial Intelligence (AI) takes many forms and can even be a droid like Beanie in the graphic novel. When AI is by our side and used correctly, public health has never been so exciting and full of promise. Just as AI is giving a high-tech makeover to industries left and right, it is now flexing its silicon muscles in the world of infectious diseases:

- **Disease Surveillance:** Like a detective with super-sleuth skills, AI scans mountains of health data, from doctor's notes to trending tweets, and shouts, "Aha, outbreak alert!" before the bad stuff gets out of hand.
- **Outbreak Modelling:** Think of AI as the magician who conjures up a crystal ball. It gazes into the data abyss and predicts the future of diseases, helping health wizards plan their moves and protect us from the next health catastrophe.
- **Diagnostic Assistance:** Similar to a trusty medical sidekick, AI helps doctors make spot-on diagnoses, analysing X-rays, blood tests, and patient histories faster than a speeding bullet.
- **Drug Discovery:** AI is like a super-smart lab assistant in a white coat, sifting through databases to find new medicines or revamp old ones. It is a chemical wizard, brewing up remedies.
- **Health Behaviour Analysis:** AI is like the data D.J. at a health disco, spinning numbers to understand why we make health choices. AI helps create health campaigns that are more irresistible than a catchy tune.
- **Resource Allocation:** AI is a master organiser. It sorts out where hospitals, doctors and supplies should go, like a health GPS guiding resources to where they're needed most.
- **Health Monitoring:** It's like having a personal health coach, but one that never sleeps. Wearables and health apps with AI are your 24/7 wellness buddy, giving high-fives and health advice.
- **Contact Tracing:** During outbreaks, AI is like a digital detective tracing who met who and when. It's akin to Sherlock Holmes—not for crime, but for germs.
- **Telemedicine:** AI appears in the form of a friendly health chatbot, ready to answer questions and provide medical advice. It's like having a doctor in your pocket, available anytime and anywhere.
- **Public Health Policy:** AI is the master analyst who helps governments make smarter choices. It crunches the numbers and whispers, "Here's the best path to good health."

New problems are always coming across to EPI-FORCE, from antibiotic-resistant microbes to the unruly vector-borne viruses. You can never let your guard down, for there will be some surprise package in the form of occasional Malaria, Zika, Chikungunya, or Yellow Fever. Going beyond mosquito-borne mayhem, there's Avian influenza, Middle Eastern Respiratory Syndrome and the ever-sinister Ebola, just to name a few.

Navigating this labyrinth of complex emergent threats is like chasing a runaway train. And health problems are a bit like an onion—they have layers. So, this isn't a sprint; it's more like a marathon through the labyrinth of changes in infrastructure, consumption, behaviour and politics. Public health never operates in a vacuum; it's part of the 'socio-ecological context', which sounds fancy but means considering everything from neighbourhoods to the world stage.

Take mosquito breeding in our water containers, for instance. It's not just about some unruly larvae having a pool party; it's about dengue (and other) viruses that use them as infective adult vectors to spread mosquito-borne outbreaks. And it's all backed by science, because evidence is the name of the game. Lessons learned from past successes (and oops moments) in disease control become the compass that guides the run.

As for threat response, it's a mixed bag—from mosquitoes to elusive germs that play hide-and-seek. Countries are battling the creaks and groans of ageing populations while at the same time doing the epidemiologic tango. To save the day, our heroes must focus on promoting health and bridging the gap between the haves and the have-nots. This cannot be a one-person job; it's a full-blown Avengers team-up.

Epidemiologists, clinicians, scientists, social whizzes, and environment experts are very much needed in the health universe. Teamwork is the secret sauce, and it starts by gathering the folks who are in the thick of the health battle. Everyone's voice should be heard, even the smallest, squeakiest ones. The youth join the party too, with their fresh perspective and endless energy.

So, in the end, it's all about coming together—from preventing epidemics to sprucing up the environment, or tackling on-the-job health dilemmas. It's a

community affair where everyone has a part to play, even if it's just bringing the chips. So, here's to a healthier world, and one collaborative, entertaining and sometimes perplexing public health dance.

TRAINING FOR OUTBREAK READINESS (Refer to graphic novel p.166)

April is told in the graphic novel, "You must complete basic training first before venturing out[...]". This is important because the superhero squad must be ever ready to defend human health and well-being in the face of unusual health emergencies. Think of it, outbreak heroes (and not zeroes) working tirelessly to keep us safe.

Here's a closer look at the exciting world of outbreak readiness:

1. The Heroic Team:

Picture a dynamic team of health professionals, scientists, first responders and community leaders coming together, like the Avengers assembling to protect the world. These everyday heroes are ready to leap into action when trouble strikes.

2. The Crystal Ball:

In the world of research and preparedness, experts wield a powerful crystal ball, which is essentially a sophisticated system for monitoring disease outbreaks, tracking environmental hazards, and predicting health threats. This crystal ball helps the heroes anticipate and plan for potential crises.

3. Emergency Drills:

It's like practising for a big game, but instead of scoring goals, you're saving lives. Preparedness exercise teams conduct drills and exercises to ensure they're battle-ready. They practise their roles and responses so that when a real emergency comes, they know exactly what to do.

4. Information Sharing:

Communication is key, just like how superheroes share intel to thwart a villain's plot. Public health agencies and communities exchange information, updates and warnings to keep everyone informed and safe. This ensures that important health advice reaches the public quickly.

5. Supply Stockpiles:

Imagine a superhero lair filled with gadgets and weapons. Outbreak preparedness involves stockpiling essential medical supplies, vaccines and medicines. These resources are like a superhero's utility belt, ready for action when needed.

6. Battle Against Infectious Diseases:

One of the primary missions of preparedness is to prevent and control the spread of infectious diseases. It's like chasing down supervillains, but in this case, they're parasites, viruses and bacteria.

7. Shelter and Care:

In times of crisis, the heroes set up shelters and provide medical care. These include quarantine centres, telemedicine services and other facilities for people in need. These safe havens offer comfort, protection and healthcare to those affected.

8. Community Resilience:

Imagine a city full of everyday people who've undergone hero training. Outbreak preparedness includes empowering communities to be resilient. Communities learn how to prepare, respond and recover from events, making them strong allies in times of need.

9. Public Health Laws and Policies:

Public health preparedness is guided by laws and policies, similar to a superhero's code of conduct. These regulations ensure that everyone plays by the rules, and the heroes can act swiftly and effectively.

10. Constant Vigilance:

Superheroes don't retire, and neither do outbreak preparedness teams. They remain vigilant, ready to respond to any threat, be it a natural disaster, a disease outbreak or any other health emergency.

Outbreak readiness is all about superheroes in real-life scenarios, working tirelessly to protect us from all kinds of health threats. It's a thrilling adventure, where heroes use their knowledge, skills and dedication to ensure our safety and well-being. So, next time you see an outbreak team in action, remember: They're defending our world!

In the graphic novel, April is troubled. Mental health is the fascinating puzzle of our well-being. It's as complex as trying to balance a bowl of noodles on a unicycle while juggling flaming torches. There are so many factors at play, it's enough to make your head spin—or worse, develop a mental disorder!

We all have troubles. Let's start with socio-economic pressures. You know, the typical poverty and low education level combination. Nothing like struggling to make ends meet while trying to memorise the periodic table. It's enough to make anyone feel a bit off. And, of course, rapid social change—because who doesn't love constant uncertainty? It's like riding an emotional rollercoaster without a seatbelt.

Then, there are stressful work environments. Picture your boss as the ring-master of a three-ring circus, and you're juggling more tasks than you can manage. Stressful, right? And, let's not forget discrimination at work. Because, really, who doesn't love feeling undervalued and marginalised based on something as trivial as gender, race or age?

Unhealthy lifestyles—the classic case of eating fast food and being a couch potato. Perfect for slowly but surely chipping away at our mental well-being. As if that's not enough, addictive substances, dysfunctional communication and abusive relationships lurk around too, just waiting to add more drama to the mix. It's like living in a soap opera you didn't sign up for.

There are individual factors too, like specific psychological quirks and personality traits. Ever met someone who manages to find the dark cloud behind every silver lining? Yep, that's the one. Now, don't get me wrong, it's not all doom and gloom. Mental health and well-being is achievable but we must want them. We're talking about creating living conditions that are more supportive than a best friend during a breakup.

The secret sauce? A mix of healthy lifestyles alongside civil, political and cultural awareness, as well as socio-economic actions. Yes, it's a bit complicated. We're going beyond addressing mental disorders to diving headfirst into broader factors that make mental health a reality. Think about it—mental health promotion needs to be a part of everything. Education, labour, justice, transport, environment, housing and welfare—they're all invited to this party.

And the best part? Intersectoral strategies. Imagine early childhood interventions and support for youth—because let's be real, we all have some unresolved issues from our early days. Empowering women and minorities, supporting the elderly, and targeted programmes for vulnerable groups—everyone gets a piece of the pie. And don't forget mental health advocacy in schools, because what's a school without a bit of extra homework?

Then, there are workplace interventions, housing policies, violence prevention, poverty reduction, anti-discrimination measures, and improving care for individuals with mental disorders. It's like a mental health smorgasbord. By addressing all these aspects, we're hoping to sprinkle a bit of well-being all around.

So, in the grand circus of life, let's make sure mental health is the star of the show. Because when our minds are in balance, we can juggle those flaming torches without breaking a sweat—and maybe even add another bowl of noodles to the mix!

POPULATION NEEDS ASSESSMENT (Refer to graphic novel p.170)

Landing into a community that desperately wants help, we must know what to do. EPI-FORCE, brace yourselves—here's your toolkit for those 'save the day' moments:

- **Guided Discussion:** We're talking about a health pow-wow where folks chat their way to enlightenment. Guided discussions are like group therapy but for public health. Someone, we'll call them the 'Chat Captain,' leads the way to make sure everyone chips in, shares, and most importantly, plans for action. It's like a brainstorming bonanza!
- **Community Mapping:** Ever thought of making a treasure map? Well, community mapping is kind of like that—except instead of 'X marks the spot', it's health issues here. By plotting out what's where, you'll unearth health problem patterns, figure out why they're happening, and discover hidden community gems you didn't know existed. Also, it's just plain fun to play cartographer!
- **Health Walks:** Put on your walking shoes because it's time for a health walk. Your mission? To inspect your community Sherlock Holmes-style. You're looking for culprits behind health problems, like sketchy water sources or misbehaving factories. But here's the twist—it's a group adventure. Share your findings and team up to hatch clever solutions.

- **Drawing activities:** Who knew that wielding a paintbrush could help solve health issues? Drawing activities let your creative juices flow. They're a fantastic conversation starter, especially if reading and writing aren't your jam. Gather your tribe, sketch out the problems, and maybe, just maybe, your masterpiece will inspire ground-breaking solutions.
- **Skits:** Brace yourselves, because it's showtime. Skits are more than just drama; they are a whirlwind of ideas, entertainment, and fun. Put on your acting hats and use the stage to explore health hiccups and spin tales of solutions. Some problems are just easier to tackle when they're transported to a faraway land or a bygone era—voilà, the magic of theatre!

Remember, not every tool fits every situation, but with these in your utility belt, you're ready to make people's health feel like a thrilling adventure.

ADDRESSING RESOURCE INEQUITY (Refer to graphic novel p.170)

So, in an outbreak situation, here's the deal: Resource inequity is like that never-ending game of Monopoly—only this time, it's real life. Wealth, corporate muscle and government antics are handing out 'Get Out of Health Trouble' cards, and not everyone's getting a fair share. Health disparities are the unwanted party favours.

Social epidemiology—because who doesn't love a bit of social gossip, especially when it's about how resources are divvied up and affecting our collective health. Think of it as the neighbourhood grapevine with a healthy twist. This is not about gripe sessions but to find out what is exactly needed. Our health problems are basically a Goldilocks syndrome of the three bears: 'Too little of the good stuff' (scarcity), 'too much of the bad' (excess), and 'just right, is it?' (complacency). To escape this fairy-tale gone wrong, we need to protect communities from the three bears and set ourselves up for a happily ever after.

Now, "I don't want children because costs are too high and immigrants are taking all our jobs" are the kind of rumours that won't go away. But here's the thing: Government policy and handouts, while helpful, aren't the one-stop-shop for solving problems of poverty and inequality. Instead, we should focus on making sure everyone's life is a fairy tale with a happy ending by levelling the resource playing field.

And when it comes to saving the planet and ourselves, it's also about being eco-friendly. 'Reduce, reuse, recycle' is not just for soda cans. We're talking less waste, fewer emissions and happier polar bears. To do this, we need to convince the resource-gobblers of the world to become eco-warriors.

Early intervention to address resource inequity is like preventing a cold before it turns into a full-blown flu epidemic. It's about finding out what's ailing our communities pronto. Conducting an assessment for population needs helps, such as health check-ups for neighbourhoods. They help us spot problems, figure out why they're happening, and decide what needs fixing—all for a healthier, happier community.

So, in the whirlwind of any outbreak, remember, the health of our community is in our hands. Let's make it a good story worth telling.

ENVIRONMENTAL DISEASE VECTORS (Refer to graphic novel pp.171-172)

Darth Vector, guess what? With its black and white stripes, the *Aedes* mosquito is fast becoming the tiny fashionista of all environmental disease vectors. As a collective, they're trying to make a statement: "I like spreading disease, and I'm doing it in style!"

In order to prevent dengue outbreaks and other nasty fevers, we have to outsmart these vectors. Look out particularly for these mosquitoes that clearly missed the memo on camouflage—they're the ones rocking the zebra look while everyone else is trying to blend in with nature.

Find their secret breeding habitats. Apparently, *Aedes* mosquitoes are all about that high class treatment, preferring clean and stagnant water. No muddy puddles for these divas! So, check your flowerpots, empty containers and neglected birdbaths—basically, anywhere a mosquito might throw a pool party. Get rid of that stagnant water, and prevent those mosquitoes from scattering faster than a fashionista at a 90% discounted designer shoe sale. In the end, remember, it's not just about preventing dengue fever; it's about outsmarting these stylish little troublemakers.

The guidelines below will give you an overview of how you can prevent mosquito breeding:

- Turn pails and water cans over and store them under shelter.
- Remove water in plant pot plates; clean and scrub the plates thoroughly to remove mosquito eggs; avoid the use of plant pot plates if possible.
- Loosen soil from potted plants to prevent the accumulation of stagnant water on the surface of the hardened soil.
- Do not block the flow of water in scupper drains along common corridors in housing estates; avoid placing potted plants and other paraphernalia over the scupper drains.
- Cover rarely used gully traps; replace gully traps with non-perforated ones and install anti-mosquito valves.
- Cover bamboo pole holders after use; rainwater can potentially accumulate in these bamboo pole holders if they are uncovered and thereby create a habitat.
- No tray should be placed beneath any air-conditioning unit.
- Be a hero to help search and destroy mosquito breeding habitats in your neighbourhood!

COMMUNITY CARE COORDINATION (Refer to graphic novel p.173)

Community care coordination is like the ultimate buddy cop movie. Picture this: a grizzled healthcare provider and a clever disease detective working together to save the day! Let's break it down, action-movie style:

- **Prevention and Promotion:** The disease detective swoops in, championing outbreak epidemiology and preventive measures, while the healthcare provider hands out the immunisation shots. Like superhero and sidekick, they're a dynamic duo fighting off the bad guys—disease and unhealthy habits.
- **Outbreak Response:** It's the nail-biting moment when the disease detective takes the lead to identify the supervillain, 'Outbreak,' while the healthcare provider rushes in to treat the affected patients. The secret weapon? Close communication and data sharing—like a well-coordinated operations network.
- **Data Sharing:** This is like a thrilling heist film, where the disease detective gathers intel on the population's health while the healthcare provider has access to individual patient data. Sharing de-identified patient data is their way of decoding the plot and unveiling the villains' next move.

- **Crisis Management:** Imagine a disaster movie where the dynamic duo are called upon to be the first responders, swooping in when the city is in peril. They're the heroes who coordinate all efforts to keep everyone safe from an unusual crisis event such as bioterrorism or even a pandemic.
- **Policy and Advocacy:** The disease detective, armed with policies like 'The Lockdown of Premises,' is the fearless lawmaker fighting for good health. The healthcare provider is the key informant with movement history-taking at the individual patient level, making observations that policies are followed. It's a tag-team effort for a healthier world.
- **Vulnerable Populations:** In this heart-warming drama, the healthcare provider becomes a guardian angel for vulnerable populations, providing medical care. Meanwhile, the disease detective addresses social determinants and ensures universal access to healthcare.
- **Health Information Exchange:** It's a cybersecurity thriller where electronic health records and public health surveillance systems are being attacked. The high-tech superheroes must protect patient data while allowing for the seamless exchange of information. They're the guardians of privacy.
- **Community Engagement:** This is the story of our superheroes fighting health disparities. The disease detective connects with the community, while the healthcare provider participates in community health initiatives. Together, they're a tag team celebrating health and diversity.
- **Research and Evaluation:** Picture it as a science fiction adventure, where research findings are the blueprints for new public healthcare practices. Coordination ensures that these findings translate into real-world health solutions, making every step a thrilling moment.

In the end, community care coordination isn't just teamwork—it's a blockbuster partnership that saves the day, one health challenge at a time. It's the cinematic saga where our heroes work together synergistically to provide comprehensive, effective and equitable care services.

GLOBAL-URBAN HEALTH SECURITY (Refer to graphic novel p.174)

EPI-FORCE is like running the ultimate global health detective agency. It's the cool kid at the intersection of global health and international politics, wearing shades and solving health mysteries worldwide. On the one hand, you've got

political decisions, international handshakes and rulebooks. On the other, you've got our superheroes fighting germs and saving lives. Outbreak geopolitics is where these two worlds collide. Here are some examples:

- **Health Diplomacy:** Think of this as the Avengers of health negotiating with countries to create disease-fighting alliances. WHO is tasked to be the matchmaking service that makes sure these diplomatic rendezvous go smoothly. Health security suits up to tackle threats like infectious diseases, bioterrorism and pandemics. They've got surveillance gadgets, a rapid response team and a hotline to share health secrets between countries.
- **Trade and Migration:** This is where the drama unfolds with intellectual property rights, affordable medicine showdowns and food safety disputes. Health security steps in as the referee arbitrating in the fight. When people shuffle around the world bringing germs, health security plays the role of the cautious host, making sure migrants (and refugees) get the healthcare they need while keeping an eye on the bugs they might be carrying.
- **Global Health Inequities:** It's the worldwide health game show with prizes like resources, development assistance and the influence of powerful nations. Health security is the judge, making sure the game isn't rigged and that everyone gets a fair shot at good health.
- **Humanitarian Health Interventions:** When health heroes swoop into disaster scenes, health security navigates the political minefield to get aid to people in need. Health security watches over the rulebook makers, treaty signers, and global health decision shapers. These organisations set the stage for health's greatest hits, like the WHO making sure everyone's on the same page.

In a nutshell, global-urban health security is the bridge that connects health to the wild world of global politics. It's the secret sauce in the recipe for healthy, happy populations all around the globe.



Operation Justice

**A workshop sampler on
Global-Urban Health Security**

Urban Outbreak Management

SAMPLE STORYBOARD TO SET THE STAGE FOR THE WORKSHOP

The Great Detective Escape...

This is an interactive public healthcare workshop focused on global-urban health security and the challenges of detecting and managing an emerging infectious disease threat such as vector-borne outbreaks in densely populated urban settings. Through a scenario-based storyboard, participants immerse themselves into the fray of a massive dengue epidemic breaking out in a metropolitan area. Exercising justice, they learn about harnessing artificial intelligence, complex threat response, training for outbreak readiness, mental health and well-being, population needs assessment, addressing resource inequity, environmental disease vectors, and community care coordination.

How do we make the great detective escape? This workshop emphasises urban resilience, multisectoral collaboration, emergency coordination, and equitable public health responses. Interactive exercises include incident briefings, urban risk mapping, media communication simulations, and policy discussions. By the end of the workshop, participants will better understand how globalisation and urbanisation shape health security decisions and response strategies.

- Fun theme: Project Fulushou – The Bug Stops Here!
- Coverage: Aetiologic Agents, Urban Environmental Drivers, Global Health Diplomacy
- Your hosts: C.O.R.G.I. (Centre for Outbreak Research and Global Intelligence) Secret Agency, with Professors Dumbledore, Max, Eve and more
- Storyboard: Operation Justice progresses with *Roleplay Studio for C.O.R.G.I. Secret Agents*, and *The Great Detective Escape*
- Finale: *C.O.R.G.I. Commencement*

Global-Urban Health Security

Workshop Day 1	
Operation Justice: Signals, Solutions, Security	
09:00–09:30	Day's Overview Welcome and Curriculum
09:30–11:00	Field Epidemiology @ Work Emergent Threats: A Series of Unfortunate Events By the end of this session, participants should be able to: • Apply incidence, prevalence and mortality • Describe global health security systems • Explain the emergence of infectious diseases
11:00–13:00	Emerging Disease Master Class Mycosis: Eye for Troubling Unusual Outbreaks By the end of this session, participants should be able to: • Glean lessons about Fusariosis and Microsporidiosis • Critique outbreak management • Describe the prevention and control of contact transmissible diseases
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Complex Threat Response: Perspectives on outbreaks, contact tracing, quarantine and business continuity planning Part 1 of Project: Your Project Skit

Workshop Day 2	
Operation Justice: Signals, Solutions, Security	
09:00–09:30	Day's Overview Urban Lifestyle and Risk Management
09:30–11:00	Field Epidemiology @ Work Arboviruses: The Bad Beginning By the end of this session, participants should be able to: • Apply outbreak concepts • Describe the prevention and control of vector-borne diseases • Explain the emergence of Zika, Chikungunya
11:00–13:00	Emerging Disease Master Class Mpox: Pottering Along Calmly By the end of this session, participants should be able to: • Glean lessons from the changing epidemiology of Mpox • Describe social and environmental determinants • Describe the prevention and control of emerging infections
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Population Needs Assessment: Outbreak management, case finding, contact tracing and community health protection from bio-threats Part 2 of Project: Visit to a City Gallery

Workshop Day 3	
Operation Justice: Signals, Solutions, Security	
09:00–09:30	Day's Overview Multisectoral Global Collaboration
09:30–11:00	Field Epidemiology @ Work Coronaviruses: Bad, Dangerous, Invincible By the end of this session, participants should be able to: • Apply surveillance and field data • Describe the prevention and control of epidemic diseases • Explain the emergence of SARS, MERS, COVID-19
11:00–13:00	Emerging Disease Master Class Food-borne Illnesses: Massive Outbreaks Alert By the end of this session, participants should be able to: • Glean lessons about Vibriosis and Salmonellosis • Critique disease cause and effect • Describe the prevention and control of food-borne diseases
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Addressing Resource Inequity: Emergent urban threats, public health guidance, social determinants, vulnerable populations Part 3 of Project: Health Security Exercise

Workshop Day 4	
Operation Justice: Signals, Solutions, Security	
09:00–09:30	Day's Overview Health Emergencies in Urban Settings
09:30–11:00	Field Epidemiology @ Work Henipaviruses : Braving a Killer Outbreak By the end of this session, participants should be able to: • Critique observational study design • Describe the prevention and control of zoonotic diseases • Explain the emergence of the Nipah disease
11:00–13:00	Emerging Disease Master Class Viral Gastroenteritis: The Penultimate Peril By the end of this session, participants should be able to: • Glean lessons about Norovirus and other aetiologies • Apply principles in breaking the chain of transmission • Describe the prevention and control of Gastroenteritis
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Community Care Coordination: Healthcare and emerging infections prevention and control, applying epidemiology in Nosocomial risk management Part 4 of Project: EPI-FORCE Prologue

Workshop Day 5	
Operation Justice: Signals, Solutions, Security	
09:00–09:30	Day's Overview Preparedness, Prevention, Protection
09:30–11:00	Field Epidemiology @ Work Enteroviruses: Preschool Menace and More By the end of this session, participants should be able to: • Interpret the ecology of the biosphere • Describe the prevention and control of childhood diseases • Explain the emergence of fatal enterovirus A71 infections
11:00–13:00	Emerging Disease Master Class Commencement: Making the Most of Unfortunate Events By the end of this session, participants should be able to: • Glean lessons from the re-emergence of measles • Articulate global health security concerns • Describe the prevention and control of re-emerging infections
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Global-Urban Health Security: Perspectives on health security concerns in scenario role-plays by course participants as experts and stakeholders Part 5 of Project : Survivors Morphing Heroes

Operation Justice: Self-Reflection for Trainees

"That's not fair!" How many times have we heard, felt or shouted these words? On a human level, the virtue of justice sits between the two extremes of leniency and injustice. Think of a situation you are facing and that calls you to act. How are you judging right from wrong in this situation, and how can you respond to this situation in a way that reflects justice?

Justice Reflection and Sharing

As you progress in your learning journey, this section may be used for personal reflection and for group sharing of views. In a personal reflection, what stirs your heart? Remain with it for a while. You may reflect on one or more of the following questions according to your context. In a group context, allow enough time to reflect in a safe space and for everyone to respond.

Questions on Justice

- i. What does justice mean to you, and how does your understanding of justice influence your actions and decisions?
- ii. How do socioeconomic privileges affect the distribution of justice?
- iii. Is justice an inherent human value, or is it culturally and historically constructed?
- iv. In what ways can justice be achieved on both individual and collective levels?
- v. How does one balance the pursuit of justice with the principles of forgiveness and reconciliation?
- vi. Can justice ever be truly impartial, or is it always influenced by subjective perspectives and biases?
- vii. Reflecting on historical and contemporary examples, how has the concept of justice evolved over time?
- viii. How do legal systems around the world uphold or fall short of delivering justice to all members of society?

- ix. What responsibilities do individuals have in advocating for justice, both locally and on a global scale?
- x. How does the pursuit of justice intersect with other moral principles, such as compassion?

Suggestions for Reflection

Four cardinal virtues form the basis of ethics first described by Plato (427-348 BC) and elaborated by Aristotle (384-322 BC). They are:

1. **Prudence:** Practical wisdom and right judgement; the virtue that disposes the practical reason to discern in every circumstance our true good and the right means for achieving it.
2. **Justice:** Righteousness and fairness; the virtue that consists in the firm and constant will to respect the rights of each and give to others their due.
3. **Fortitude:** Courage and steadfastness; the virtue that ensures firmness in difficulties to overcome obstacles and constancy in the pursuit of the good.
4. **Temperance:** Self-control and healthy-minded sobriety; the virtue that moderates the attraction of the pleasures of the senses and provides balance in the use of created goods.

Cardinal virtues are a habitual and firm disposition for one to do good and become the best version of oneself to attain happiness and well-being. They grow through education, deliberate acts, and perseverance in struggle, and enables our experience of ease, self-mastery and joy.

Justice is the virtue that consists in the constant and firm will to give their due to others. It disposes one to respect the rights of each and to establish in human relationships the harmony that promotes equity with regard to persons and to the common good. The just man is distinguished by habitual right thinking and the uprightness of his conduct toward his neighbour.

We see that justice is a quality or habit which perfects the will and inclines it to render to each and to all what belongs to them. The object of the virtue of justice is the other person's rights, whether natural or bestowed by state.

Justice requires that all persons should be left in the free enjoyment of all their rights. The rights which belong to every human being are absolute and inalienable.

There is an extreme view of justice in negative terms as in punishing criminals who deserve it. But it would be a mistake to think of justice only as dealing out punishment. Justice is a virtue that is first and foremost a positive thing. Living justly is to render things perfectly.

On the other hand, another extreme is viewing justice as a vague and sentimental desire to help everyone. This is often under the guise of social justice. While social justice is a valid concept when strictly and carefully defined, it often simply becomes an excuse for political violations of private property, dignity and respect, and even human life. Even with the above definition of justice, it is still a virtue that is likely to be misunderstood due to two opposite extremes in understanding it. Justice is not just negative—a matter of dealing out judgement—but also a positive thing in that we render whatever is owed to others.

To avoid violating natural law in the name of justice, we must first understand what human rights truly are and not invent rights that do not exist. Compassion, not justice, should motivate us to help our neighbour.

Seeking Health & Security

Lifestyle May Threaten Our Well-Being!



**JOIN US FOR
THE FURTHER
ADVENTURES OF
EPI-MAN AND
EPI-FORCE**

Workshop Musings

An observational guide on the ingredients of success, and how to live well, live long, and live with peace of mind...



Fu: Fortune Magical Rise and Fall

Fu: Blessings Security, Womb to Tomb

Fu: Happiness Marveling at One's Happiness

Lu: Status What's My Batting Average?



Lu: Influence Wonder if We're Enslaved?

Lu: Wealth1 Our Wealth Taken in a Flash

Lu: Wealth2 Flashy Seducing Lifestyles

Shou: Longevity Living Long, How to Go?



Shou: Benefaction Joy with Benefaction

Shou: Health Ironing Out My Well-being

Fulushou: Purpose Do Right, Do Good!

Fulushou



We see these figures and their symbols everywhere... in the Asian tradition, *Fu*, *Lu* and *Shou*, also known as the three stars, are the deities of success!

The character *Fu* denotes **fortune, blessings, happiness**. It denotes being happy as the result of being lucky. The character is prominently displayed on doors, often upside-down, as 'turn upside-down' and a word meaning 'arrive' are homophones; in other words, to say 'luck upside-down' sounds like luck is coming. Instead of seeking happiness, modern lifestyles pursue pleasure...

The character *Lu* connotes pursuing **status, influence, wealth**. it symbolises a civil service position, one of the most desired jobs in old China. The Confucian system of study followed by examination and placement holds sway in the culture to this day, and is seen as key to success. Instead of seeking wealth, modern lifestyles pursue conspicuous consumption...

The character *shou* stands for **longevity, benefaction, health**. *Shou* and *Fu* co-exist; to live long is to have *Fu*. Some popular designs in folk culture show *Shou* encircled by *Fu*, or side by side being equally important. Instead of seeking health, modern lifestyles pursue fitness and beauty...

By examining the attributes of *Fulushou*, we hope to understand better our personal lifestyle and how specific choices can add to our wellbeing. But there are pitfalls along the way...



We see *Caishen*, the deity of prosperity, during Lunar New Year celebrations and often confuse him with *Fu* or *Lu*. Somehow, we believe they are all the same because we have been told, “if we are wealthy and prosperous, then we will be happy.” This simplification has proven to be a mistake.

In truth, we have to seek success in all three attributes of *Fulushou*. The ancients already knew very well the truth that happiness and prosperity are two very independent aspirations. Often, families break up because the single-minded pursuit of wealth can destroy happiness and health.

At festivities, we come together irrespective of race, language or religion and wish each other good health, good life (prosperity) and good cheer (happiness). Despite other differences in opinion, we can still agree that successful people share a combination of health, prosperity and happiness. These three attributes are common aspirations from sage wisdom found in all civilisations and cultures.

Yet we often fail. To find out more on how our modern lifestyles may threaten our well-being, read on!



Magical Rise and Fall

Is it largely luck that drives a nation's fortunes? With all the economic uncertainty surrounding us, is Singapore still speeding down a fast-track lane to good fortune? Or are we seeing the early signs of an imminent global shock?

Let's face it. The US-led way of doing things is being challenged and the world is changing, for better or worse. To make sense of trends, Winston Churchill once noted, "The longer you can look back, the farther you can look forward." Many historians have studied the fate of great nations and seen common patterns in their rise and fall. This consistency of observable stages in history that tends to recycle can hold important lessons for us.

John Glubb's *The Fate of Empires and the Search for Survival* documents five stages of growth, prosperity and decline:

Pioneers: Society starts with good faith and courage, with many liberties in a young nation.

Conquests and commerce: With socioeconomic development comes the trappings of power; society becomes self-absorbed.

Affluence: Abundance is evident and with it, expenditures, complacency and dependency grow.

Intellect: As intellectualism and dependency abound, economy weakens and massive wealth transfers start to occur.

Decadence: Economic bubbles appear and burst, leading to societal crisis and collapse.

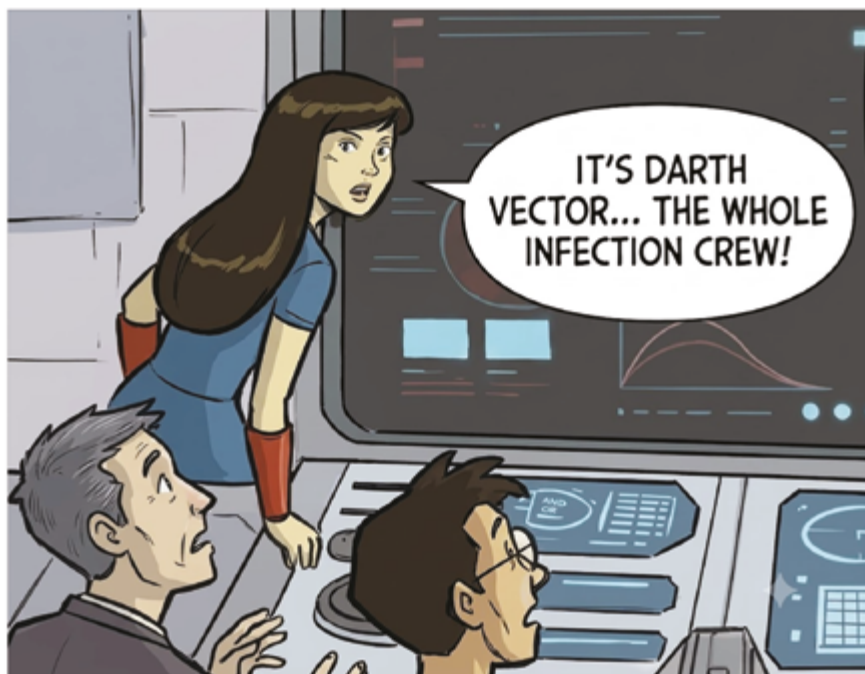
A more detailed account of the final stage is provided by Dmitri Orlov, who observed firsthand the fall of the Soviet Union during the 1990s. He describes the sequential nature of collapses experienced by society as follows:

- Financial collapse, when 'business as usual' is lost
- Commercial collapse, when 'the market shall provide' is lost
- Political collapse, when 'the government will take care of you' is lost
- Social collapse, when 'your people will take care of you' is lost
- Cultural collapse, when 'the goodness of humanity' is lost.

How should we react to these historical insights? While contexts may differ, resilience is about preparing ourselves for potential speed traps and flashpoints. By knowing history better, we can better project our likely national future, and also do some personal planning. Luck may play a part, but there is a lot else we can do!

The more we're prepared, the more fortunate we get!





Security, Womb to Tomb

Many countries openly aspire to replicate a successful country's achievements. But they have also discovered just how difficult it is to do so. Our list includes good public health indices, a safe and green environment, social harmony, health and education services, clean drinking water, world-class connectivity, low unemployment, an honest civil service, and not last nor least, affordable good food everywhere!

If we can count so many blessings, why then do segments of society persist with complaints and an unhappy psyche? In a word: Insecurity. Despite all our achievements, many of us still feel inherently insecure.

Security is not synonymous with safety—safety is freedom from danger, but security is more a freedom from fear. To explain insecurity, let us examine the example of a SWOT analysis prepared by academic Kishore Mahbubani on Singapore...

Strengths: political stability; ethnic harmony; military and financial muscle; cosmopolitan culture; clean water; public safety; world-class universities and think-tanks; regional peace.

Weaknesses: small size; demographic decline; emigration; volatile neighbourhood; weak national identity.

Opportunities: the New York or London of Asia; surfing the Asian cultural renaissance; the epicentre of Asian wealth management; the intellectual and think-tank capital of Asia.

Threats: political disgruntlement; public transport woes; housing prices; resentment towards foreign talent; competition from other cities; melting polar ice; geopolitical uncertainty.

It becomes apparent then that while we are blessed with many strengths and opportunities, we also feel constrained with quite a fair share of weaknesses and threats. This thinking applies at both country and personal level. Paradoxically, in a yin-yang way, the sense of insecurity has precisely been the powerful driver—harnessing actions that have fuelled many national and personal achievements.

At personal and higher levels, we have no choice but to engage in this reflection, and the sooner we recognise our weaknesses and threats, the better off we will be. And we shall have made a major leap forward in feeling blessed, and dealing with the unhappy psyche of ourselves!

Count blessings, and use insecurity positively!



Marveling at One's Happiness



Do we know how to be happy in spite of insecurity? It appears that the bulk of what determines happiness is due to personality and, more importantly, thoughts and behaviors that can be changed. Only ten percent or so of the variation in people's reports of happiness can be explained by differences in their circumstances.

Although we may have thought, as many people do, that happiness comes from being born rich or beautiful or living a stress-free life, the reality is that people who have wealth, beauty or less stress are not any happier on average than those who do not enjoy those blessings.

Studies show that people who are happy seem to intuitively know that their happiness is the sum of their life choices, and their lives are built on the following pillars:

- Devoting time to family and friends, investing in relationships
- Maintaining an optimistic outlook, cultivating optimism
- Finding and feeling a sense of purpose
- Living in the moment
- Appreciating what they have, expressing gratitude.

If we have been looking for happiness, the good news is that our choices, thoughts and actions can influence our level of happiness. Like love, happiness is more a commitment than a feeling. You can tune it, like a dial.

Do not postpone joy by waiting for a day when our life is less busy or less stressful. That day may never come. Instead, look for opportunities to savor the small pleasures of everyday life. Focus on the positives in the present moment and be thankful. The past is a present for the future!

Being thankful is more than saying thank you. It is a sense of wonder, appreciation and, yes, gratitude for life. It's easy to go through life without appreciating our family and friends. Often, it takes a serious illness or other tragic event to jolt people into recognising the good things in their lives. Don't wait for something like that to happen.

Make a commitment to practice gratitude. Each day, identify at least one thing that enriches life. Let gratitude be the last thought before we power off, and our first thought when we come back on!

To find inner happiness, be thankful!



What's My Batting Average?

Most of us desire status. Hence, without really thinking about it, we are awash in the trappings of wealth that actually send us in the opposite direction. Banks gladly do their part to help us along, with credit cards, house mortgage, and car loan, all on easy repayment terms.

Then we read about loan sharks and what they do. Creditors have serious powers to extract money from us. Aside from harassment, they seize any collateral that we had pledged. And if it involved the big ticket stuff such as our house or car, creditors can readily repossess them. Even if we have second thoughts, before long, we are already on a path that is pretty hard to get off. Because, after all, what are our choices?

Aside from the option of being deprived, which is pretty unappealing, we just need to find work and get paid, and put in as many years as it takes to pay our debts! If we end up with more debt than we can pay off, this path, sometimes referred to as a rat race, can lead to debt slavery. On the scale of historical forms of enslavement, its level of violence is subdued but our freedom is nevertheless severely constrained. We either do what it takes to make each debt repayment, or creditors start ruining our life.

The truth is that status symbols seldom correlate with happiness, with the latter largely a function of our outlook in life. Those of us who pursue status can feel unhappy and insecure to the extent that it harms our mental and physical health. Basically, the more we have, the more we worry about how to retain them!

There are many chronic lifestyle diseases which have no cure, and we cannot buy back health with money. Most people get it. To achieve a happy and productive life, one basic ingredient is to stay happy and healthy. Yet, it's not just about diet and exercise. We also have to manage our time, our talents and our ties. This determines our level of stress, which if too high, would lead to health problems.

There is one proper way to get out of debt slavery, which is to pay our way out. If we earn enough money and can accept a more frugal lifestyle for a while, we can pay off our debts and eventually become debt free. Before we drown in debts, we must ask ourselves what drives our lifestyle choices. We probably need some trappings of wealth as aspirational goals, but we must be careful not to lose our order of priorities.

For each of us, what would be our highest priority?



Wonder if We're Enslaved?



How much influence do we exercise in our lives? When working to earn wages, do we lose our power? When our boss asks us to do something we feel is inappropriate, do we feel like we have no choice? No one makes us go to work every day and yet, we do not have the freedom to say, "No." We have become wage slaves.

Choosing to be a wage slave is very different from choosing to be a debt slave, because it is a choice we make every day. One does not become a wage slave with one decision, the way a single choice to take on debt can colour our life for decades. The only way to become a wage slave is to make the decision to be one, day after day.

It starts like this: We get a job, find a place to live, buy the stuff we need and, without much thought going into it, pretty soon our lifestyle demands the continued flow of wages. When jobs are plentiful, we can work for wages and still be fairly free. So what if one boss goes bankrupt, or another boss turns out to be a psychopath? We can always find another job if our experience turns bad. But in an economic downturn, a lot of people are reminded that we cannot always change jobs. When there's only one job, the shackles of wage slavery start to feel tighter.

The hard part of escaping wage slavery is making a mental shift from wage slavery to work dignity every day. It is not just the fear that we might lose a lifestyle to which we have become accustomed. It is also the fear that we will under-achieve, and find a more meagre lifestyle acceptable. And keeping up with the Joneses helps prod us from being slackers. But many feel that if they did not need to work, they would not want to work. That could be a bad thing as well, because work can be beneficial.

If we can develop a higher personal mission, our work then conveys dignity and no longer accentuates the meaninglessness of life. Once we do that, some key moves become easy:

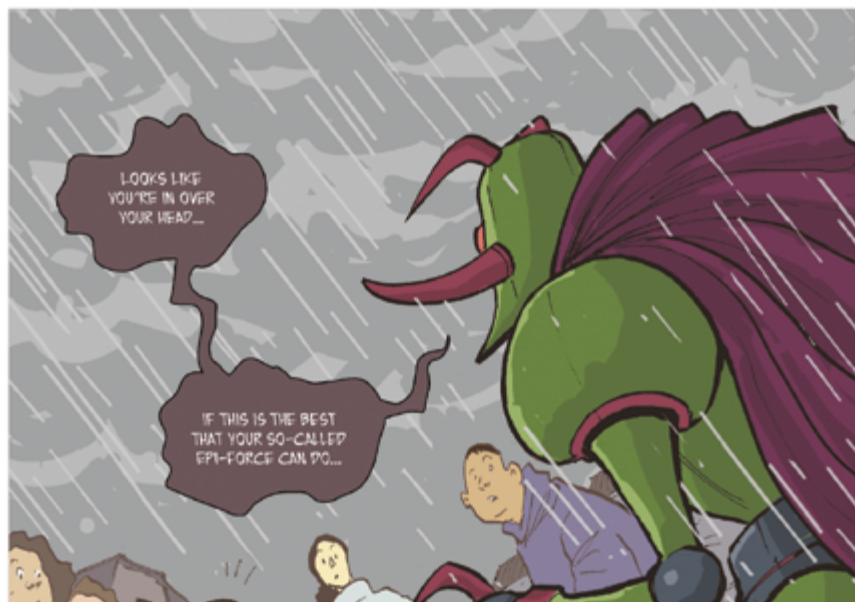
Avoid debt: We went over this before, with one exception being perhaps the purchase of a productive investment asset.

Be frugal: Do not let our living costs rise until we cannot leave that one and only job that pays enough to cover our bills.

Expand our skills: New skills would let us develop ourselves and our marketability, and give us more flexibility.

Never lose our dignity. And when we are on the path out of wage slavery, 'Boss' then no longer has that life and death influence over us. Spiderman became a superhero after being bitten by a spider. What have you become after being bitten by your boss?

Maintain influence and dignity at work!



Our Wealth Taken in a Flash

We too often equate wealth with money. We have learnt something about our enslavement to debt and wages. Now, let us look at another facet of the modern day, urban lifestyle: How much of our time is really ours? Do you feel you have enough time to do the things you love to do? Shouldn't we be free enough to pursue our interests? Don't you hate it when all your work just controls how you spend your time?

Many have now realised that money is just a tool by others for trading in our time. Owing to debt slavery and wage slavery, we are now also short of time. Time freedom is fast becoming the new measure of true wealth.

Time freedom is becoming that one thing that many of us want more of in our lives. This is because money becomes much less useful when we do not have time, or when all our energy is already sapped from us during our time at work.

Contrary to popular opinion, we are all blessed with time—unless we're already dead. You know, those 24 hours in a day that must be apportioned. Imagine they all belong to you, every day. No need to imagine, they really do. And no one, not even your boss, tells you how much time to devote to something. Our epiphany moment is this: If we can feel our life is going faster and faster, it's likely going downhill!

When we strive for time freedom, we start to see the routines and work constraints that make us run around like headless chickens. Embracing time freedom means taking control of daily life, with more flexibility to be spontaneous, and doing more remarkable, meaningful activities. We can then lead a less conventional lifestyle, which gives us a new sense of true freedom and prosperity.

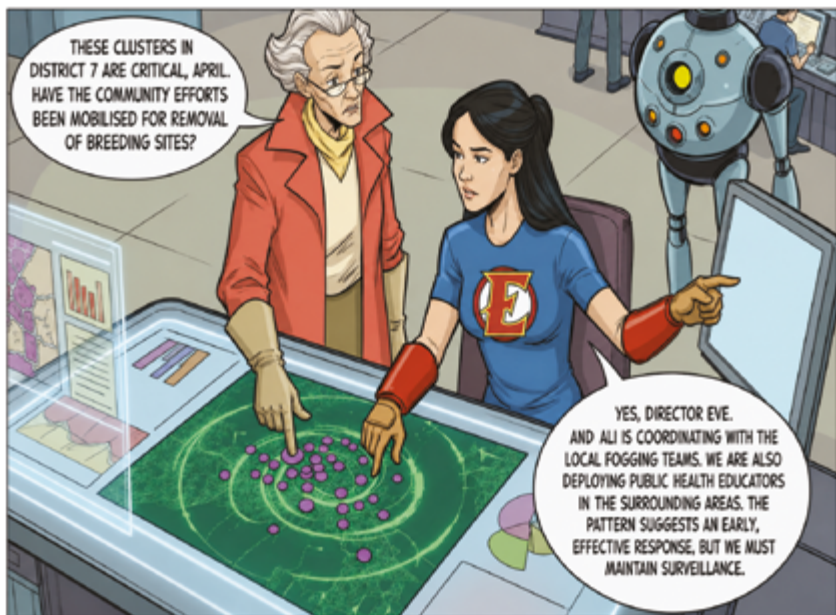
When time freedom is achieved, a person is free to pursue dreams, be a benefactor to others, and leave a legacy for posterity. Time freedom is actually having the time to move deliberately through the world—appreciating life, our environment, and people around us—in a much deeper way. And changing the world for ourselves and other people. This is indeed a measure of how we help ourselves and others prosper.

How are you managing the time of your life? You decide.

Time freedom—precious, not to be wasted!



Flashy Seducing Lifestyles



Somehow, living in a modern society with all its flashy lifestyles and glamour, we seem to have accepted the dominance of wealth over our lives. Society measures success by how much wealth we've accumulated, and assigns us our net worth and value as individuals in terms of money. Materialism and conspicuous consumption rule, but we have not always been like this.

A new tyranny is moving into place, imposing its rules of the game on all our lives. Everyone is subject to the corporate pursuit of profits under the laws of global competition. By creating an idol in wealth and money, our society has returned to an ancient worship of the golden calf in a fresh and ruthless guise.

On the global level, we are seeing rampant corruption to buy influence and the widening hunt by indebted governments for taxes. Growing debt is also preventing many people from realising their full potential and enjoying purchasing power. To all this, add a winner-takes-all mentality that knows no limits in devouring everything that stands in the way, including our natural environment.

On the individual level, as the wealth of a super elite grows exponentially at one end, so too does the conspicuous consumption that is intent on making others drool. In a survival of the fittest (or meanest), the powerful feed upon the weak.

At the other end, poor people are finding themselves marginalised, excluded from good paying jobs, and without means of escape. Many who queue to buy 4D are actually buying hope—which can be in short supply.

And right in the middle class where most of us are, we get caught up in the emotions of greed and fear—greed to acquire as much wealth as possible before we too lose out, and fear when financial insecurity throws all our long-term growth plans out the window.

This imbalance is accentuated by unchecked practices in capitalist markets which reject the idea of equitable distribution of wealth. Our discomfort with money stems from the fact that the global economic engine lacks a truly human purpose. Gandhi once said that, “The world has enough for everyone’s need, but not enough for everyone’s greed.” There is a lesson here for each of us.

Has our flashy lifestyle seduced us?





Living Long, How to Go?

Lee Kuan Yew revealed in his book, *One Man's View of the World*, that despite a disciplined lifestyle, "There is an end to everything and I want mine to come as quickly and painlessly as possible, not with me incapacitated, half in coma in bed and with a tube going into my nostrils and down to my stomach."

Lee also expressed in the book his blunt views on religion, "I wouldn't call myself an atheist. I neither deny nor accept that there is a God... So I do not laugh at people who believe in God. But I do not necessarily believe in God—nor deny that there could be one." Asked where he drew comfort from if not from religion, he said: "It is the end of any aches and pains and suffering. So I hope the end will come quickly."

Consider also the comments made by Pope Francis at Rio de Janeiro on the occasion of World Youth Day, 2013: "We need saints with jeans and tennis shoes. We need saints that go to the movies, that listen to music, that hang out with friends. We need saints who put God in first place, ahead of succeeding in any career. We need saints who look for time to pray every day and who know how to be in love with purity, chastity, and all good things. We need saints, Saints of the 21st century with a spirituality appropriate to our new time. We need saints that have a commitment to helping the poor and to make the needed social change. We need saints to live in the world, to sanctify the world and to not be afraid of living in the world by their presence in it. We need saints that drink Coca-Cola, that eat hot dogs, that surf the internet and that listen to their iPods. We need saints who love the movies, dance, sports, theatres. We need saints that are open, sociable, normal, happy companions. We need saints who are in this world and who know how to enjoy the best in this world without being callous or mundane."

Khaw Boon Wan had said in Parliament: "At every Chinese New Year, I wish my residents " 健康长寿 " (good health and longevity). They said yes to the good part, good health. But on longevity, many said: "not too long please". I know what they meant. We strive for a long meaningful life. But the two words 'long' and 'meaningful' come together to make a happy person. A long life of pain and suffering is a miserable life."

What would you consider to be a life well lived to the end?

Attract longevity by engaging in meaningful activity.



Shou: Benefaction



Joy with Benefaction

We work very hard at our desk job every day and accumulate money. Then, we buy things we do not need, with money we do not fully have, to impress people we do not even like! Clearly, there must be a better way to enjoy life...

Money may buy 'happiness' as long as we spend it according to certain principles, according to a book by Michael Norton and Elizabeth Dunn, *Happy Money: The Science of Smarter Spending*. Their book comes on the heels of research that shows earning a middle-class income helps boost happiness. Anything more than that does not appreciably help, while income less than that decreases one's feeling of contentment. So, how can we best spend what we have?

There is a difference between happiness and joy. One is dependent on circumstances while the other is independent. The former pursues what is material while the latter seeks purpose, gratitude and contentment. How can we spend money to achieve joy?

Buy time... Consider optimising time together with loved ones as beneficiaries. We may then want to pay to relieve ourselves of chores such as marketing, laundry and ironing, as well as modes of transport that consume our time. "Thinking about how every purchase you make is going to affect your time allows us to spend money in ways that buy us happier time."

Buy experiences... Spending money on consumer items like gadgets, books and lattes would not make us unhappy, but do not plan on it making us happier either. "Consider the difference between buying a TV and buying a vacation. TV is great, sure, but the experience of watching TV pales in comparison to the experience of going to a special meal once a week with a partner or friend."

Buy for others... Think of others and be generous. Giving provides a benefit not only to the recipient, but to the giver. "We consistently find that spending money on other people—whether buying gifts for friends or donating to charity—provides people with much more happiness than spending that money on themselves."

Also, know that the anticipation of some purchase can be more pleasurable than the actual purchase. So, delayed gratification does have value! Are we using it in the best way to bring joy and benefaction? Consider your opportunity costs!

Benefaction brings you benefits.



Ironing Out My Well-being



Are you a healthy hero? It's difficult for us to be successful in our endeavours if we are not in a state of well-being physically, mentally and socially. Health is our first wealth. Besides guarding against disease or infirmity, we can gauge ourselves by asking some questions:

Am I engaged in something I love? To stay healthy, try to align daily activities with your long-term purpose in life. The end result is not as important as considering if the journey to get there is a meaningful one to you. Those who strive to find a worthwhile mission—whether it's being a hero fighting injustice, caring for children, tending to nature, or finding one's spirituality—are generally happier than those who do not have aspirations.

Having a sense of mission provides a personal purpose, bolsters self-esteem, and also brings people together.

What excites and energises me? When fulfilling your mission, many healthy ways exist to manage and cope with stressors, but they all require change. You can either change the situation or change your reaction. When deciding which option to choose, it's helpful to think of the four As: Avoid; Alter; Adapt; or Accept! Everyone has a unique response to stressors and there is no single method that works for every situation, so experiment with different techniques and strategies.

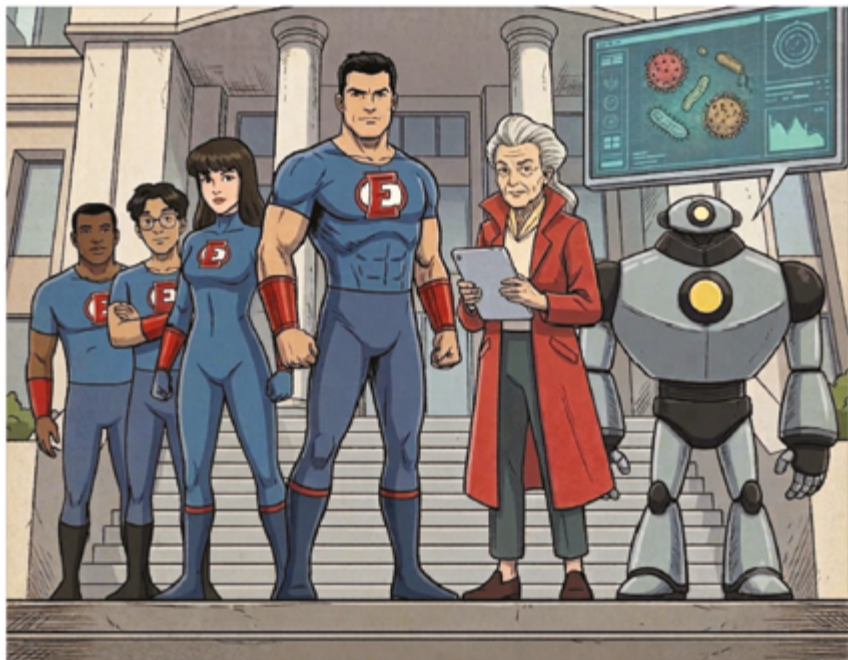
Focus on what makes you feel calm and in control. Develop the habit of seeing the positive side of things. If you're not an optimist by nature, it may take time for you to modify your normal thinking. Start by recognising negative thoughts as you have them. Remember that what is right about you almost always trumps what is wrong!

How do I want others to remember me? Although it is easy to take friends and family for granted, these relationships need nurturing. Build up your emotional bank account with others using kind words and actions. Be careful and gracious with critique. Let people know that you appreciate what they do for you, and that you're glad they are part of your life.

Find company with people who are joyful and contented with their own lives, as their mood will rub onto you. Similarly, you will be able to spread happiness to those around you when you are in a good mood yourself!

Be healthy in body, mind and spirit!





Do Right, Do Good!

This is so important it must be repeated: Do right, do good... you will do well! People who strive to find a worthwhile mission are generally happier and healthier than those who do not have such aspirations.

Having this mission provides a sense of purpose, bolsters self-esteem and brings people together. What your goal is does not matter as much as whether the process of working toward it is meaningful to you.

Try to align your daily activities with the long-term meaning for your life. Studies suggest that relationships provide the strongest purpose to our life. So, cultivate meaningful relationships.

Are you engaged in something you love? Ask yourself this question to discover how you can find your mission: What are my proudest and most satisfying achievements?

There are four cardinal virtues which, when expressed, will involve self-mastery and a joy that results from living a moral life.

Prudence is the first of these virtues. Prudence gives people the ability to use their powers of reason to see what is good and what is evil. Through prudence, people have the ability to make moral choices.

The second virtue is justice. When human beings practice justice, they respect others' rights. Just persons strive for equality among all people and for conditions that serve the common good.

The third virtue, fortitude, gives people the courage to stand up for what is good and right. Even in the face of death, persons with fortitude are willing to make the ultimate sacrifice for just causes.

The fourth virtue of temperance leads people to practice moderation in the pleasures they seek and in the goods they use.

Focus on what makes you feel calm and in control, and stay in good health! Surround yourself with happy people—being around people who are content buoys your own mood. And by being happy yourself, you give something back to those around you. Friends and family help you celebrate life's successes and support you in difficult times.

Synergise your health, wealth and happiness!



Ever heard of *Ikigai*? It is a Japanese word, meaning 'the reason for being.' According to this concept, everyone has an *Ikigai*. An *Ikigai*, as depicted below, is essentially a very good reason to get up in the morning, and to enjoy life...



All success is personal. Nonetheless, despite differences in personal priorities, we can agree that those who have health, wealth and happiness are prosperously successful. Also, to be truly wealthy, money must serve and not rule us, for it makes a very good slave but bad master. In addition, we need to cultivate more meaningful relationships, because studies show consistently that relationships provide the strongest sense of purpose to our life.

So there, some ingredients to help seek super security as our *Ikigai*, lifestyle and well-being!



***Seeking Health & Security is a product of
Survivor School***



EPI-sode 3: Epidemic Intelligence Gathering

Life on the Outbreak Wave...

(Tune: Life on the Ocean Wave)

Verse 1

A life on the outbreak wave
We're home on the rolling deep
Where the scattered agents rave,
And ill winds, their revels keep!
Epidemic curves I find
On this ever-changing score
Oh test me bacterial brine
The spray and the tempest's roar!

Chorus

A life on the outbreak wave
We're home on the rolling deep
Where the scattered agents rave,
And ill winds, their revels keep!
Ill winds, ill winds, ill winds, enemy's here
(ill winds, ill winds, ill winds, enemy's here)

Verse 2

The end is no longer in view
The crowds have begun to frown
But with a stout vessel and crew
We'll weather the storm right down
And the song of our hearts shall be
While the wind and the waters rave
Urban health emergency...
A life on the outbreak wave!

Perspective on Environments and Epidemics

INTRODUCTION

Epidemiologists play an integral role in preparing for and responding to emergency disease threats for both humans and animals. Epidemics of novel zoonotic viruses, including recently emergent viruses, such as SARS CoV-2, Ebola, Nipah, Avian influenza, Japanese encephalitis and HIV, have been linked to human activities such as deforestation, agricultural expansion and intensification, urbanisation, hunting, travel, wildlife trade, and climate change.^{1,2} Pandemic and epidemic intelligence to better prepare the world for future threats requires competencies in: Early detection of disease threats; performance of risk assessments; policy development, adaptation and implementation; cross-sectoral coordination and incident command; and emergency risk communication.³⁻⁵ They must be prepared to coordinate, cooperate and collaborate with cross-sector partners and organisations when emergencies occur, regardless of the type, scale, or severity. In addition, some countries may choose to include training in specific types of preparedness and response for mass gatherings, humanitarian crises/natural disasters, or chemical, biological, radiological and nuclear threats.

Epidemic intelligence training involves having skilled practitioners mounting a timely response to outbreaks through field investigation and quickly implementing appropriate control measures. Training in this area serves as the cornerstone of cooperation in workforce development. The variations that exist across programmes are part of what defines the Field Epidemiology Training Programme (FETP). Facing different geopolitical and social challenges, many FETPs have been successful in fulfilling the need to build a functional programme in the most cost-efficient manner. The situation is far from static and FETPs are studying introduction of: (1) new training tracks to widen skills upgrading and career progression; (2) additional elements of global outbreak alert and public health response; and (3) a quality programme to add external

faculty and improve the in-house pool of trainers. This customisation of the regional and local experience is to be expected, but very few published articles are available.

SHORT HISTORY OF FETPS

The United States Centers for Disease Control and Prevention (CDC) conceived the Epidemic Intelligence Service (EIS) in 1951 as a way of creating a global workforce of competent field epidemiologists.⁶ In 1980, the first FETP was initiated in Thailand (preceded by the establishment of the Canadian Field Epidemiology Program in 1975). By the 1990s, FETPs were in Australia, Canada, Colombia, Egypt, Germany, Ghana, Indonesia, Mexico, Peru, the Philippines, Saudi Arabia, Spain, Thailand, Uganda, and Zimbabwe. Recognising the benefits of working together and with support from CDC, WHO, and the Merieux foundation, a network was formalised in 1997 as the Training Programs in Epidemiology and Public Health Interventions Network, or TEPHINET.⁷ In 2000, the Global Outbreak Alert and Response Network (GOARN) formed and three years later, One Health was introduced. Malaysia and Singapore joined the family of FETPs in 2002 and 2010, respectively. Following the establishment of TEPHINET came regional networks such as the African Field Epidemiology Network (AFENET) in 2005, Eastern Mediterranean Public Health Network (EMPHNET) in 2009, and the ASEAN+3 Field Epidemiology Training Network (FETN) in 2011. These regional networks are committed to strengthening FETPs with the aim of establishing and sustaining effective field epidemiology capacity in every country.

The past decade saw the 2014-2016 Ebola outbreak in West Africa and the 2015-2016 Zika outbreak in the Americas. TEPHINET supported the development of Frontline and Intermediate FETPs, and specialised learning and professional development for trainees, alumni, faculty and mentors. The onset of COVID-19 in late 2019 was a stark reminder of urgent needs for timely case detection and outbreak response to save lives. While the pandemic raged on, it was fortunate that the world already possessed a means of scaling up the trained field epidemiology workforce that had proven effective over the course of the last four decades. Today, over 80 FETPs train public health workers across more than 160 countries and territories. Collectively, member programmes have trained more than 18,000 'disease detectives' to serve as the boots on the ground in the fight for improved public health for all.⁷⁻⁹ As more

countries and regions adapt the professional training to meet their local needs and resources, the curriculum becomes different for each FETP.¹⁰

EIS TRAINING IN THE REGION

The Epidemic Intelligence Programme (EIP) of Malaysia was initiated to strengthen disease control following a Nipah encephalitis outbreak in early 1999. It is a unique, two-year, in-service, on-the-job training in field epidemiology consisting of 70 per cent field-based work and 30 per cent didactic lessons. The curriculum includes situational analysis, surveillance evaluation and outbreak management. The program is coordinated by the appointed Director of EIP Malaysia through the Disease Control Division of the Malaysia Ministry of Health. The goal of the training is to strengthen the practice of applied epidemiology for enhancing public health surveillance and outbreak investigation. Through coursework and active field assignments, the program hopes to produce graduates who will be able to: (1) conceptualise key epidemiological principles and methods; (2) develop competencies in surveillance and rapid response; and (3) conduct study projects that contribute directly to the enhancement of public health surveillance. EIP Malaysia has accomplished many important milestones, one of which is the formation of the 'EIP Gives Back Program' which is conducted by EIP alumni, district health officers and state epidemiologists. Graduates have been deployed to several countries like the Philippines and West Africa to assist with disease outbreak and disaster relief. Graduates also contribute their expertise to various fields both nationally and internationally.

The Singapore FETP is a training partnership of the Saw Swee Hock School of Public Health and the National Centre for Infectious Diseases hosting multisectoral tiered programmes for those interested in epidemic intelligence training. It has been recognised by the Singapore Ministry of Health as an important line of defence against emergent threats. Global-urban health security extends beyond human health to involve data sciences, genomics, environmental vectors, veterinary-wildlife epidemiology, food safety and security, and psychosocial resilience. In 2017-18, at the ASEAN+3 training network steering committee, Singapore cross-consulted with other member countries on novel training methods. Separately, at a WHO joint external evaluation of our IHR core capacities, the WHO team noted that Singapore's experience was valuable and should be shared with the wider global health workforce. The experts further recommended that this programme be expanded with a

re-design of human resources towards higher-level functioning even as innovations in technology are introduced. For sustainable workforce development beyond EIS officers, it has developed a bespoke training platform to address wider requirements by various Ministries, agencies and the hospitals.

Thailand's International FETP was expanded in 1998 to offer training for other Asian countries and in 2004, a memorandum of understanding for field epidemiology workforce development was signed to train veterinarians in the two-year FETP. These veterinary graduates are key persons in the Regional Field Epidemiology Training Program for Veterinarians (RFETPV) which operates under Thailand's Department of Livestock Development. In 2008, a two-month Training of Trainers course was established to fill the mentorship training gaps experienced by many FETPs in ASEAN and increase the number of competent field epidemiology mentors. After the first wave of the COVID-19 pandemic, Thailand's FETP reviewed the gaps and capacity of Thailand field epidemiologists to respond to the pandemic. There were five areas that needed strengthening and additional capacity: (1) Disease surveillance system set-up; (2) emerging infectious disease (EID) management; (3) risk assessment; (4) public health emergency management and law enforcement; and (5) risk communication and policy advocacy. The new EID track aims to build capacity of epidemiologists and enable graduates to apply epidemiology concepts for responding to large scale epidemics and global pandemics and manage EIDs.

MULTISECTORAL EPIDEMIC INTELLIGENCE

The EIS must comprise officers proficient in handling national surveillance programmes, event-based monitoring, field epidemiologic investigations, and epidemic response capabilities. Early disease detection relies on astute physicians and primary healthcare practitioners, an efficient national disease surveillance system, and close collaboration between the many agencies which have to work together. Communications are disseminated in a timely and accurate manner so that medical practitioners, stakeholders and the public can make informed decisions and participate in prevention and control. Often, public urgency and government reaction dictate the need for immediate control measures while an investigation is ongoing. Public health response measures include, among many actions, establishing a task force/outbreak response team, managing ill persons, sizing the extent and severity of illness, instituting epidemic control measures, and undertaking risk communications.

The need for proper One Health competencies in epidemiological investigation and outbreak response at the human-animal-environmental health interface is a system requirement recognised by the global public health community and international development partners. The WHO-FAO-WOAH-UNEP Quadripartite developed field epidemiology competencies in a One Health context for reference and use by countries and regions when planning and reviewing their One Health FETP. Operational tools are available for this kind of joint assessment to identify the risks posed at the human-animal-environment interface within a population and geographical area. Risk framing is typically completed and shared before the technical team starts its assessment. In risk characterisation, based on likelihood and impact estimates, considering the uncertainty level for each of the risk assessment questions, and given the situation and national context discussed, a qualitative technical interpretation of the overall risk assessment is provided.

UNDERSTANDING ENVIRONMENT DRIVERS

A cause of a disease is an event, condition, characteristic or a combination of these factors, which can include environment drivers. The battle against disease and disaster is one that requires constant vigilance. In ecological terms, modern lifestyles and urbanisation have resulted in an increasingly built environment with new dynamic interactions between niches that are natural with those that are man-made. This in turn leads to stressors causing health concerns peculiar to the highly urban physical and social environment. A new variable that may amplify disease transmission is psychosocial health. These events are indicative of an upset ecosystem that remains poorly understood and addressed, even as the community grapples with new realities.

Response proficiency enables the identification of factors contributing to unusual health events by integrating knowledge across human, animal and environmental health. An understanding of disease spread is essential, including pathogen life cycles, modes of transmission, and concepts of immunity—active, passive and herd. Key epidemiological terms such as cluster, outbreak, epidemic, pandemic and endemic, as well as veterinary parallels like epizootic and enzootic, are fundamental. Tools like the SIR model (Susceptible, Infected, Recovered/Removed) help in modelling disease dynamics.

Disease surveillance needs to be combined with data from other sectors beyond health. This is so as to facilitate timely assessments that guide decision-making and response in consideration of social and environmental determinants. Various sources and types of information are needed to assess exposure and contextual vulnerabilities as part of the risk assessment and for decision-makers to formulate the objectives, nature, scale, timing and types of response needed. No single surveillance system or information source is suitable for all purposes, as each one varies in terms of objectives, timeliness, sensitivity, representativeness and completeness. Consistent information about a public health event from multiple sources increases confidence that a signal is credible and requires further investigation.

CONCLUSION

The management of health emergencies is an exciting and challenging field. Officers must investigate an identified hazard and support the mitigation of specific associated risks, as well as provide a basis for management and communications decisions. Outbreak prevention and control requires national surveillance programmes, event-based and internet-based real-time surveillance, field epidemiologic investigations, epidemic response capabilities, travel health, and hospital control measures. Infection prevention and control with standard and transmission-based precautions must be observed when caring for patients who are, or are suspected to be, infected by an EID for which additional requirements are needed to prevent spread.

[Excerpts of this article first appeared in: National Centre of Infectious Diseases. Pandemic Health. *Infectious Disease Intelligence*.2022;1(2). https://www.nhghealth.com.sg/ncid/media-library/about-us/NCID-news_Q2_v10.pdf. Accessed July 22, 2026.]

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EPI-FORCE

URBAN HEALTH ADVENTURES



Enemies in Our Midst

EPI-FORCE

URBAN HEALTH ADVENTURES

Written by

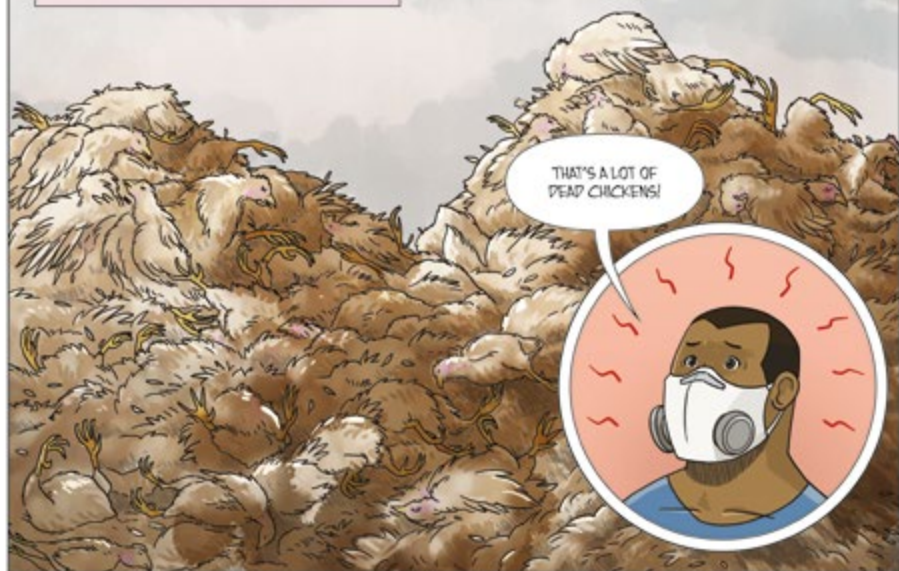
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Dr Gao Qi
A/Prof Steven Ooi
Sonny Liew**

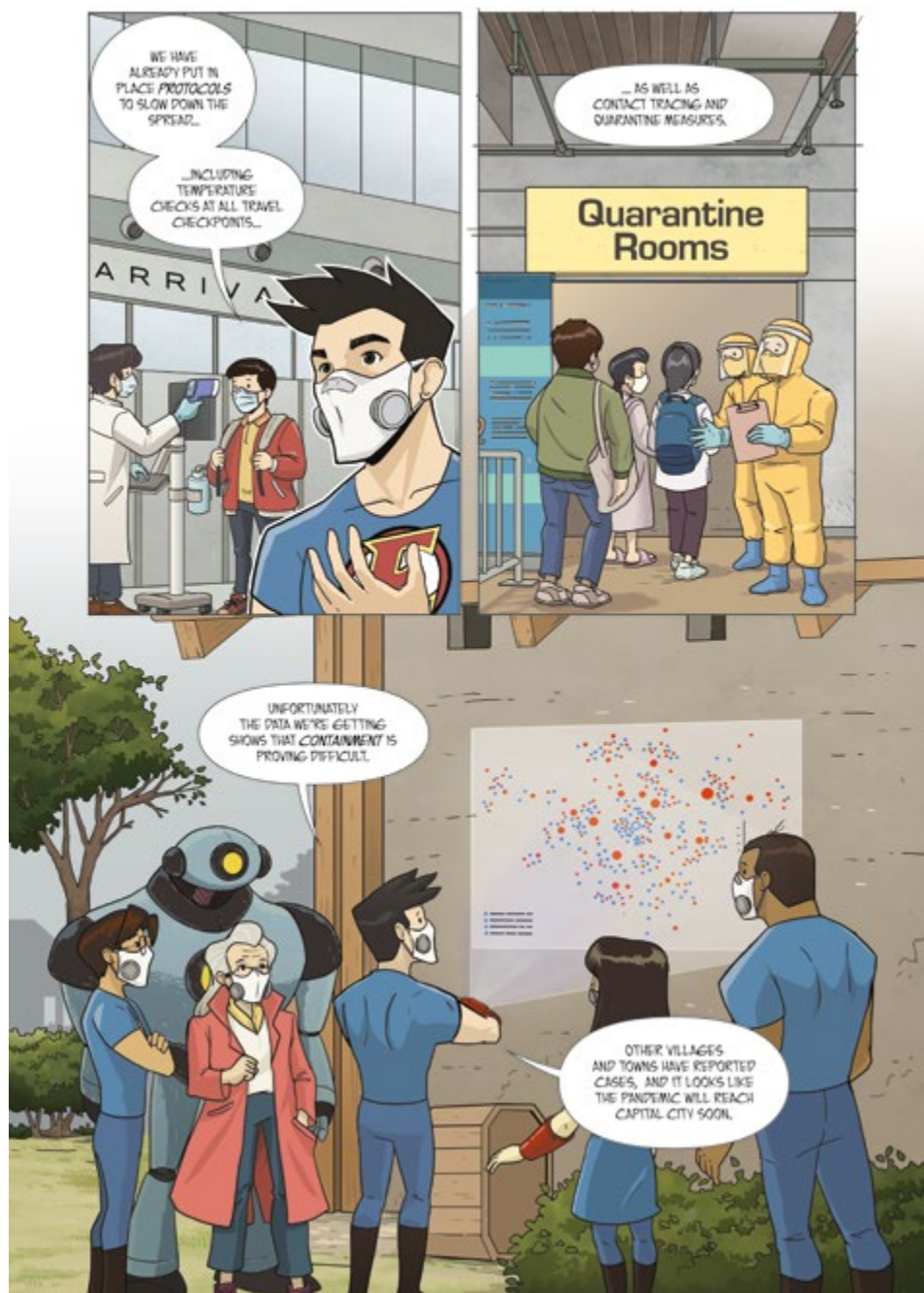
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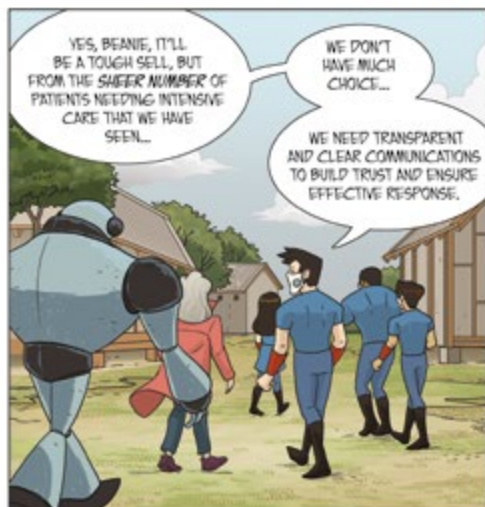
Nicholas Liem



AT IPO VILLAGE, OUTSKIRTS OF CAPITAL CITY.











THE TEAM ARRIVES AT CAPITAL CITY...



...FOR A SESSION WITH CITY GOVERNMENT OFFICIALS.

HI DIRECTOR EVE,
APOLOGIES FOR THE
QUARANTINE
MEASURES.

EVEN THE
CIRCUMSTANCES,
AN IN-PERSON MEETING
SEEMED UNWISE.

PROF MAX,
MY FRIEND, NO
WORKS.

I'M VERY GLAD
YOU ARE HERE...

I HAVEN'T BEEN
ABLE TO PERSUADE
COUNCILLOR CHRY TO
IMPOSE LOCKDOWN
MEASURES...

PERHAPS
YOU WILL BE MORE
CONVINCING!

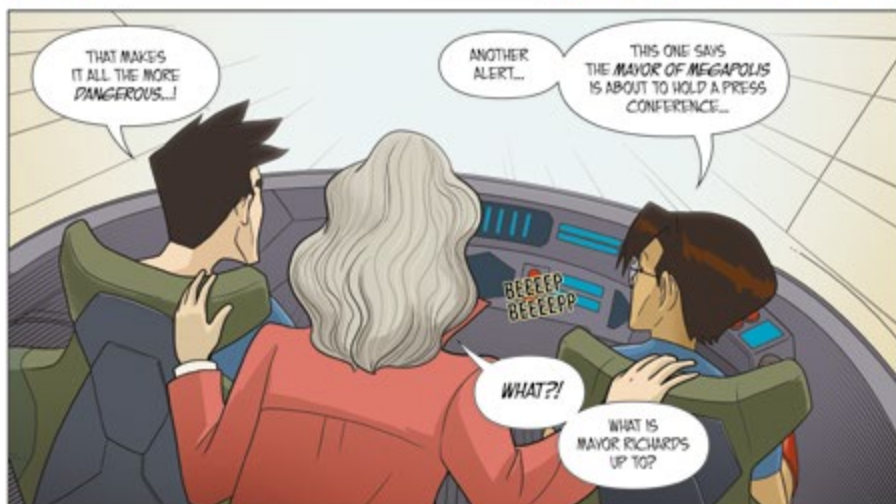
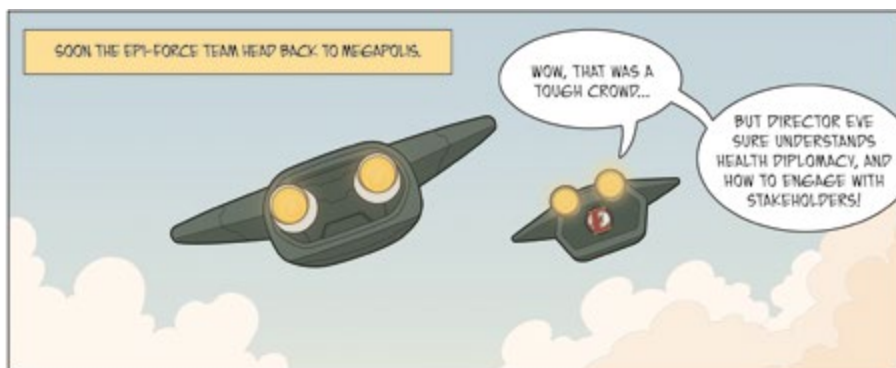
DIRECTOR EVE,
PROF MAX HERE
TELLS ME URGENT
ACTION IS NEEDED...

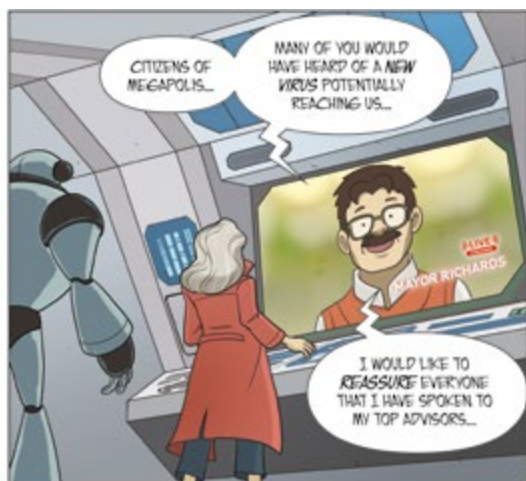
BUT I REMAIN
UNCERTAIN ABOUT
THE COSTS AND
TRADE-OFFS
INVOLVED!











Field Notes

**Outbreak epidemiologic sciences based on
the graphic novel, Enemies in Our Midst**

Against environmental drivers, epidemic intelligence gathering involves a number of scientific and practical skillsets which are stackable like Lego in any configuration that makes most sense for responding to infectious disease...

Enemies in Our Midst
Prevention of Zoonosis Spillover
Business Continuity Planning
Evaluating Surveillance Systems
Epidemiologic Investigation
Ecosystems Thinking
Engaging with Stakeholders
Balancing Trade-offs
Influencing Policymakers
Infodemic Management

ENEMIES IN OUR MIDST (Refer to graphic novel pp.237-239)

Brace ourselves, EPI-FORCE, for enemies are in our midst. We're diving into the chaotic world of health emergencies that are not-so-polite—they just saunter over international borders without a care in the world. Say hello to the health issues that don't care for national boundaries—they're the ultimate party crashers. Emergent infectious disease threats include HIV-AIDS, TB, vector-borne diseases such as Dengue and Malaria, and diarrhoeal illnesses.

To meet these challenges, initiatives are needed to deal with the health of populations in a global context that transcends the perspectives and concerns of individuals. Why do we need these global health initiatives, you ask? It's simple: Epidemics. These pesky global troublemakers have a habit of causing a ruckus, and nobody wants an uninvited crisis at their global shindig.

Then there's the aggravating issue of environmental degradation. For example, respiratory infections are compounded by transboundary pollution from forest fires turning our atmosphere into a smoke haze. It's like the Earth is hosting its very own BBQ party, with the fire started by us, but nobody appreciates it. Thanks to the information revolution, people expect the authorities to be on top of every concern. It's like we're all playing a giant game of 'Spot the Problem' and tagging the authorities on social media when we find one.

Health emergencies are like a giant potluck where everyone brings their unique dish—we're talking medicine, sociology, economics, and even some political science seasoning. The head chef in this culinary chaos is none other than WHO, the master of ceremonies for all things global health. And don't forget the supporting actors like UNEP, FAO, WOA, and the World Bank. It's a real star-studded cast!

So, folks, when you hear of health emergencies, just remember it's the super-hero squad battling enemies in our midst that refuse to stick to the script. They're here to ensure everyone, no matter where they are on the globe, gets a fair shot at success, good health and happiness.

PREVENTION OF ZONOSIS SPILLOVER (Refer to graphic novel p.239)

A “zoonosis” is an illness that jumps from animals to humans. “Spillover” is the actual leap across species. Most microbes can't do this—your dog's cold

doesn't usually become your cold—but occasionally a virus or bacterium hits the evolutionary jackpot and adapts to a new host.

Imagine something more exotic. You're at a crowded animal nightclub somewhere deep in a rainforest. Bats are hanging from the ceiling, monkeys are sharing snacks, mosquitoes are buzzing around like overcaffeinated D.J.s—and humans suddenly walk in with chainsaws, livestock, and selfie sticks. That awkward moment when a virus says, "Huh... maybe I could try infecting *that* species instead," is basically the beginning of zoonotic spillover.

This term zoonotic spillover sounds like something out of a science fiction flick, doesn't it? In a world where viruses can jump species from animals to humans, cue dramatic music! But here's the kicker: 60-75% of all human infectious diseases originate from animals. That's right, folks, the animal kingdom is just handing us diseases like party favours at a birthday bash. Some famous examples include COVID-19, Ebola virus disease, Avian influenza and rabies. The bugs say, "Here, have some Ebola!" and "Enjoy your Lyme disease!"

What's the big deal with this spillover thing? It sounds like the plot of a terrible sitcom. Picture this: a bunch of viruses hanging out in a bar, one says, "Oops, I spilled over into humans again! My bad!" Maybe it's because they've seen our Netflix habits and want to be a part of the binge-watching experience. But bad jokes aside, it's actually crucial stuff.

A classic way to picture it is this: Every species is a locked house. Most pathogens don't have the key. Spillover happens when one accidentally picks the lock. What makes zoonotic spillover especially fascinating is that it sits at the crossroads of virology, ecology, evolutionary biology, One Health and even human behaviour.

Scientists study spillover because they must predict which tiny biological 'tourists' might cross borders next. The recipe often involves close contact between humans and wildlife, environmental disruption like deforestation, crowded farming conditions, and lots of opportunities for germs to experiment.

We need to figure out why these viruses are treating us like their personal petri dishes for the next pandemic. In other words: Pandemics don't begin in a laboratory beaker labelled 'Doom.' They often begin with ordinary interactions between animals, humans, and changing ecosystems.

So, in the end, One Health is all about understanding this virus party crasher situation and making sure the animals and plants behave themselves. It's like being the ultimate party host, but instead of managing rowdy guests, you're managing microscopic troublemakers.

BUSINESS CONTINUITY PLANNING (Refer to graphic novel p.240)

Emergent infectious threats require business continuity planning, including temperatures checks and contact tracing. Microbes, the party crashers of the health world, always show up uninvited. Picture this: They're the life of the infectious disease party, creating a ruckus we didn't see coming—it's like they learned some new dance moves and decided to show off.

During an outbreak, companies face all kinds of challenges all at once. Employees may become sick, offices may close, travel may stop, and supply chains can break down unexpectedly. Without a plan, the situation can quickly turn chaotic. With business continuity planning, however, the organisation already knows what to do. It is like having a calm operations chief in the middle of flashing warning lights saying, "Relax. We rehearsed this."

One major component of the plan involves preparing employees to work remotely. Instead of operations stopping completely, teams can continue working from home with laptops, online systems and virtual meetings. A good continuity plan ensures employees can still access important files, communicate with one another, and continue serving customers without everything collapsing into video-call confusion.

Another important component is having backup options ready. If one supplier suddenly becomes unavailable, the business already has alternatives lined up. It is similar to discovering your favourite pizza place is closed but already knowing three other places that can deliver. This reduces delays and helps the company continue operating even when normal systems are disrupted.

Companies need clear policies about health measures, sick leave, remote work and workplace safety. Good planning helps organisations protect their teams while maintaining essential operations. It establishes clear communication channels so everyone knows where updates come from, what actions to take, and what changes are happening. This helps reduce uncertainty during panic situations.

Ultimately, business continuity planning is about being prepared enough to keep critical operations running, protect people, and reduce chaos when unexpected disruptions occur—something you hope you never need, but are incredibly grateful for when disaster strikes.

EVALUATING SURVEILLANCE SYSTEMS (Refer to graphic novel p.240)

Surveillance systems evaluate if containment works, but how do we evaluate surveillance to see whether it's doing the intended job? We need systems that can run like clockwork and sound the alarm at the right time, just like alarm clocks that get us up regularly in the morning!

Based on time-tested evaluation criteria, good surveillance systems must be...

- **Simple:** Think of surveillance like a recipe—it should be as easy to follow as making a peanut butter sandwich. If it gets too complicated, you might end up with a surveillance soufflé that no one understands!
- **Timely:** Surveillance data should be faster than a pizza delivery. If you have to wait too long, the outbreak might be over, and you'll just have a cold, soggy problem on your hands.
- **Acceptable:** Surveillance should be as popular as a cat video on the internet. If people and organisations aren't willing to participate, it's like throwing a party that no one shows up to—a real snoozefest!
- **Representative:** Imagine if your survey only covered people in one city—you'd be missing out on the big picture. Surveillance needs to be like a buffet, with a little taste of everything to truly represent what's going on.
- **Sensitive:** Surveillance should have a nose for trouble, like a sniffer dog at an airport. If it can't detect the health problems it's meant to, it's as useful as a chocolate teapot!
- **Predictive Value Positive:** You want surveillance to be more like a skilled detective, not a false alarm at a fire station. If it raises the alarm, there better be a real fire to put out.
- **Adaptable:** Think of surveillance like a superhero costume—it needs to fit any situation. If it can't adapt, it's like a superhero stuck in spandex at a formal dinner.
- **Data Quality:** Surveillance data should be as complete and valid as your grandmother's secret cookie recipe. Missing ingredients just won't cut it!

- **Stable:** Surveillance needs to be as reliable as your grandma's old rocking chair, always there when you need it, and not falling apart when things get busy.

So, in a nutshell, surveillance should be simple as pie, timely as a fast-food order, acceptable like a viral meme, representative of all aspects, sensitive like a keen detective, predict the real problems, adapt to changing scenarios, have high data quality, and be as stable as grandma's rocking chair. And if surveillance was a superhero, it would be known as the 'Vigilant Avenger'!

EPIDEMIOLOGIC INVESTIGATION (Refer to graphic novel p.241)

In EPI-FORCE investigations to get on top of what's happening, epidemiologists don their journalistic hats aiming to answer critical questions of "who, where, when, why, how, and what now", just like reporters covering a breaking news story. But instead of juicy headlines, they're chasing down a health crisis.

Remember, this sleuth-like approach might involve some plot twists and side-tracks, but it's all part of the thrilling journey to tackle outbreaks head-on. Here's the playbook—a guide to unravelling outbreaks:

1. **Case Clues:** Verify the diagnosis and confirm the outbreak's existence, like a journalist checking the facts.
2. **Define the Drama:** The epidemiologists craft a working case definition (the 'what' of the story) to know exactly what they're dealing with.
3. **Hot on the Trail:** Count cases and gather essential information to compare—a bit like journalists tracking down leads.
4. **Location, Location:** Describe the outbreak's whereabouts, creating an epi curve and spot map of events.
5. **Whodunit Theories:** Develop and refine hypotheses (the 'how' and 'why' of the story)—like reporters chasing clues in a mystery novel.
6. **Connect the Dots:** Piece together the findings, making sense of the outbreak's storyline.
7. **Operation Control:** Roll out measures to put a stop to the outbreak—it's the 'what now' in epidemiologists' quest to save the day.
8. **Spill the Beans:** Share the findings with the world, revealing the scoop.

While the order might shift depending on the outbreak, this investigative process ensures they don't miss a beat. Epidemiologists are EPI-FORCE detectives piecing together outbreaks one clue at a time, safeguarding communities from emergent health threats.

ECOSYSTEMS THINKING (Refer to graphic novel pp.242-243)

You can find them in the air, on food, in plants and animals, in the soil, in the water, and on just about every other surface—including your own body. Most microbes will not harm you. However, some microbes do.

Pandemic ecosystems thinking begins the moment you realise a virus does not care about organisational charts, national borders, or your beautifully colour-coded contingency plan. What starts as 'a health issue' quickly turns into a sprawling ecosystem of hospitals, supply chains, public trust, politics, human behaviour, misinformation, vaccine logistics, remote work, and suddenly everyone is making sourdough bread.

Epidemiologists model transmission rates while economists predict recessions, teachers reinvent classrooms, and your uncle forwards a message claiming garlic water can solve everything. The known knowns include things like "viruses spread"; the known unknowns are "how fast?" and "how severe?"; and the unknown unknowns are discovering halfway through the crisis that toilet paper has somehow become a financial instrument.

Throughout all this, what's the best way to stay disease-free? Prevent infections from happening in the first place! You can prevent infection through eight simple tactics:

- Wash your hands often, especially after being outside or going to the bathroom.
- Cover your mouth and nose with a tissue when you sneeze or cough.
- If you blow your nose, throw the tissues away into a proper receptacle immediately.
- Avoid touching your eyes, nose or mouth.
- Avoid large public gatherings wherever possible.
- Avoid close contact with people who are sick with the flu.
- Stay at home when you are sick; rest, take medicine, and drink plenty of fluids.
- Stay informed of any infectious disease developments!

The humbling part of ecosystems thinking is watching every attempted solution produce side effects like a game of global *Whack-A-Mole*. Close borders, and supply chains panic. Open too early, and hospitals panic. Tell people not to panic, and naturally everyone panic-buys canned food like civilisation as we know it will soon end.

Leaders ask for certainty from scientists whose entire profession revolves around updating conclusions when new evidence appears, which is a bit like demanding GPS directions while the roads are still being built. In the end, managing a pandemic ecosystem means accepting that uncertainty is not a temporary bug in the system—it is the system.

ENGAGING WITH STAKEHOLDERS (Refer to graphic novel p.244)

Stakeholders can show up expectedly or unexpectedly at your party. They can be anyone from government officials and healthcare pros to everyday folks, researchers, and even your neighbour's cat. Seriously, that cat might have an interest in your party; you never know! These stakeholders have a stake in the game, and their involvement can make or break your health initiatives.

Stakeholder engagement is a good thing and here is why...

1. **Diverse Perspectives:** It's like having a superhero team with a scientist, a chef, a grandma and a politician. Their diverse backgrounds help you understand the problem from all angles, making your decisions as informed as a fortune teller with a crystal ball.
2. **Resource Mobilisation:** Think of this as a fundraising telethon, but instead of asking for money, you're asking for resources. Benefactors might throw support at you, while community groups offer their time and talents. It's like Robin Hood, but with healthier intentions.
3. **Improved Expertise and Buy-In:** You've got a bunch of concerned citizens in the room, each with their own superpower. By including them, you can tap into their wisdom to develop strategies that are as evidence-based as a Sherlock Holmes novel. If your stakeholders are in on the planning, they're also more likely to be your biggest cheerleaders.
4. **Tailored Solutions:** Imagine creating a menu for a restaurant—the more you know about your customers, the better you can cater to their tastes. Here, it's about crafting interventions that can match the stakeholders.

5. **Enhanced Accountability:** Some stakeholders can also act as referees at the game. They keep everyone in check, making sure your game is played fairly and honestly.

Let's look at some simple steps we can take to get stakeholders on board:

Identify and Map Stakeholders: It's like creating a treasure map but with people. Find out who's who, what they care about, and how much influence they have.

Open Communication Channels: Don't keep your party a secret! Host regular meetings, webinars and workshops, and create online forums to keep everyone in the loop.

Listen Actively: Be the best listener in the room—stakeholders have valuable insights that can turn your public health project into a blockbuster hit.

Collaborate and Build Partnerships: It's like a superhero team-up—combining powers makes you stronger. Collaborate with stakeholders for more effective and sustainable results.

Be Transparent: Keep everyone informed about your progress and share your results. Transparency builds trust faster than a see-through raincoat.

Empower Communities: Encourage people to take charge of their own health. Teach them how to be their own health heroes—it's like giving them their own capes.

Evaluate and Adapt: Keep your detective hat on and analyse how well your stakeholder engagement is working. Listen to feedback and make improvements for the next health adventure.

In the grand finale, remember that stakeholder engagement isn't just a task; it's the secret sauce that turns your health plan from meh to marvellous. So, embrace your inner party planner, invite everyone to the public health soiree, and get ready for a health revolution that's more thrilling than a rollercoaster ride!

Infectious diseases control is basically society trying to negotiate with microbes that have absolutely no interest in compromise. Every outbreak forces health officials into a giant balancing act with trade-offs. Close borders too early, and people complain you're destroying tourism and the economy. Close them too late, and suddenly everyone becomes an amateur epidemiologist asking why nobody acted sooner. It's the only job where you're criticised both for overreacting and underreacting—often by the same person, in the same week.

Take quarantine policies. EPI-FORCE says, "We need people to stay home for a bit to slow transmission." The public hears, "So you're telling me sourdough bread is now my entire personality." Meanwhile, economists worry about businesses, parents worry about childcare, students worry about exams, and somewhere an introvert quietly whispers, "Honestly... this part isn't terrible."

Then there's masking. From a scientific perspective, it's a straightforward risk-reduction tool. From a social perspective, it somehow becomes a referendum on freedom, identity, and whether breathing through fabric counts as oppression. Infectious diseases don't care about politics, but they certainly appreciate how much politics helps them travel.

Vaccination campaigns are another masterclass in trade-offs. Vaccinate quickly, and people worry about safety. Move slowly, and people worry about the outbreak spreading. Health experts spend years studying immunology only to end up debating someone whose main research credential is 'watched two videos while eating cereal.'

And infectious diseases are uniquely rude because success is invisible. If containment works, people say the threat was exaggerated. If containment fails, people ask why authorities weren't better prepared. It's like deploying umbrellas perfectly before a storm and then being mocked because everyone stayed dry.

The hardest part is that microbes move faster than public consensus. Viruses don't wait for committee meetings, opinion polls or comment sections to calm down. While society debates the wording of advisories, the pathogen is already boarding its next flight.

Effective disease control ultimately means accepting some uncomfortable trade-offs. Every intervention has a cost. Every delay has a cost. And no matter how carefully experts explain relative risk, someone will still say, “Actually, I heard garlic water kills viruses instantly.” The microbes, meanwhile, are thrilled with the confusion.

INFLUENCING POLICYMAKERS (Refer to graphic novel p.246)

Public health policy is basically the world’s most complicated group project, except nobody agreed on the rubric and half the class thinks wearing gloves is a conspiracy invented by Big Elastic Inc. Wanted to reduce smoking? Great—now you’re accused of ruining backyard barbecues and making cigarettes cost more than concert tickets. Wanted to ban supersized sodas? Suddenly people act like epidemiologists have personally kicked down their door and confiscated grandma’s sweet tea recipe.

Health officials spend their days playing a game called ‘Pick Which Angry Email You Want Today.’ If they close schools during an outbreak, people complain kids are falling behind. If they keep schools open, people complain kids are falling over. If they recommend outdoor exercise continues, someone says it’s ableist bias. If they don’t, someone else says society has surrendered to couches.

And then there’s the eternal balancing act between individual freedom and collective safety. The cruel irony is that when public health works perfectly, nothing happens—and then everyone asks why we spent money on it. It’s like hiring firefighters and then getting mad there weren’t enough fires to justify the fire department. “Wow, the bridge *didn’t* collapse. Waste of infrastructure spending.”

Meanwhile, politicians want simple answers from scientists whose entire profession revolves around saying, “Well, it depends.” Health experts speak in cautious probabilities; policymakers want weather forecasts delivered with the confidence of a sports commentator. Epidemiologists will say, “This intervention reduces risk by 20%,” while the public hears either: “We are all doomed,” or “So you’re saying there’s only a small chance.” Even statistics become emotional.

At its heart, influencing policymakers is about accepting that there is no magical solution with zero downside. Every policy is a weird seesaw involving economics, behaviour, ethics, politics, and whether people will actually listen to instructions that begin with “for your own good.” Which, historically, they absolutely will not.

Take heart, have fortitude! In the world of public health policy, EPI-FORCE is the one making sure everyone stays safe, all while having some fun along the way. It's like being a detective, explorer and superhero all rolled into one!

INFODEMIC MANAGEMENT (Refer to graphic novel pp.247-248)

An infodemic is the chaotic flood of misinformation, disinformation, half-truths, conspiracy theories, miracle cures and stories that explode during a crisis. EPI-FORCE can spend days scrolling through social media, news sites, forums and comment sections. Infodemic management is basically what happens when health professionals realise they're not just fighting a virus—they're also fighting your uncle's forwarded WhatsApp messages.

So how do health heroes handle it? They've to track rumours, myths and conspiracy theories before they spread faster than a cat meme. When misinformation pops up, teams move like firefighters—except instead of hoses, they use evidence, official statements and scientifically accurate Instagram posts. Infodemic management also involves teaching people how to spot suspicious information. The aim is to help everyone become part-time detectives and full-time sceptics.

Technology helps identify misinformation quickly. Algorithms flag fake news, fact-checking tools verify claims, and chatbots provide accurate answers 24/7. But risk communication is a delicate art. Too much jargon? People tune out. Too little detail? People panic. The goal is to explain serious issues clearly, calmly and honestly—basically translating ‘epidemiological uncertainty’ into “Here's what we know, here's what we don't, and please stop drinking bleach.”

People are more likely to trust information when they feel heard. That's why health experts engage directly with communities, answer questions, and address fears with empathy. Because yelling “Read the press release!” at people has surprisingly low success rates.

At the end of the day, infodemic management is like trying to clean up a glitter explosion during a hurricane—exhausting, messy and somehow never fully over. But it's also a story of teamwork, resilience and people working together to protect our populations from the world's most contagious condition (bad information shared with absolute confidence). Keep calm and hero on!



Operation Fortitude

**A workshop sampler on
Epidemic Intelligence Gathering**

Outbreak Epidemiologic Methods

SAMPLE STORYBOARD TO SET THE STAGE FOR THE WORKSHOP

Life on the Outbreak Wave...

This is an interactive public healthcare workshop introducing participants to the principles and practice of urban field epidemiology, and the role of environmental drivers in disease emergence and spread. Through a scenario-based storyboard, participants investigate a zoonotic disease that originated from wild birds and developed the ability for human-to-human spread. Exercising fortitude, they learn about the prevention of zoonosis spillover, business continuity planning, the evaluation of surveillance systems, epidemiologic investigation, ecosystems thinking, engaging with stakeholders, balancing trade-offs, influencing policymakers, and infodemic management.

Life can feel choppy riding on the outbreak wave. This workshop emphasises early warning systems, epidemic intelligence, multisectoral collaboration, and evidence-based decision-making. Interactive exercises include rapid assessments, outbreak mapping, and emergency coordination briefings. By the end of the workshop, participants will better understand how environmental change influences epidemics and how epidemic intelligence supports effective public health response.

- Fun theme: Project Padawan - Enemies in Our Midst!
- Coverage: Outbreak Determinants, Epidemic and Pandemic Preparedness, Business Continuity
- Your hosts: S.W.E.A.T. (Stressful Work Environment Attenuation Taskforce) Laboratories, with Doc Vader, Debby Mok, TBBT academics, and more
- Storyboard: *Operation Fortitude* progresses with *SARSWARS the Reality Show*, and *Life on the Outbreak Wave*
- Finale: *Quest for a Healing Environment*

Epidemic Intelligence Gathering

Workshop Day 1	
Operation Fortitude: Environments and Epidemics	
09:00–09:30	Day's Overview Welcome and Curriculum
09:30–11:00	Field Epidemiology @ Work Epidemics from our Biosphere By the end of this session, participants should be able to: • Describe survivor ecology and how our biosphere began • Explain the Darwinian expansion of biodiversity • Identify spheres of influence and threats to health
11:00–13:00	Emerging Disease Master Class Outbreak Epidemiology Assessment Tools By the end of this session, participants should be able to: • Describe the threats from pandemics and the environment • Explain the use of epidemiology tools to combat threats • Outline steps in preparedness planning
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Prevention of Zoonosis Spillover: Changing landscapes in epidemics and public health emergencies of international concern Part 1 of Project: Your Project Skit

Workshop Day 2	
Operation Fortitude: Environments and Epidemics	
09:00–09:30	Day's Overview One Health All-Hazards Framework
09:30–11:00	Field Epidemiology @ Work Eco-Epidemiology Challenge By the end of this session, participants should be able to: • Describe the public health challenges in eco-epidemiology • Explain viral, bacterial and other infections • Apply risk analysis and communications
11:00–13:00	Emerging Disease Master Class Global Environmental Health Trends By the end of this session, participants should be able to: • Describe the environment as a determinant of health • Explain climate change and planetary health issues • Outline the scope of environmental health practice
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Business Continuity Planning: Use of data science for surveillance, exposure risk analysis, disease intelligence, and communications Part 2 of Project: Visit to a City Gallery

Workshop Day 3	
Operation Fortitude: Environments and Epidemics	
09:00–09:30	Day's Overview Outbreak Determinants: Technosphere vs Biosphere
09:30–11:00	Field Epidemiology @ Work Vermin-Vectors and Zoonoses By the end of this session, participants should be able to: • Describe the vermin-vectors in our backyard • Explain One Health and vector-borne disease outbreaks • Outline our problem with zoonoses
11:00–13:00	Emerging Disease Master Class Managing Emergent Environmental Threats By the end of this session, participants should be able to: • Describe the issues in sick buildings and public places • Explain threats from city fomites and indoor air • Outline our problem of co-existing with pests
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Ecosystems Thinking: Wildlife concerns and field epidemiology practice in outbreak alerts and response Part 3 of Project: Epidemic Intelligence Exercise

Workshop Day 4	
Operation Fortitude: Environments and Epidemics	
09:00–09:30	Day's Overview Preserving Health and Business Continuity
09:30–11:00	Field Epidemiology @ Work Food Safety and Health Security By the end of this session, participants should be able to: • Describe food and water as vehicles of exposure • Explain how microbial agents get into food and multiply • Apply the golden rules for food safety and security
11:00–13:00	Emerging Disease Master Class Epidemic Intelligence Management By the end of this session, participants should be able to: • Describe the agent risks as determinant of health • Explain health protection and social contact networks • Identify the steps in policy, administration and communications
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Engaging with Stakeholders: Use of data science for surveillance, exposure risk analysis, disease intelligence, and communications Part 4 of Project: EPI-FORCE Prologue

Workshop Day 5	
Operation Fortitude: Environments and Epidemics	
09:00–09:30	Day's Overview Environmental Biopsychosocial Supports
09:30–11:00	Field Epidemiology @ Work Communicable Diseases Control By the end of this session, participants should be able to: • Describe disease investigation, prevention and control • Explain the host lifestyle as a determinant of health • Apply interventions against emerging threats
11:00–13:00	Emerging Disease Master Class Quest for a Healing Environment By the end of this session, participants should be able to: • Describe the case for a healing environment • Explain the role of stressors as the cause of illness • Outline how we can create a healing environment
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Infodemic Management: Perspectives on epidemic intelligence in scenario role-plays by course participants as experts and stakeholders Part 5 of Project: Survivors Morphing Heroes

Operation Fortitude: Self-Reflection for Trainees

Think about something you face that will demand courage—whether a lot or a little. What are you afraid of? *Fortitude* is the remedy for a specific type of fear that is familiar to all of us—the fear of doing what is right. Fortitude is not just a virtue that we practice in the more dramatic moments of life. It is the capacity to persevere in ‘doing the right thing’ when it would be much easier not to.

Fortitude Reflection and Sharing

As you progress in your learning journey, this section may be used for personal reflection and for group sharing of views. In a personal reflection, what stirs your heart? Remain with it for a while. You may reflect on one or more of the following questions according to your context. In a group context, allow enough time to reflect in a safe space and for everyone to respond.

Questions on Fortitude

- i. What do you mean by fortitude, and how do you cultivate it in your own professional life?
- ii. Can fortitude be learned, or is it an innate trait that some people possess naturally?
- iii. In what ways does adversity contribute to the development of fortitude?
- iv. How do societal expectations and cultural norms influence our understanding and practice of fortitude?
- v. Is there a difference between physical and moral fortitude? How do they intersect or diverge?
- vi. Can fortitude sometimes be misguided or misapplied? If so, what are the potential consequences?
- vii. What role does fear play in the cultivation of fortitude, and how can it be overcome or managed?
- viii. Can fortitude be a form of resistance against oppression or injustice? How does it manifest in such contexts?

- ix. Reflect on a time in your life when you demonstrated fortitude. What did you learn from that experience?
- x. In what ways does practicing fortitude contribute to personal well-being and fulfilment?

Suggestions for Reflection

Four cardinal virtues form the basis of ethics first described by Plato (427-348 BC) and elaborated by Aristotle (384-322 BC). They are:

1. **Prudence:** Practical wisdom and right judgement; the virtue that disposes the practical reason to discern in every circumstance our true good and the right means for achieving it.
2. **Justice:** Righteousness and fairness; the virtue that consists in the firm and constant will to respect the rights of each and give to others their due.
3. **Fortitude:** Courage and steadfastness; the virtue that ensures firmness in difficulties to overcome obstacles and constancy in the pursuit of the good.
4. **Temperance:** Self-control and healthy-minded sobriety; the virtue that moderates the attraction of the pleasures of the senses and provides balance in the use of created goods.

Cardinal virtues are a habitual and firm disposition for one to do good and become the best version of oneself to attain happiness and well-being. They grow through education, deliberate acts and perseverance in struggle, and enables our experience of ease, self-mastery and joy.

Fortitude is the virtue that ensures firmness in difficulties and constancy in the pursuit of the good. It strengthens the resolve to overcome obstacles in the moral life. It disposes one even to sacrifice in defence of a just cause. The virtue of fortitude enables one to conquer fear, even fear of death, and to face trials and persecutions.

Most of us do not have to face any real danger on a daily basis. But there are still ample opportunities for acts of courage and fortitude. Even simple acts may require a small amount of fortitude for most of us.

Perhaps the most obvious opportunity for fortitude is present when we witness the moral and social inequities around us. Livelihoods are teetering

precariously; violence plagues our society; children are being sexualised; the family unit is crumbling; and the list goes on. While doing public health work, we see how vested interests can attack that which is good, beautiful and true, while increasingly criminalising dissent in the name of tolerance.

Now, more than ever, fortitude is needed among us. Far from being afraid, we need to be courageous in the face of these moral assaults. We are called to stand firm and recognise that, no matter how bad things may seem, there is good in this world, and it is worth fighting for.

Fortitude is the ability to choose what is right even when everything inside of us and outside of us is telling us to run away in fear. It is the ability to stand firm and pursue good in the face of danger and potential suffering.

How to Keep Calm and Hero On

UNFORTUNATELY
THE DATA WE'RE GETTING
SHOWS THAT *CONTAINMENT* IS
PROVING DIFFICULT.



Field Manual for Heroes Without Capes

Workshop Musings

Here, we pay tribute to the legends of DC Comics by gleaning lessons from simple observational epidemiology! A survivor's ten light-hearted, do-it-yourself steps for the wannabe hero, using pointers from the world of comic books...

- #1 Identify your powers
- #2 Know your origin story
- #3 Build your reputation
- #4 Protect yourself with a persona
- #5 Find a place to recharge
- #6 Invest wisely, in yourself
- #7 Fight for a worthy cause
- #8 Consider forming a league
- #9 Join an epic project
- #10 Impart your insights

Plus: The Paradoxical Commandments!

Can we self
transform from
super zero to
action hero?

Step #1

Identify your powers



Are you sitting around in your underwear all day, feeling bored? Were you ever bullied by your boss or perhaps one of your overbearing friends? Have you been smacked before by someone who was smaller than you?

If you answered "Yes" to any of the above, perhaps you need to start on transformation. You see, action heroes are made, not born. Even those with super powers had to start somewhere. That's where this guide comes in handy. Courtesy of Batman, we have a primer on what it takes to help you keep up with the (Indiana) Joneses!

Here are today's lessons from the Batsy files:

1. From your many strengths, identify some powers of yours that you can call on readily (a smile, word of encouragement, helping hand, force field, telepathy)...
2. To add a real-life *yin-yang* twist, consider that your power, if not used properly, can also be your curse...
3. At the same time, know your weaknesses. For example, Superman, kryptonite; for many others, chocolate...

Want to know how Evil thinks? Like the action heroes, knowing your power is just as important for professional super-villainy. But it isn't just all fun and torture. For insider information on evil, Batman shares from a certain Joker's scientific writings in the *Journal of the Epidemiological Society of Super Villains* (yes, Batman subscribes to keep up to date with villainy).

And the Joker says... "If my minion says, "I am but one man—what can only one man possibly do?," I'll reply "This!" and kill him. This action is to remind my minions that one person's action does make a difference. It is also to remind myself that such behaviour can often be counterproductive." [Joker *et al*, *Journal of the Epidemiological Society of Super Villains*, 2026;6(2):325-329]

There you have it. You're on your way to being an action hero! But how to tell if you cannot make it?

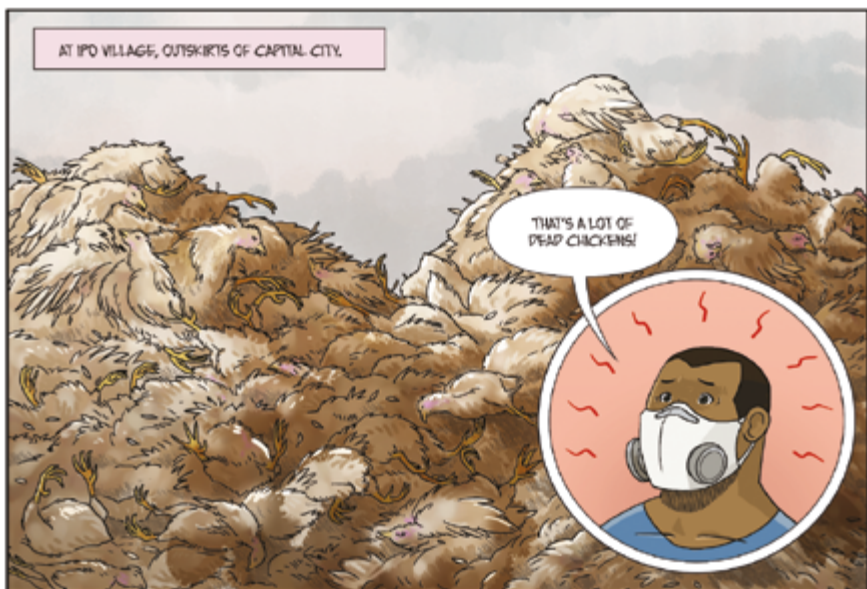


Early Action Hero Fail Signs

Your force field seems to repel only attractive members of the opposite sex, and telepathy keeps hearing what they think about you!

Step #2

Know your origin story



Everyone knows how Bruce Wayne came to be the Batman, caped crusader against crime. Do you recall your own origins—the moment you first decided to help humanity? Would people be inspired by your origins story to make a difference?

Here are today's lessons from the Batsy files:

- If you are successful as a hero, your origins story will be the stuff of legend for generations to come...
- Think hard. How did you get here? An experiment that backfired? Mother fell into a vat of radioactive waste while pregnant? Think harder...
- Research your original back story thoroughly—you need to outdo other wannabe hero types to come up with a captivating spiel...

Once you get your origins right, the truth will sustain you for years. It is a valuable story that could even land you on a tidy sum of money—just look at the Marvel blockbusters and think slick merchandising. This money would then help fund your daily operational hero costs, which can get pretty high on repairs. But be really careful in your hero pursuits not to be distracted by all the money, which is typically what Evil is after.

And the Jokerster says... “While amassing power, people generally find my profit-driven selfish motives despicable. To project better branding for my despicable actions, I should learn from how Lehman Brothers became defunct. I must also remember that it is still not cool to indulge in maniacal laughter despite the stress-relieving effects it accords me...” [Plenary Lecture delivered to the Super Villains Workshop of the 2024 PHOM Conference]

Ok, Geeks, with your powers and origins story now firmly in place, let's get ready to loom large in the annals of legends! Read on!



Early Action Hero Fail Signs

Your Batsy mobile is leased from City Cab, and nobody comes to you for help because you have Bat breath!

Step #3



Build your reputation

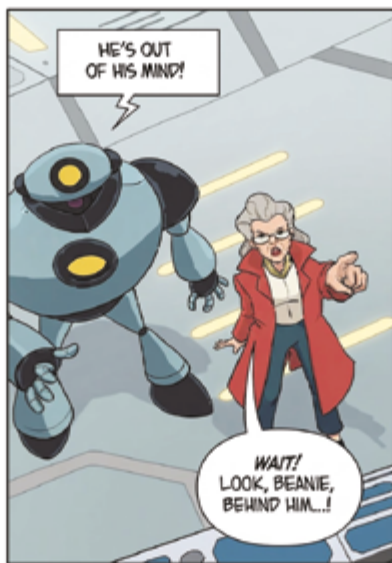
You have to prepare for the time when you must truly be known to the world. We are talking about your reputation. People tend to judge you by who you are, what you do and what you have, and will find a convenient way to categorise you. This impression based on your name, symbol or the products you offer sticks in their minds. Hence, your choice of signature iconography is important to capture the popular imagination, and for your reputation to grow.

Here are today's lessons from the Batsy files:

- Knowing your powers, peeves and tastes, create a descriptor for yourself that fits your mission. How should others know you? Heroes like to classify themselves by gender (woman, man), honorifics (doctor, captain), or just plain 'The' followed by an adjective (e.g., *The Invincible Iron Man*). Create something iconic...
- Still not sure? Are you the hero or anti-hero type? What is the worst that others have called you? Start from there, and work at how people should know you...

Over time, your name, when mentioned, will evoke moral rectitude. And your symbol, when projected into the night sky, or incorporated as a watermark in the letterhead of your hero stationery, will henceforth represent integrity. This is your soft power and influence. Okay, you will find it difficult at first to remember to respond when people refer to you by flashing your iconic branding. No worries, you just need some time to get used to it.

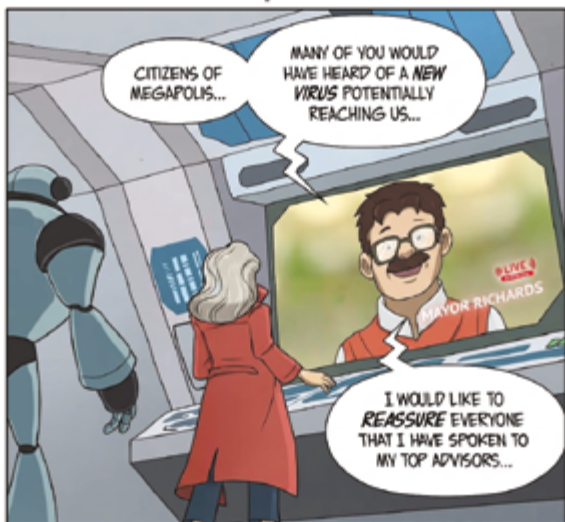
And the Jokerster says... "It is becoming increasingly difficult to make a name for myself in this tough world. The fastest way up is to zap someone like Justin Bieber or Katy Perry and assume the identity, but this kind of power comes with loads of public expectation. No matter how tempting, always be careful with what one wishes for." [Jokerster *et al*, Journal of the Epidemiological Society of Super Villains, 2024;4(2):330-334]



Early Action Hero Fail Signs

Your friends call you the Invisible Man because of where you usually hang out and their adjective is correct!

Step #4



Protect yourself with a persona

So now you've decided on your hero type: Powers, origins story, reputation, iconic symbol and a cause to champion. As you prepare your spandex suit and launch out to fight Evil, take some time to think about your public persona—that is how you want to be viewed in the general community.

Persona refers to a person's social facade or front, and reflects the role that one plays in life. This protects the true self from undesired scrutiny. An introvert may put up the persona of an energetic extrovert, a playful joker or a studious nerd.

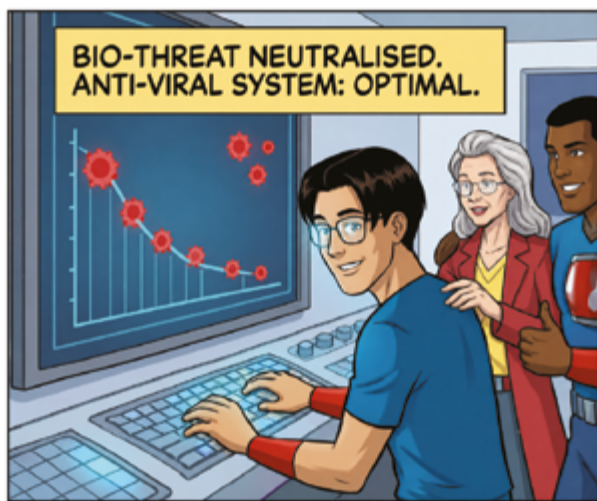
Here are today's lessons from the Batsy files:

- Many action heroes go around displaying a persona, because having a persona can protect the vulnerable you...
- No rule states that heroes must hide their secret identity from friends...
- Alternatively, there is also no need to go secret if you have no friends...

In the process of building up your persona, you will clearly have to set some priorities for yourself. Your costumed exterior is the first thing that most people will notice about you, so make sure your dressing matches your style and the image you want. Decide on your persona and how you intend to protect yourself in a meaningful way. Begin with the end in mind.

Beyond dressing, you will also be judged by your mood, outlook, mannerisms and rhetoric. You must ultimately be comfortable in order to remain consistent. Do not react or be distracted by how others behave. It is their persona. Know what the Joker thinks about distractions?

And the Joker says... "Distractions in life are almost always urgent but not important. I can also use distractions on others to my advantage. To lock the throngs daily into a mindless trance, provide them with free internet access." [Joker *et al*, Journal of the Epidemiological Society of Super Villains, 2022;2(2):346-349]

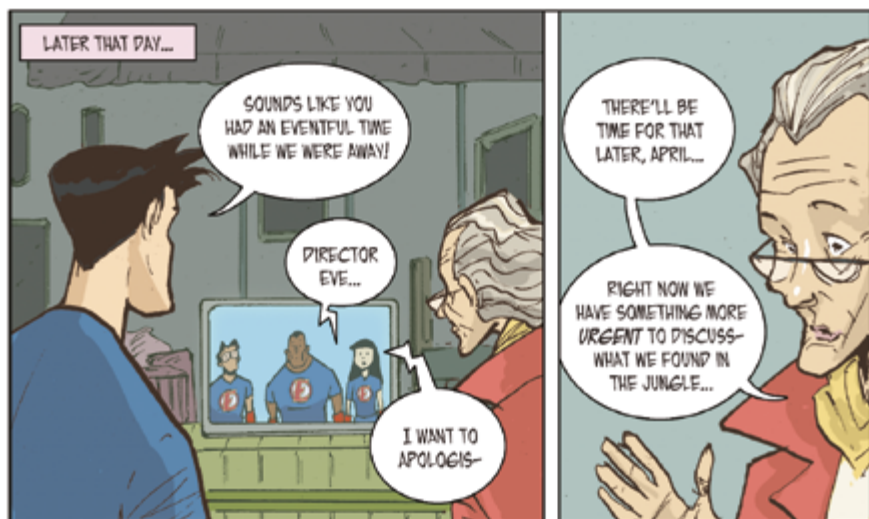


Early Action Hero Fail Signs

Your animal mimicry persona is always stuck on 'toad', and bugs get swallowed whenever you open your mouth!

Step #5

Find a place to recharge



In the previous step, we learnt the importance of protecting yourself with a persona when you fight for a worthy cause. That will hold you steady while you are doing battle. Actually, there's something even better than persona... and it is resilience.

Once you are truly resilient, persona can be replaced with authenticity. But you'll need time to build this. How? Find a place to recharge. You cannot control where you will do battle. But where you retire after the battle to lick your wounds, build resilience, and plan your next move is very much up to you.

Here are today's lessons from the Batsy files:

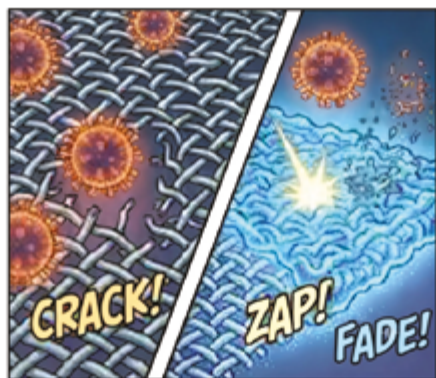
- All superheroes have a secret lair or sanctum in which to recharge, a unique spot that builds character...
- Once recharged, your appearance from the lair will strike fear in the hearts of baddies and bring joy to others...

- In your lair, do you have to constantly battle with personal inner demons? This adds depth to your backstory. Also good for merchandising later...

When choosing the spot, always consider location, location, location. You need a quiet place to reflect, and a properly chosen and equipped secret lair will help you to do so.

Once you settle into your secret lair, the first step to recharge is to reflect on yourself and your motivations. In the process, you will discover what obsessions you have that can be your vulnerability. Chart your progress in handling problems and self-control. This can be done by keeping a simple diary or a highly elaborate supercomputer records system, depending on you.

And the Jokerster says... "My addictive desire to undermine others could cause me to undermine myself. I must see my psychiatrist (Dr H Quinn) for help to get treated and cured. But if I end up undermining her as well, that means no more help for my future relapses..." [Jokerster *et al*, Journal of the Epidemiological Society of Super Villains, 2023;3(2):340-345]



Early Action Hero Fail Signs

What, no Bat cave? Toilet cube your secret lair?
And your supercomputer runs on Windows 98?

Step #6



Invest wisely, in yourself

When the time comes to act, will you proceed with brawn alone? Should you be aided in your actions by some smarts and nifty devices that leave others in awe?

Here are today's lessons from the Batsy files:

- How do you equip yourself in order to function as a hero? Your most basic investment must be in building brain skills for knowing and interpreting things...
- If you must spend money on stuff, make sure your equipment helps, e.g., bright colourful spandex is good only if you are invulnerable...
- Be careful—being flashy or flamboyant can provoke negative reactions from others...

Whatever else you acquire, you need good brain skills to protect yourself mentally while doing battle.

A wise hero will not neglect the need for tough mental training. If you wish to remain at the top of your game, you will have to learn to overcome your sense of insecurity. Seek wisdom.

A sense of humour also helps. So, remind yourself why you are in this hero business. With all the attention on you every day, the main goal of your tenure as action hero may end up as only to enjoy your tenure!

In the process of knowing and interpreting, if you actually help people, this becomes real power and influence. How ready are we to handle such influence? Want to know what Evil thinks about dominating the world? There are incredible insights excerpted below from a stolen manuscript that is being authored by Jokerster and is tentatively titled *The Super Villain's Shopping Guide*.

And the Jokerster says... "World domination is over-rated. I must be secure in my genius and not keep wanting to show off. If my captured adversary says, "Tell me how you did it," just shoot him else I end up talking to myself as he escapes. Also, never buy things I don't need with money I don't have to impress people I don't like." [*The Super Villain's Shopping Guide*, 2026]

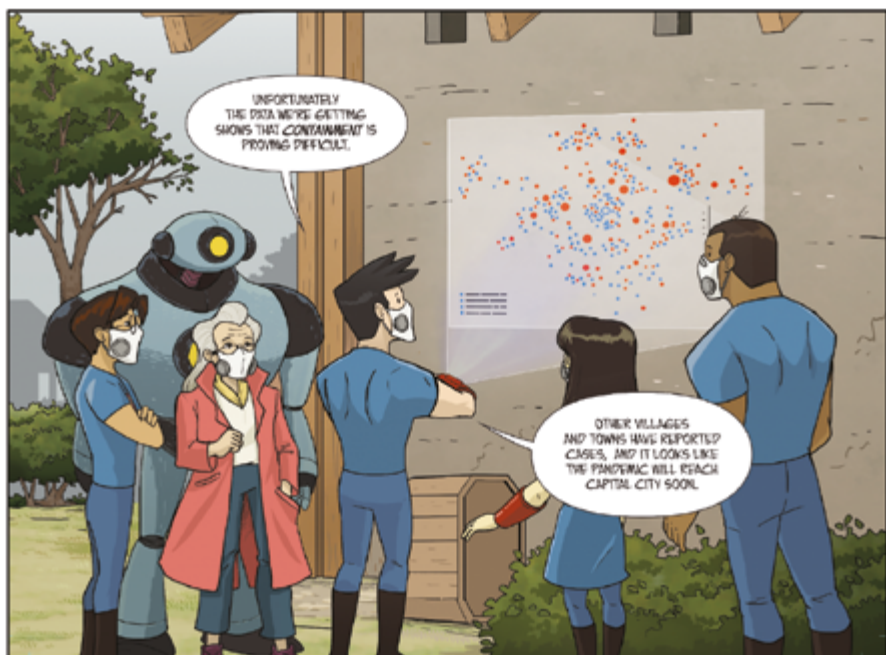


Early Action Hero Fail Signs

You can run like the Flash faster than a train, but only our MRT on a bad day. Worse, your symbol resembles the MRT logo!

Step #7

Fight for a worthy cause



People who strive for a worthy cause are cool. And happier, as it provides a sense of purpose and bolsters self-esteem. Are you cool? Find the cause that creates meaning for you!

Here are today's lessons from the Batsy files:

- All heroes are coolest when championing and *advocating-impacting* their cause. Similar for you, but can you also pull it off?...
- Take time to try out some causes that fit your idea of truly living life...
- What is the coolest image or lifestyle that fits in with your sense of mission? Project a purpose that clearly identifies you...

When advocating for a cause, we face stress and our ability to handle setbacks grows. Character and resilience are built through experiencing severe setbacks. Every setback is a learning opportunity. In this way, they are stepping stones to success.

And the Joker says... "When faced with setbacks, stay attentive to the challenges unfolding in front of me. In a crisis, I must not fly into a rage and kill the messenger who brings me bad news. This is because messengers are quite hard to come by, so do not waste them." [Jokerster *et al*, Conference Proceedings of the Epidemiological Society of Super Villains, 2023]

Right on, Geeks, beware of trade-offs in the process!



Early Action Hero Fail Signs

**Cannot fight effectively because you keep recording on TikTok
and when fighting in tights, you always get a wedgie!**

Step #8



Consider forming a league

Why work in a league when you can fly solo? The answer is: Evil. Some action heroes team up at the slightest provocation and that is not cool. There must be a higher purpose to working in a league, and that is networking and connecting to fight evil guys who, by definition, do not play fair.

Geeks, here are today's lessons from the Batsy files:

- Teamwork with networking and connecting is important for solving complex problems...
- Many heroes choose to work in a justice league, but duo or trio combos will also do...
- Be aware that working together can drastically change your respect for each other...

You may find yourself acquiring natural allies in the course of your action hero routine. But do not let your need for allies push you into forming a league where you clearly do not belong (like cats with dogs). And do not be hurt if your efforts to network and connect on the ground are turned down.



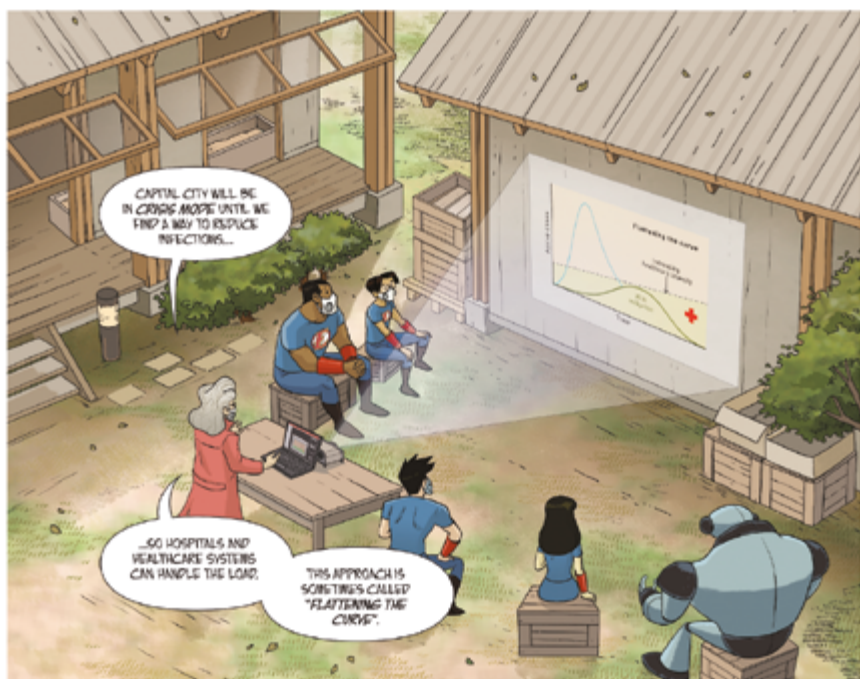
Once you are in a league, you must make useful contributions and add value as a team member. Very important traits are keeping everything in check and being able to manage your successes without pride. Action heroes know from experience that pride comes before a fall.

And the Joker says... "While admiring minions come in handy for my ego sometimes, pride typically comes before a fall. I must maintain a healthy amount of scepticism in myself and not believe my own rubbish. This is especially important when I hear someone is attracted to my good looks..." [Joker *et al*, Journal of the Epidemiological Society of Super Villains, 2021;1(2):347-349]

Early Action Hero Fail Signs

When the League assembles, you're always absent with apologies, and whilst other heroes go "Pow!" you only go "Wow!"

Join in an epic project



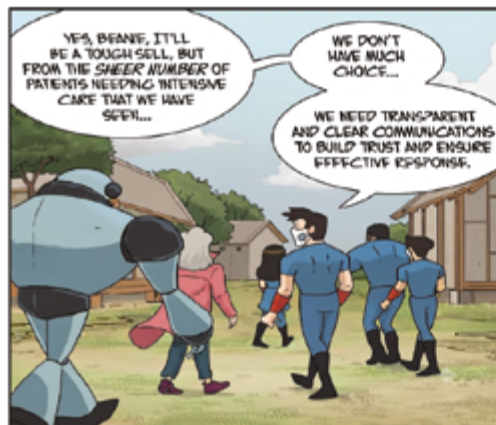
Join in an epic project to bring good to the world! Make history, what you do will be remembered for years to come. It requires working interdependently—a state in which persons mutually rely on each other and are morally responsible to each other.

Here are today's lessons from the Batsy files:

- Help in shaping and organising an epic project that puts group interests above self and go out of the way to make others look good.
- Make others feel good to work with you, and always remember to reciprocate...
- Help the other action hero to be good, for it will keep his or her powers honed...

Working interdependently to shape and organise things can be trickier than you imagine. As working together drastically changes your respect for each other, negative feelings that arise can prevent you from achieving the desired outcomes. Clearly, the rewards of shaping and organising the epic project agenda make it truly worthwhile. But what if you develop negative feelings?

And the Joker says... "Negative feelings for my adversary often distracts me from my goals. Plotting revenge with fancy rhetoric is very time consuming. Cultivating hatred is like taking poison—I must not keep taking poison in the hope that my adversary dies." [Joker *et al*, Journal of the Epidemiological Society of Super Villains, 2025;5(2):358-360]



Early Action Hero Fail Signs

You keep leaving your keys inside the Batsy mobile, and your emergency escape plan B involves a City Cab booking!

Impart your insights



Ever wonder why so many action heroes have a sidekick? Yes, it is to ensure continuity. In the past, persons who desired to learn a craft and intended to make it their life's work, apprenticed to a master craftsman. It is the same here, and for a sustainable future, mentor someone special (evil geniuses, please put this idea down and back away slowly). If you hope to leave a legacy, this is the best thing you can do for others and yourself!

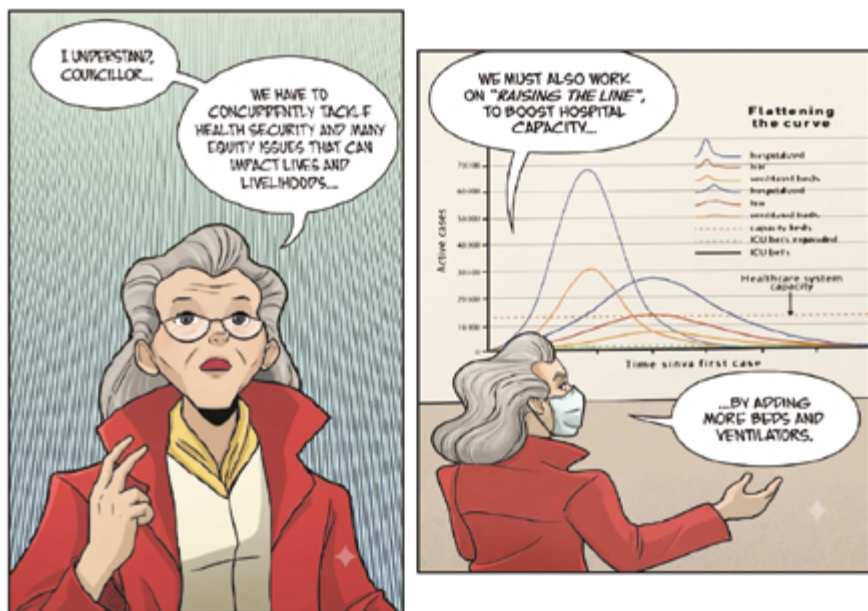
Here are today's lessons from the Batsy files:

- Find yourself an apprentice (e.g., an unsuspecting Robin) for mentoring and nurturing but never be cocky about it...
- Be willing to share insights with each other, especially if both of you believe your own keen strategy had saved the day...
- Humility is important for growth—if you think you are more gifted than others, let it pass...

Instead of mentoring and nurturing a sidekick, super villains typically engage minions to assist them, and by the hordes. You can obtain some incredible insights by observing the many negative examples in those who are currently mentoring many wannabe villains amongst their minion horde.

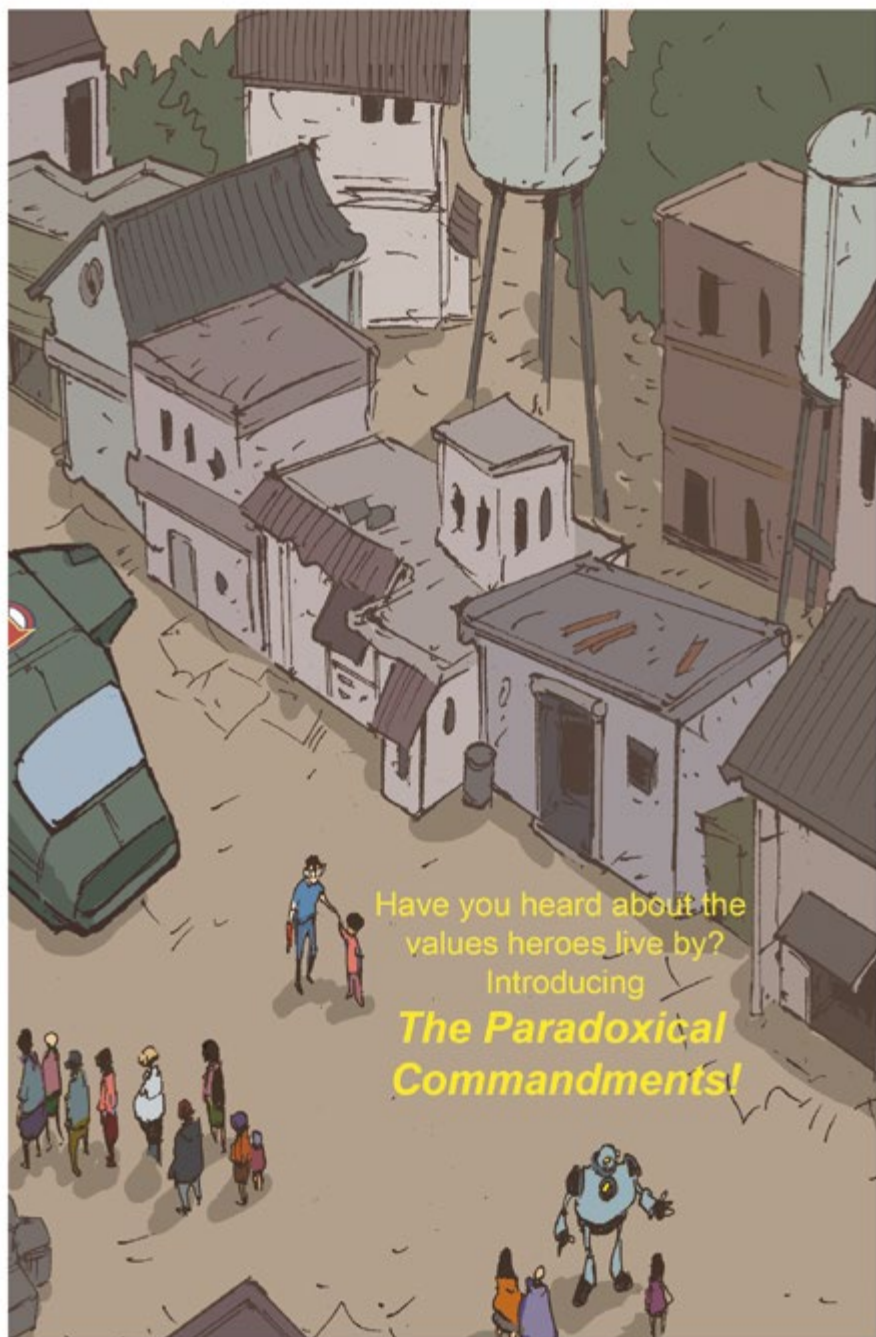
And the Jokerster says... "In the minion market, the cliché "good help is hard to find" is wrong because it implies good help exists. If a minion fails miserably at a task, I must not berate him for incompetence and then insanely send him out expecting a different result. When mentoring and nurturing someone, training and coaching are not vehicle options." [Jokerster *et al*, Scientific Poster Presentation at the 2025 PHOM Conference]

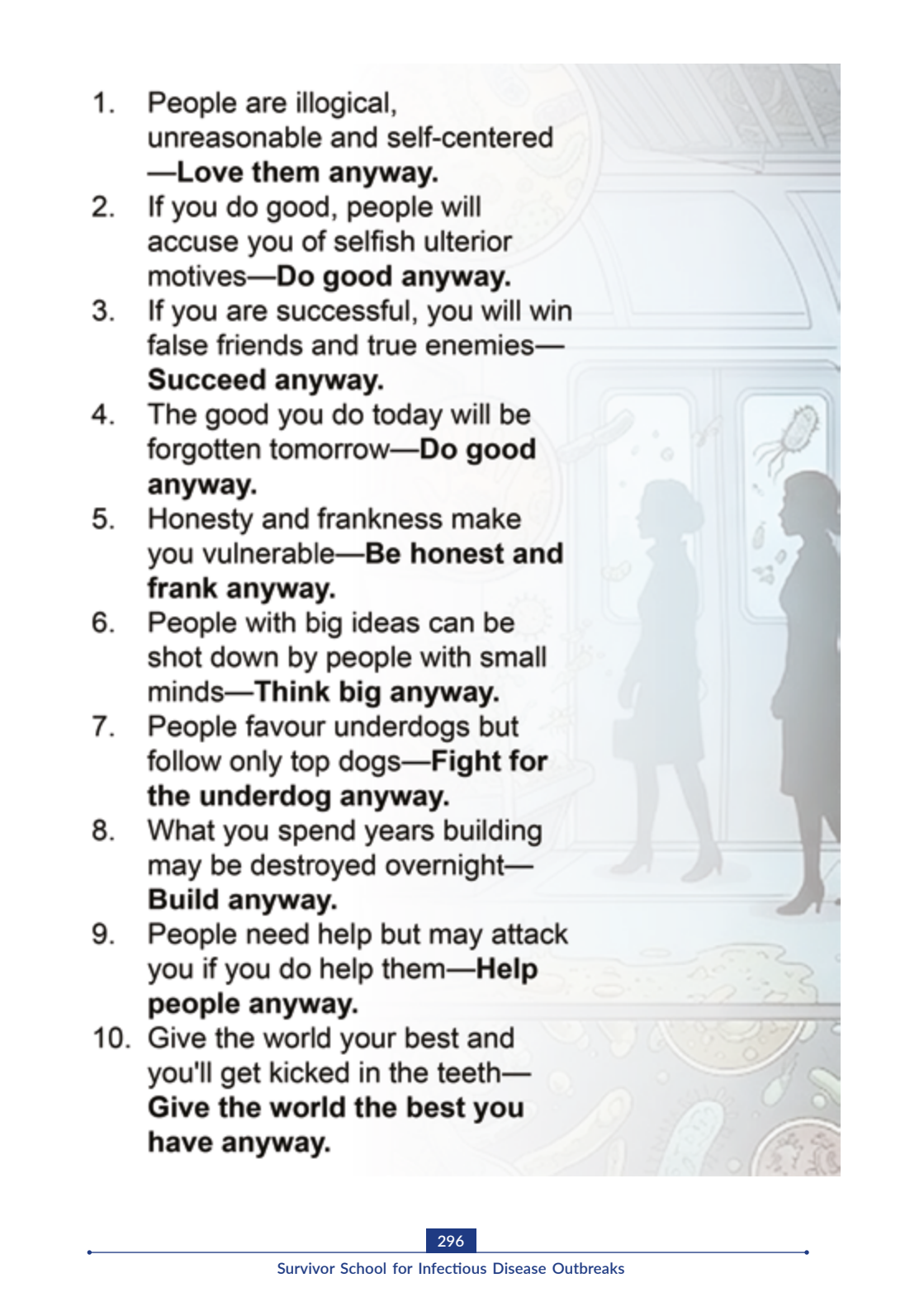
So there, geeks, your ten steps... K.S., as in Keep Serving!



Early Action Hero Fail Signs

Your sidekick seems to be always busy crafting letters, embellishing his CV, and checking for mail!



- 
1. People are illogical, unreasonable and self-centered—**Love them anyway.**
2. If you do good, people will accuse you of selfish ulterior motives—**Do good anyway.**
3. If you are successful, you will win false friends and true enemies—**Succeed anyway.**
4. The good you do today will be forgotten tomorrow—**Do good anyway.**
5. Honesty and frankness make you vulnerable—**Be honest and frank anyway.**
6. People with big ideas can be shot down by people with small minds—**Think big anyway.**
7. People favour underdogs but follow only top dogs—**Fight for the underdog anyway.**
8. What you spend years building may be destroyed overnight—**Build anyway.**
9. People need help but may attack you if you do help them—**Help people anyway.**
10. Give the world your best and you'll get kicked in the teeth—**Give the world the best you have anyway.**





And One More...
The world is full of violence,
injustice, starvation, disease
and environmental
destruction –
Have faith anyway!



Congratulations, you're well on your way towards achieving hero status. Because apathy is so last decade!



Our original EPiMAN comics cover, circa 2011



***How to Keep Calm and Hero On is a product of
Survivor School***



**EPI-sode 4:
Leadership for Risk
Management**

Gary and Owen Join EPI-FORCE...

(Tune: Garyowen)

Verse 1

Amidst outbreaks, we're in the field,
Our teams serve as the people's shield;
Against all odds, be not dismayed,
Gary go forth, investigate!

We're EPI-FORCE, we seek no fame,
Let no one know from where we came;
Outbreak control, we'll do in stealth,
A mission pure, the public's health!

Chorus

In the silent war against disease,
We can never ever be at ease;
Our vigilance shall never cease,
We are disease detectives! (Repeat)

Verse 2

And when there's work, much to be done,
Duty calls us from our loved ones;
We're steadfast in the public's cause,
To strive and seek and serve — no pause!

Live long, live well, with peace of mind,
We greet peoples of many kinds,
We're EPI-FORCE, for our first wealth,
A mission pure, the public's health!

Perspective on Outbreak Risk Management

INTRODUCTION

Over the past decade, the global community has witnessed a series of infectious disease events that underscore the fragility of health security systems. The COVID-19 pandemic was followed by a sequence of other threats to our populations from pathogens including mpox, measles and Nipah virus infection. These dynamic events illustrate the reality of modern situations: Emerging pathogens rarely appear without warning. Early signals are often detected within clinical practice, laboratory diagnostics and syndromic surveillance systems before an outbreak becomes widely recognised. Frontline clinicians remain a critical component of infectious disease epidemic intelligence gathering.

At the same time, geopolitics affecting global health and the global resurgence of pathogens highlight persistent vulnerabilities in public health infrastructure. Disruptions to healthcare services, population displacement and declining vaccination coverage all contribute to the re-emergence of infectious diseases once thought to be under control. Strengthening infectious disease intelligence requires not only improved surveillance systems but also stronger integration between the fields of clinical medicine, epidemiology, and One Health practice.

GEOPOLITICAL PUBLIC HEALTH

In an age of emerging infectious diseases (EIDs), preparedness for health emergencies especially in urban settings must be a priority for all. The countries of East Asia include Russia, China, Japan, Mongolia, North Korea and South Korea, while Southeast Asia is composed of the ASEAN states of Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Timor-Leste and Vietnam. A region of impressive diversity in many ways, it is also at grave risk of EIDs causing health emergencies with pandemic potential, requiring multilateral cooperation.^{1,2}

Multilateral cooperation in pandemic health has its roots in the third cholera pandemic which swept across Europe from 1846-60. Incidentally, it was around this time that a cholera outbreak in London made famous one physician named John Snow who identified a town pump as contaminated and convinced officials to remove its handle to prevent people from drawing water there. The first international sanitary conference was held in France in July 1851 with the objective of harmonising and reducing costly maritime quarantine requirements among the nations. Cholera and plague became the first two diseases to be addressed in international conferences. Independent health organisations which coexisted after the First World War were the Office International d'Hygiène Publique, the Health Organization of the League of Nations, and the Pan American Sanitary Bureau. In April 1945, at a United Nations conference, China and Brazil proposed that an international health organisation should be established, and this brought about the birth of the World Health Organization (WHO).

WHO is the United Nations' specialised agency founded in 1948 and headquartered in Geneva to direct global health emergencies, set health standards and promote universal health coverage, aiming to ensure the highest level of health for everyone. WHO's World Health Assembly adopted the International Health Regulations (IHR) in 1969 to control six quarantinable diseases, namely plague, cholera, yellow fever, smallpox, typhus and relapsing fever. IHR was twice amended to reduce coverage to yellow fever, plague and cholera, and to mark the global eradication of smallpox. Shortcomings were apparent when cholera occurred in South America in 1991, plague in Surat, India in 1994, and Ebola in Kikwit, Democratic Republic of Congo in 1995.³ These included a dependency on governments to notify, a lack of internationally coordinated mechanisms to contain disease spread, and inability of WHO to ensure compliance. Revisions were called for in 1995, reinforced by the SARS pandemic in 2003. A new IHR was adopted by the World Health Assembly on 23 May 2005 and came into effect on 15 June 2007.^{4,5} This IHR (2005) is an international legal instrument that binds 196 countries, including 194 state parties. WHO is mandated under IHR (2005) to strengthen the global and regional systems and capacities in detecting, assessing and responding to all acute public health emergencies of international concern (also known as PHEIC). Despite delays in implementation, the importance of IHR (2005) was demonstrated in its first decade when WHO declared four events to be PHEIC—the influenza A (H1N1) pandemic in 2009, spread of wild poliovirus in 2014, Ebola outbreaks in West Africa in 2014, and complicated Zika virus infections in 2016. WHO developed its

Asia Pacific strategy for emerging diseases and for public health emergencies to strengthen existing systems for surveillance, risk assessment, information sharing, preparedness and response.

Under Annex 2 of WHO's International Health Regulations (2005), a public health threat assessment is required before notifying WHO of any qualifying events. Four criteria for evaluating health threats are: (1) Seriousness of public health impact; (2) usual or unexpected nature of the event; (3) potential for cross-border spread; and (4) potential for international trade or travel disruptions.

APPLYING THE EPIDEMIOLOGIC TRIAD

The epidemiologic triad is used in risk management to study how factors interplay between the host, pathogenic agent and the environment. Whenever there's an occurrence of an outbreak (e.g., cholera, norovirus), we examine each side of the triad to help frame our thinking on the many factors (clinical, microbiological, physical, ecological and/or social) causing the unusual health event. All the above steps can be simplified as the ABC of outbreak management: A to assess the situation, B to break the chain of transmission and C to communicate the risks. Systematically, we answer a series of progressive questions that help us to describe the outbreak (who, where, when?), make appropriate inferences by hypothesis testing (why, how?), and institute control measures (so, so what, so what now?). Hence, field epidemiology is useful in: (1) Explaining aetiology by likely source of infection and mode of transmission; (2) providing the scientific basis for prevention and control measures; and (3) monitoring the follow up with affected populations.

How do we grow our proficiency in the clinical, epidemiological, microbiological and environmental methods in managing risks? Through the One Health multisectoral approach. For example, in vector-borne outbreaks, epidemic control measures involve fever surveys, diagnostic screening, engagement with residents on repellent use and when to seek care, search and destroy operations for mosquito breeding sites, larval source reduction, fogging with adulticides, targeted environmental inspections and community cleanups. In foodborne outbreaks, we typically carry out what is known as the case-control study which involves hypothesis formulation and testing, multivariable analysis and reporting of significant findings (p-value, 95% confidence intervals).

To protect populations, leadership for risk management focuses on strengthening resilience within cities to prevent, detect, and respond to health emergencies. Outbreak investigation and analytics requires spatial and social network mapping to delineate transmission clusters. Heterogeneity within cities means the data must be disaggregated to a neighbourhood or ward level to reveal hotspots that would otherwise be obscured in citywide averages.

Regional capacity building is key to effective health emergency preparedness. In January 2022, ASEAN convened its global health security agenda consultative meeting on multisectoral workforce developments at the subnational level. ASEAN+3 countries engaged partners in a project on “Strengthening public health and animal health epidemiological capacity for emerging infectious diseases response” with the Canada Global Partnership programme, and another on “Enhancing regional field epidemiology training workforce capability to prevent, detect and respond to transboundary emerging infectious diseases” with the US Centers for Disease Control and Prevention. In addition, the region is blessed to have the multiple applied epidemiology networks:

- ASEAN+3 [China, Japan, South Korea] Field Epidemiology Training Network (FETN)
- ASEAN Veterinary Epidemiology Group (AVEG)
- WHO Global Outbreak Alert and Response Network (GOARN)
- South Asia Field Epidemiology and Technology Network (SAFETYNET)
- Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET)

At the beginning of the COVID-19 pandemic, regional countries formed a community of practice known as the FETN Technical Expert and Advisory Panel. To date, four expert meetings have been convened involving 17 experts from nine countries, with the last one on 9 March 2022. Despite considerable progress in disease control, EIDs continue to challenge public health systems and hotspots peppering the region.^{1,2} Serious outbreaks can result in high mortality and morbidity, and enormous economic loss to the country. The COVID-19 pandemic experience has particularly underscored the impact of EIDs on human health and economic development.⁶ While the initial impact would be within countries with weaker public health systems or inadequate resources, global health will ultimately be at risk. Singapore has served as the represen-

tative for Western Pacific countries in TEPHINET and contributed in the One Health WHO-FAO-OIE field epidemiology curriculum group.

SURVEILLANCE AND HEALTH DIPLOMACY

Surveillance can be viewed basically as a system with components for the collection, collation, analysis, interpretation and dissemination of data for public health actions. Passive surveillance involves: (1) Indicator-based surveillance, disease notifications from doctors and laboratories required by law; and (2) event-based surveillance, information obtained via hotlines set up by the authority, and social media. Active surveillance involves going into the population to actively find cases through health screening. This usually occurs when specific health threats urgently require timely actions. In situations with limited resources, it may be expedient to focus on important sites such as a hospital or GP network. Sentinel surveillance is then used to monitor cases, either passively or actively.

When a condition is detected through regional surveillance, verification must follow. Clinicians, laboratorians, One Health partners, community health workers, representatives and volunteers all play a role in the process of alerting and responding. For the surveillance system to be responsive, some key attributes are that it must be acceptable to all users, stable with good data quality, simple and timely, representative and flexible.

Interpreting surveillance data begins with a case description which involves: (1) Personal details such as age, occupation, socio-economics, hobbies or pets; (2) place variables such as residence, workplace or travel; and (3) time such as any seasonality or periodicity. How do we report the information? A picture paints a thousand words, and we display summary data in pictograms, pie charts, bar charts, histograms (incl. epidemic curve), spot maps, and tables—disease incidence, prevalence, mortality and case-fatality, using summary measures for central tendency (mean, median, mode), dispersion (range, standard deviation), and association (odds ratio, relative risk).

Health diplomacy is important when handling cross-border matters. With this, surveillance helps to appropriately direct outbreak investigation and risk assessment so that control measures can be taken. In outbreak analytics, we analyse data from line lists and use probabilistic thinking to determine

the validity of a hypothesis concerning the occurrence of diseases and its relationship to possible causal risk factors.

GLOBAL HEALTH COOPERATION

One success story of global health cooperation is in ASEAN's regional response using a multisectoral One Health approach towards emerging disease outbreaks. Over 60 per cent of emerging infectious diseases in humans originate from animals, and the surveillance of zoonotic reservoirs and transmission pathways is critical for outbreak detection and early warning. The public health (and economic) challenges of zoonotic spillover in our region include outbreaks of Avian influenza, hantavirus, Japanese encephalitis, leptospirosis, Nipah virus, rabies and coronavirus infections. They can be triggered by environmental drivers such as land-use change, deforestation, biodiversity loss and climate change which reshapes pathogen dynamics, vector ecology and the geographical distribution of infectious agents.

Through regular joint AVEG-FETN conferences, public health and veterinary health professionals have come together on common issues since the first annual Joint Consultative AVEG-FETN Meeting was convened in 2016. Five years later, a joint video conferencing was held on 14 November 2021 before the fourth annual meeting on 14–15 December 2021 to develop its five-year strategic framework of cooperation. In addition, a workshop on risk communication titled, “Lessons learned from the Covid-19 pandemic” was held on 17, 20 and 24 August 2021 for 50 participants from regional countries. Another regional workshop to provide training on One Health risk assessment was held on 19, 21 and 26 April 2022. These small steps all add up to promote the sharing of epidemiologic information with counterparts, contingency planning for outbreaks of EIDs and health emergency preparedness.

The One Health multisectoral framework details various ecosystem interactions at the human-animal-environment interface that can give rise to disease spillover and transmission. It requires an understanding of zoonotic diseases, antimicrobial resistance, urban vector control, food safety, recreational exposures, sanitation and water quality, and building-related infections. Real-world surveillance structures help to address contemporary public health challenges.

CONCLUSION

The emphasis on leadership for risk management can provide the mechanisms to promote the sharing of epidemiological information with counterparts, contingency planning for outbreaks of EIDs, and for rapid epidemiological response.^{7,8} The transmission potential of high urban density coupled with travel frequency and novel epidemic occurrences make cities at high-risk in pandemics. Professionals with expertise ranging from public health to food safety, veterinary medicine, wildlife and the environment have to join forces in designing and implementing programmes, policies, legislation and research in which multiple sectors collaborate to achieve better public health outcomes. According to WHO, Disease X represents the knowledge that a serious international epidemic could be caused by a pathogen currently unknown to cause human disease. The test of Disease X is yet to come!

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EPI-FORCE

URBAN HEALTH ADVENTURES



SURVIVORS MORPHING HEROES

EPI-FORCE

URBAN HEALTH ADVENTURES

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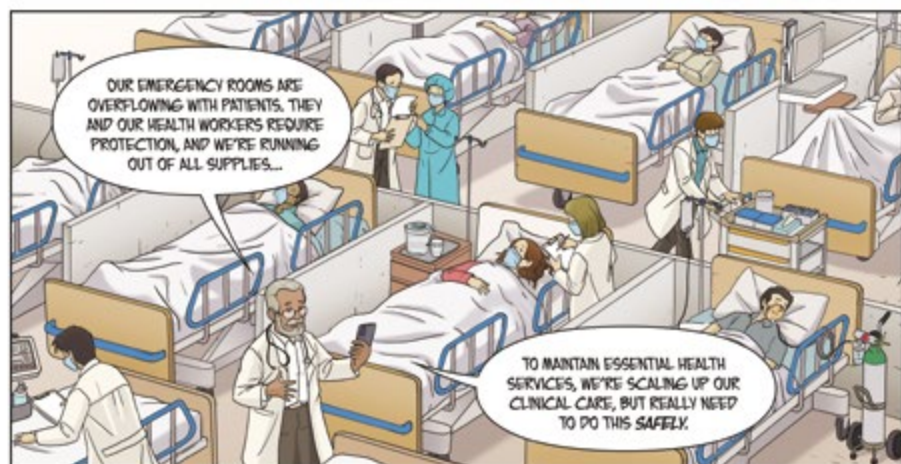
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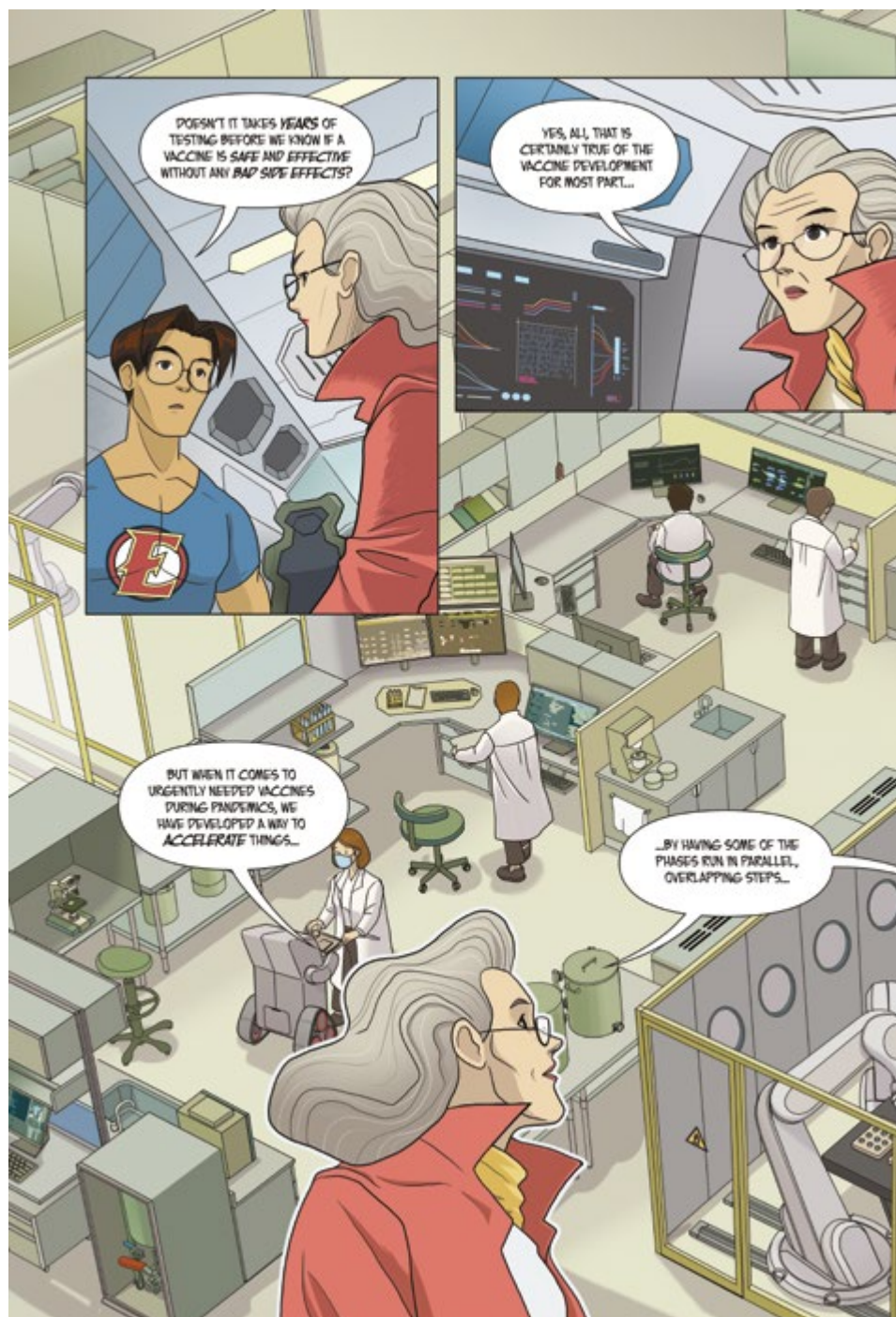


ONBOARD THEIR SHIP, THE EPI-FORCE TEAM DISCOVERS THAT ENEMY AGENTS HAVE INFILTRATED MEGAPOLIS, RIGHT UP TO THE OFFICE OF MAYOR RICHARDS...















FIGHTING RESUMES AND, WITH RENEWED VIGOUR, THE EPI-FORCE DUO DISPATCHES THE DRONES AND ANDROIDS TO SUBDUDE LADY INFLUENZA AND ZOONOTIC ZOMBIE.







Field Notes

**Outbreak epidemiologic sciences based on
the graphic novel, Survivors Morphing Heroes**

Bring it all together! Leadership for risk management involves a number of scientific and practical skill sets which are stackable like Lego in any configuration that make most sense for responding to infectious diseases...

Survivors Morphing Heroes
Modern Lifestyle Contexts
Social and Community Dimensions
Travel Health Precautions
Vaccines Counter Measure
Urban Health Drivers
Verification of Event Signals
Analysis and Assessment of Risk
Risk Communication
Chem-Bioterrorism Ahead

SURVIVORS MORPHING HEROES (Refer to graphic novel pp.311-313)

No one wakes up during an outbreak thinking, “Today feels like a good day to develop character, antibodies and a lifelong interest in epidemic curves.” And yet—here we are. The outbreak survivor begins life as a perfectly ordinary citizen. Then comes *The Event*: An indignance, a quarantine order or the unforgettable moment someone says, “You’re positive.” At first, survival is the only goal. Time is measured in swabs, symptoms, and WhatsApp messages titled “Check in please”. Netflix asks if you’re still watching; you are, but only because there’s nothing else to do except contemplate the meaning of fever.

Then something shifts. Once recovered, indignant survivors emerge blinking into society with powers. Not supernatural ones—nothing flashy—but deeply unsettling competencies: An instinctive ability to spot poor mask etiquette from 20 metres; an irrational calm during news briefings that send everyone else panicbuying toilet paper; and a reflexive urge to explain incubation periods. Soon, colleagues begin consulting and asking questions. The survivor, once armed only with Panadol and patience, now wields knowledge. And knowledge, it turns out, is contagious too.

Some take it further. They sign up for training. They attend talks ‘just out of interest’. They start saying phrases like “from a public health perspective” and “in the community setting” without irony. Before long, they are volunteering, teaching, advising—occasionally correcting news anchors from their sofa. Thus, the outbreak survivor becomes the health hero. Not the capewearing kind (though many have strong feelings about personal protective equipment), but the quiet, resilient sort: The one who translates uncertainty into reassurance, fear into facts, and lived experience into empathy.

They still remember the waiting. The not knowing. The strange silence of isolation. And that’s exactly why they’re good at this. Because the best heroes aren’t born—they’re swabbed and transformed. We are all pandemic survivors morphing into healthcare heroes.

MODERN LIFESTYLES CONTEXT (Refer to graphic novel p.313)

In the old days, people caught infections from dramatic things like wars or drinking suspicious swamp water. Today? Modern life is basically a relay race for germs. We touch elevator buttons, train poles, self-checkout screens and

gym equipment that somehow remains damp regardless of the weather. Science calls this 'transmission'. Society merely calls it a 'Tuesday'.

Modern lifestyles have done wonders for convenience, entertainment and food delivery, but they have also turned humanity into a highly efficient disease bug transportation system. Hundreds of people squeeze into packed places and schedules, politely pretending not to notice the stranger sneezing with the force of a leaf blower. Fitness culture adds another layer of excitement, because apparently every gym contains at least one person who believes wiping equipment is an optional personality trait.

Open-plan offices with shared workstations make things even better for bugs by removing walls, privacy and apparently basic survival instincts. 'Collaboration' is corporate language for 'sharing respiratory droplets'. Food is delivered at work to be mindlessly consumed. Hot-desking by multiple staff deserves special mention for its contribution to the infectious disease drama. When one person arrives sick 'to show dedication', the entire department can sound like a retirement home harmonica club within three days.

At this point, infectious diseases are not merely surviving modern lifestyles; they are thriving in them like tourists at an all-inclusive resort. Seven lifestyle choices we can take as simple steps to prevent illness:

- Respiratory etiquette: Wear a mask to avoid spreading respiratory illnesses. Do not litter used tissues!
- Food hygiene: Purchase food items only from clean stalls and vendors that exhibit good hygiene practices.
- Toilet sanitation: Use non-touch technique as much as possible in public toilets. Wash your hands after that with plenty of soap. Do not use a public towel.
- Workstations: Reduce clutter and dust collection at work. Keep your desk surface clean and allow cleaners to vacuum your cubicle.
- Ventilation: Ensure adequate ventilation and thermal comfort. Identify and remove damp indoor spaces and mould growth.
- Common areas: Get rid of vermin infestation!

SOCIAL AND COMMUNITY DIMENSIONS (Refer to graphic novel p.314)

In the graphic novel, Mayor Richards kept rejecting all infection control recommendations. Managing outbreaks is not just a medical challenge; it is a social experiment involving germs, group chats, and at least one uncle who believes garlic soup can defeat everything from influenza to tax audits. Public health experts may develop brilliant containment strategies, but success ultimately depends on communities behaving responsibly for longer than twelve minutes.

The social-community dimension of infectious diseases management becomes obvious the moment someone coughs dramatically in public transport and everyone nearby suddenly studies the ceiling with spiritual intensity. Humans are deeply social creatures, which is unfortunate because microbes are enthusiastic networkers. Diseases can spread through communities as fast as gossip about office layoffs or celebrity breakups.

Those among us managing risks quickly learn that people do not enjoy restrictions, especially when those restrictions involve cancelling weddings, festivals, or unlimited buffet nights. Communities respond best when trust exists. If local leaders communicate clearly and honestly, people cooperate. If communication becomes confusing, citizens begin collecting 'medical advice' from random influencers named CrystalMoon77.

Neighbourhoods also develop their own coping systems. During outbreaks, communities organise food deliveries, check on elderly residents and share supplies. They also share completely unverified miracle cures involving lemons, onions and alarming quantities of vinegar. Outbreak management, therefore, is part science, part sociology and part convincing people that washing hands is not government oppression.

TRAVEL HEALTH PRECAUTIONS (Refer to graphic novel p.315)

Do not travel like Oliver who rushes around in the graphic novel! Before you embark on your globe-trotting adventures, let's get some travel smarts, shall we? We're talking about preventing those sneaky imported infections from hitching a ride back home with you. First off, if vaccinations are on the menu, make a date with a travel clinic doc at least six weeks before lift-off.

Let's chat about the notorious jet lag. The key here is preparation. Stock up on your beauty sleep before you jet-set. Hold back on the booze onboard, savour some well-balanced meals (no overeating, please!), and move those legs as much as you can mid-flight. Melatonin might be your buddy too, but just how long you can safely ride that melatonin wave is still a mystery.

When it comes to plane travel, be a savvy traveller and pack all your meds in your carry-on, including anti-malarial. Don't be caught off guard; bring enough to last your whole adventure plus a little extra for those unexpected plot twists. And never forget to pack the cheat sheet with the names and doses of your trusty meds.

Airplane air is drier than a desert, so gulp down that water to avoid turning into a human raisin. Once you touch down, it's time for some hygiene heroics. Wash those mitts regularly, steer clear of the human traffic jams, munch on piping hot, fully cooked grub and master the art of fruit peeling. When you're parched, reach for those sealed bottles like you're in a desert oasis. Ice? Not today, my friend. And when it's toothbrush time, swish with bottled water like a pro.

Now, if you're wandering into malarious lands, your main shield is mosquito bite avoidance. Dodge the buzzers, slap on the bug spray, rock the protective attire, tuck in under mosquito nets and fire up those coils and vaporiser mats. In the danger zones, load up on prophylaxis—start before the journey, keep it rolling throughout, and follow your doc's orders even after you're back in the safety of your humble abode. Happy travels!

VACCINES COUNTER MEASURE (Refer to graphic novel pp.316-317)

If public healthcare had a cast of characters, vaccines would be the unassuming one in sensible shoes—rarely dramatic, never loud, but doing most of the heavy lifting. They don't chase outbreaks or feature in crisis press conferences. Instead, they stop problems so effectively that nothing much happens at all. Which, paradoxically, is their greatest weakness in the popularity stakes.

Vaccines work by giving the immune system a rehearsal without the real world chaos. Think of it as a fire drill rather than an actual fire. Your immune cells

learn what the pathogen looks like, practice their moves, then wait patiently for a performance that ideally never opens. From a biological standpoint, it's elegant. From a public health standpoint, it's gold.

When vaccination coverage is high, outbreaks struggle to get started. This is herd immunity—essentially population-level teamwork, where individuals protect one another simply by not getting infected. It is preventive medicine scaled up to societies, and it works best precisely when everyone forgets it exists. History is full of examples. Smallpox didn't disappear because it got bored; it was systematically eliminated through vaccination. Measles, on the other hand, has proven it is always ready for a comeback tour if vaccination rates wobble.

Vaccine hesitancy often reflects a human blind spot: We struggle to value disasters that never happened. When vaccines succeed, the reward is boredom, normalcy and empty isolation wards. That may not feel impressive, but it is exactly the point. Of course, vaccines are not the only public health tool—but they are among the few that function quietly, cheaply and at scale. Unlike hospital surge capacity, they don't require last-minute heroics. They simply reduce the number of people who ever need help.

Vaccines are an excellent counter measure against infectious disease. Living amidst outbreaks, for our own good, a little more respect for vaccine production is in order.

URBAN HEALTH DRIVERS (Refer to graphic novel p.318)

The city, Megapolis, is a petri dish? Urban settings are marvellous inventions. They give us public transport, highspeed internet, artisanal coffee—and just enough crowding, stress and shared surfaces to make microbes feel truly at home. From an infectious disease perspective, the modern city is less 'concrete jungle' and more 'all-you-can-eat buffet'.

Start with density. Humans love being close to one another, especially during rush hour, concerts and elevator rides where everyone pretends not to breathe. Pathogens, on the other hand, see density as a networking opportunity. One cough becomes ten exposures, and suddenly the virus has more social contacts than most introverts manage in a year.

Then there's mobility. Cities move—people commute, travel, migrate and occasionally sprint for the last train. This constant motion helps economies thrive and microbes hitchhike efficiently across neighbourhoods, housing estates and international borders. What was once 'a local problem' becomes 'everyone's problem before lunch'.

Housing and infrastructure also play starring roles. Overcrowded homes, ageing plumbing, enthusiastic rodents and leaky drains create excellent living conditions—not for people, but for infectious agents with low standards and high ambition. Add inconsistent access to healthcare, and you have delayed diagnosis, prolonged transmission and preventable outbreaks.

Urban lifestyles add a final twist. Long working hours, chronic stress, poor sleep and fast food technically don't invite pathogens in—but they don't exactly post security at the door either. A tired immune system is a polite host that rarely asks questions.

Yet cities are not villains. They also concentrate solutions: Healthcare systems, surveillance, laboratories, public health expertise and—occasionally—common sense. When urban planning, sanitation, housing and health services work together, cities become surprisingly hostile environments for disease.

In the end, infectious diseases don't thrive in cities because cities exist. They thrive when urban systems forget that microbes are always watching, waiting and very good at exploiting design flaws. Urban health is less about fighting germs—and more about fixing the city so germs never get comfortable in the first place.

VERIFICATION OF EVENT SIGNALS (Refer to graphic novel pp.318-319)

Imagine public health intelligence as a giant, invisible detective net spread across the world. It's there, quietly watching, waiting for the moment when a disease outbreak tries to sneak in like a thief in the night. "Aha! You thought you could infect us without anyone noticing, huh?" Intelligence systems are like the James Bond gadgets of public health—sophisticated, discreet and always ready for action.

You've got your data analysis software, your network of hospitals and clinics reporting cases, and your team of public health ninjas deciphering the clues. But it's not rocket science. There's a bit of a guessing game involved. Sometimes, a spike in cough syrup sales is an event signalling a sudden and nasty spread of epidemic influenza. Or maybe it's just a really bad karaoke night in town—hard to tell.

This is the art of 'disease stalking'—a critical operational step confirming whether detected signals represent true public health events. Event verification confirming the authenticity and accuracy of the signals, and the credibility and reliability of the information source. This is a collaborative process that involves communication and discussion with different stakeholders, and consultation with official sources.

We're then the paparazzi of germs, following them around, trying to predict their next move. Experiences shared by countries have shown that verification outputs directly impact decisions on escalation, control measures and further investigation, and methodological errors or delays can result in missed opportunities for outbreak containment or misinterpretation of events. The real skill in surveillance and event verification is knowing when to sound the alarm.

In this action-packed drama, EPI-FORCE must spot the warning signs of an imminent outbreak spreading. They're like the early bird of public health, catching the worm—or in this case, the pathogen—before it can wreak havoc!

ANALYSIS AND ASSESSMENT OF RISK (Refer to graphic novel p.320)

Picture this hypothetical movie, 'The Spy Who Coughed'. You're EPI-FORCE, suave and sophisticated, sipping coffee in a dimly lit café. Your mission, should you choose to accept it (and you have to, because it's your job), is to unravel the mysterious world of epidemiologic risk assessment. Cue the dramatic music. This detective work is like being the James Bond of public health. Instead of saving the world from supervillains, you're protecting it from invisible threats—diseases! It's all about figuring out the odds of outbreaks, without the fancy exploding gadgets.

As with secret agents, EPI-FORCE uses code words—attack rates, case fatality ratios, relative risks and confidence intervals. While surveillance is the very essence of epidemiology, it's not really about watching people from parked vans (that's a different kind of surveillance). In this world, it means tracking diseases to monitor who's sick, where they've been and who they've been in contact with. You study trends, patterns and correlations, and just like solving crimes, you're deciphering disease puzzles. And when you uncover the sinister big plot, you act on the findings judiciously.

EPI-FORCE members are like night owls, burning the midnight oil, fuelled by caffeine and a dash of paranoia. They're up all night, analysing data and concocting strategies to prevent outbreaks. Who needs sleep when you can save lives, right? Risk factors are the suspects in your epidemiological whodunnit. Smoking, poor diet, high risk activity—they're all on your watchlist as contributing factors. They are hunted down by a pack of epidemiological bloodhounds trying to catch them in the act, all to determine multisectoral impact and gain actionable insights.

In the world of risk assessment, every day is a risky business! A place where statistics meet spy-level surveillance with a side of coffee! EPI-FORCE teammates are the unsung heroes, working behind the scenes to keep the world safe from disease outbreaks. So, the next time you hear about an epidemiologist, remember—they may be shaken, not stirred (like Bond's martini), but they sure know how to handle a mean set of statistics.

RISK COMMUNICATION (Refer to graphic novel p.321)

In the graphic novel, Mayor Richards reverses positions and now wants to debunk all the misinformation. Scientists are working hard, hospitals are preparing, and somewhere on the internet, there's a popular website posting that drinking melted cheese prevents infection. That's the milieu of outbreak risk communication.

Risk communication is the art and science of telling people what's happening during a health emergency without causing either total panic or total chaos. Public health officials must explain risks clearly, quickly and honestly so people know what actions to take. Think of it as customer service, except the customer is an entire population and the complaint is, "Why is everyone suddenly coughing?"

Risk communication does involve emotion. During outbreaks, people are scared, frustrated and overwhelmed. Effective communicators acknowledge those feelings while still giving practical guidance. The goal is simple: Help people make informed decisions that reduce harm. Good communication during an outbreak has a few golden rules:

- **Be fast.** If officials stay silent, rumours fill the gap immediately. Nature hates a vacuum, and so does social media.
- **Be accurate.** Saying 'everything is fine' when hospitals resemble disaster movies is not ideal.
- **Be clear.** People understand 'wash your hands' much better than 'enhance personal hygiene protocols'.
- **Be trustworthy.** If advice changes because scientists learn new information, explain why.

In other words, outbreak risk communication is part science, part psychology and part desperately trying to stop humanity from licking metaphorical doorknobs. Strategies for effective risk communication include:

1. Establishing clear communication protocols and channels.
2. Conducting regular risk assessments and scenario planning.
3. Training spokespeople and communication teams for effective crisis response.
4. Engaging with stakeholders and the media proactively.
5. Using multiple communication channels, including traditional media, social media and websites.
6. Monitoring and addressing misinformation or rumours promptly.
7. Evaluating and learning from past communication experiences to improve future responses.

CHEM-BIOTERRORISM AHEAD (Refer to graphic novel p.322)

We shall overcome every sinister challenge. Picture this: A villainous infectious disease outbreak, toxic disasters causing chaos and unexpected plot twists. Yep, that's the script for chem-bioterrorism.

Chemical and bioterrorism are forms of terrorism that involve the use of chemical or biological agents to harm or kill people, animals or plants. They represent serious threats to public safety and global security.

Chemical terrorism involves the intentional release of harmful chemicals or chemical agents such as nerve gases, toxic industrial chemicals or even common substances, to cause harm or panic. The goal is to inflict casualties, create fear, disrupt society or instigate chaos. Chemical terrorism can result in mass casualties, long-term health problems and environmental damage. Preparedness and response measures, including monitoring, detection and protective gear, are essential to counter such threats.

Bioterrorism is the deliberate use of biological agents, like bacteria, viruses, toxins or other microorganisms, to cause harm. The intent is to cause illness, death or widespread fear. Bioterrorism poses unique challenges as it can be concealed and may have delayed effects. Preventing and responding to bioterrorism involves surveillance, rapid identification, isolation, treatment and vaccination in some cases.

These forms of terrorism involve the use of substances that are about as fun as trying to juggle flaming bowling balls. While the topic itself is far from a comedy show, it's essential to take these threats seriously, and heroes are working hard to keep us safe and secure from these grim party crashers.

Dangers ahead, EPI-FORCE, stay alert!



Operation Temperance

**A workshop sampler on
Leadership for Risk Management**

Fundamental Field Epidemiology

SAMPLE STORYBOARD TO SET THE STAGE FOR THE WORKSHOP

Gary and Owen Join EPI-FORCE...

This is an interactive public healthcare workshop focused on leadership in outbreak assessment, crisis decision-making and risk management. Using a scenario-based storyboard, participants navigate a zoonosis turned pandemic disease that escalates across multiple communities, placing pressure on healthcare systems, government agencies and public confidence. Exercising temperance, they learn about modern lifestyle contexts, social and community dimensions, travel health precautions, vaccines counter measures, One Health drivers, surveillance and verification, assessment of risk, risk communication and chem-bioterrorism.

Gary and Owen are thinking of joining EPI-FORCE and need encouragement. This workshop emphasises ethical decision-making, crisis communication and risk management during rapidly changing outbreak conditions. Interactive activities include emergency coordination briefings, policy-making, stakeholder negotiations, media simulations and after action reviews. By the end of the workshop, participants will have strengthened their leadership capabilities and gained practical experience in managing risks in complex outbreak emergencies.

- Fun theme: Project EPI-FORCE-Survivors Morphing Heroes!
- Coverage: High Consequence Threats, Policy and Disease Control, with Stakeholders
- Your hosts: Disease Detective Camp, with Doctor WHO, Credible Hulk, Anime Avatars and more
- Storyboard: *Operation Temperance* progresses with *The Making of EPI-FORCE* (Genomics? No, Comics!) and *Gary and Owen join EPI-FORCE*
- Finale: *A Politically Incorrect Ending*

Leadership for Risk Management

Workshop Day 1	
Operation Temperance: Outbreak Risk Management	
09:00–09:30	Day's Overview Welcome and Curriculum
09:30–11:00	Field Epidemiology @ Work Novel Threat Calls for Leadership By the end of this session, participants should be able to: • Share insights on threat observations and integrity • Describe the management of public health emergencies • Differentiate a problem from a predicament
11:00–13:00	Emerging Disease Master Class Public Policy and Disease Control By the end of this session, participants should be able to: • Articulate perspectives on descriptive epidemiology • Describe steps in public policy and health protection • Apply adaptation and collaboration at work
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Social and Community Dimensions: Why urban settings are unique for contact transmissible and air-borne droplet contagion Part 1 of Project: Your Project Skit

Workshop Day 2	
Operation Temperance: Outbreak Risk Management	
09:00–09:30	Day's Overview High Consequence Threats
09:30–11:00	Field Epidemiology @ Work Contact Tracing of Super Spreading Events By the end of this session, participants should be able to: • Share insights on community risk management methods • Describe steps in contact tracing and quarantine • Use the available data in problem solving
11:00–13:00	Emerging Disease Master Class Policy Trade-offs in Health Emergencies By the end of this session, participants should be able to: • Articulate perspectives on analytical epidemiology • Describe steps in policy trade-offs and communication • Identify professional archetypes at work
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Risk Management Drivers: Perspectives on outbreaks, contact tracing, quarantine and business continuity Part 2 of Project: Visit to a City Gallery

Workshop Day 3	
Operation Temperance: Outbreak Risk Management	
09:00–09:30	Day's Overview Control of Zoonotic Spillover
09:30–11:00	Field Epidemiology @ Work Investigation into Mega Clusters By the end of this session, participants should be able to: • Share insights on the importance of analytics and collegiality • Refine the steps in mega clusters and outbreak response • Frame a health problem properly
11:00–13:00	Emerging Disease Master Class Outbreak Geopolitics: Vulnerable Peoples By the end of this session, participants should be able to: • Articulate perspectives on interventional epidemiology • Identify geopolitical determinants in the ecosystem • Describe the contest of knowledge and attitudes
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Humanities and Diplomacy: Multisectoral public health, genomics, community resilience, participatory governance and safeguards for future outbreaks Part 3 of Project: Risk Management Exercise

Workshop Day 4	
Operation Temperance: Outbreak Risk Management	
09:00–09:30	Day's Overview Engaging with Policymakers
09:30–11:00	Field Epidemiology @ Work Policy and Risk Analysis By the end of this session, participants should be able to: • Share insights on geopolitical global health diplomacy • Describe the evolution of field epidemiologic services • Outline the steps in policy and risk analysis
11:00–13:00	Emerging Disease Master Class Modern Lifestyle Contexts, Prosperity and Progress By the end of this session, participants should be able to: • Articulate perspectives on inferential epidemiology • Describe the modern context of lifestyle and behaviours • Navigate from problem risk analysis to policy
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Surveillance with Verification: On the need for health security and One Health leadership at the human-animal-food-environment interface Part 4 of Project: EPI-FORCE Prologue

Workshop Day 5	
Operation Temperance: Outbreak Risk Management	
09:00–09:30	Day's Overview Engaging with Powerful Stakeholders
09:30–11:00	Field Epidemiology @ Work The Hammer and the Dance By the end of this session, participants should be able to: • Share insights on urban epidemic intelligence • Describe the steps in multisectoral infectious disease control • Identify emotional determinants in the community
11:00–13:00	Emerging Disease Master Class A Politically Incorrect Ending By the end of this session, participants should be able to: • Articulate perspectives on outbreak epidemiology • Describe the context of habits and practices • Integrate skills and habits with professional work
13:00–14:00	Lunch break
14:00–17:00	Survivor School Practice Chem-Bioterrorism Ahead: Building of workforce capabilities and capacities, international technical engagement Part 5 of Project: Survivors Morphing Heroes

Operation Temperance: Self-Reflection for Trainees

Temperance helps you to cultivate the good things in life and fulfil awesome purposes without falling into excess, overindulgence and addiction. It helps you by ordering your relationship with good things which include physical pleasures, like food and drink, and spiritual pleasures, like love of learning or the pursuit of virtue. With self-control, temperance ensures that we can make decisions for the right reasons.

Temperance Reflection and Sharing

As you progress in your learning journey, this section may be used for personal reflection and for group contextual sharing of views. In a personal reflection, what stirs your heart? Remain with it for a while. You may reflect on one or more of the following questions according to your context. In a group context, allow for enough time to reflect in a safe space and for everyone to respond.

Questions on Temperance

- i. What does temperance mean to you personally, and how do you strive to practice it in your daily life?
- ii. How does temperance contribute to maintaining balance and harmony in one's life, especially in the face of temptation and excess?
- iii. In what ways can societal norms and cultural influences promote or hinder the cultivation of temperance?
- iv. How does the digital age, with its abundance of distractions and instant gratification, challenge our ability to practice temperance?
- v. How does practicing temperance impact mental and emotional well-being? Are there specific strategies or practices you employ to cultivate temperance in these areas?
- vi. How does temperance intersect with other virtues such as prudence, justice and fortitude?
- vii. Reflect on a time when you struggled with maintaining temperance. What did you learn from that experience, and how did it shape your understanding of yourself?

- viii. How does modern society's emphasis on instant gratification challenge the practice of temperance?
- ix. How does the practice of temperance influence relationships with oneself and others?
- x. How does mindfulness play a role in cultivating temperance?

Suggestions for Reflection

Four cardinal virtues form the basis of ethics first described by Plato (427-348 BC) and elaborated by Aristotle (384-322 BC). They are:

1. **Prudence:** Practical wisdom and right judgement; the virtue that disposes the practical reason to discern in every circumstance our true good and the right means for achieving it.
2. **Justice:** Righteousness and fairness; the virtue that consists in the firm and constant will to respect the rights of each and give to others their due.
3. **Fortitude:** Courage and steadfastness; the virtue that ensures firmness in difficulties to overcome obstacles and constancy in the pursuit of the good.
4. **Temperance:** Self-control and healthy-minded sobriety; the virtue that moderates the attraction of the pleasures of the senses and provides balance in the use of created goods.

Cardinal virtues are a habitual and firm disposition for one to do good and become the best version of oneself to attain happiness and well-being. They grow through education, deliberate acts, and perseverance in struggle, and enables our experience of ease, self-mastery and joy.

Temperance is the virtue which moderates in us the inordinate desire for pleasure, keeping it within the limits assigned by reason and voluntary self-restraint.

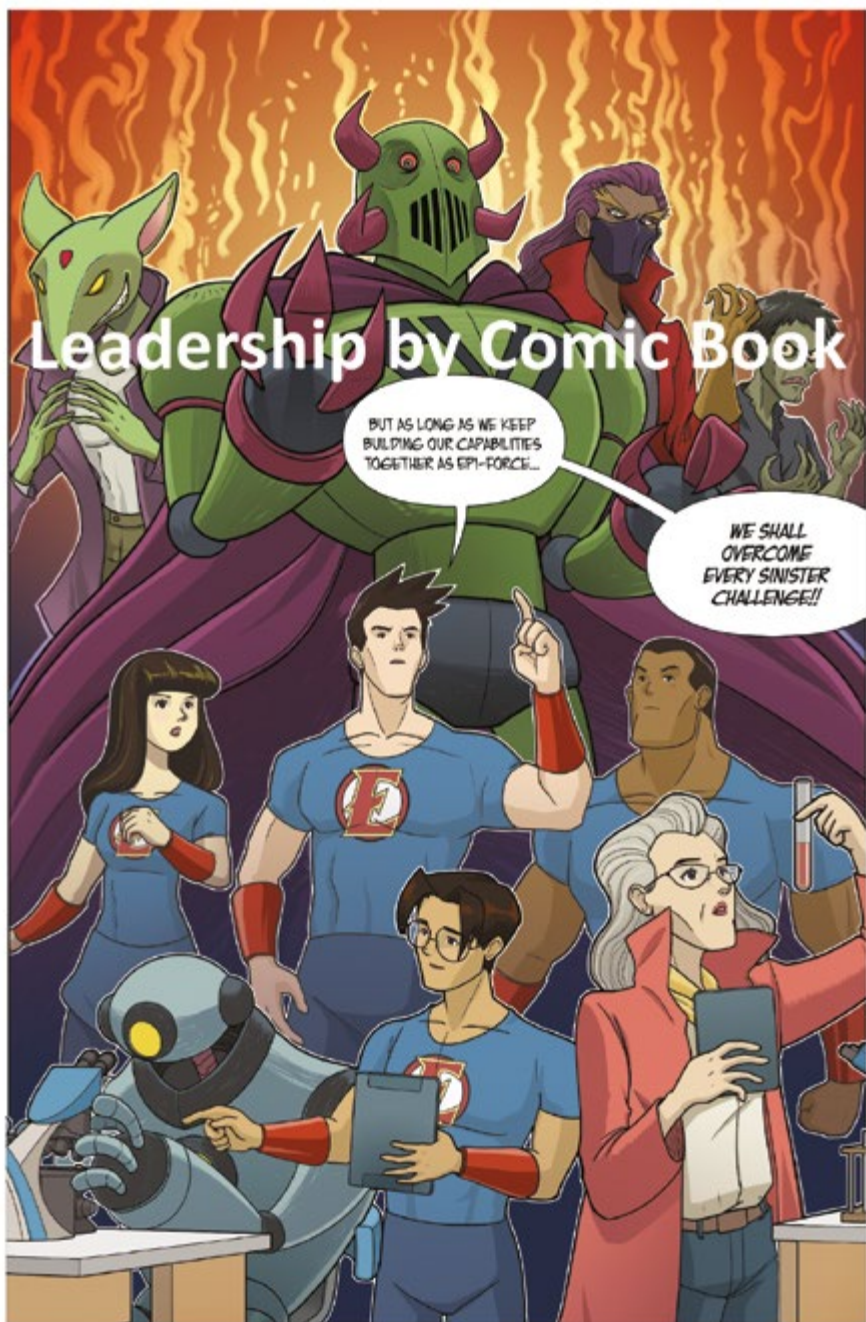
When faced with the temptation of excessive physical pleasure, temperance allows us to keep from excess. It takes our wildly free senses and pulls them back into control, harnessing them with the reins of reason. Below are three steps to the path of temperance.

Take less than you want: Again, this may not be fun at first. After all, you may really want three scoops of ice cream. Take less than you want, though, and savour it. Do this repeatedly, and you will begin to wonder why you ever needed more.

Tell yourself 'no' altogether: The world will tell you that you deserve to indulge yourself, that you are entitled to the maximum amount of pleasure. That simply isn't true. Next time you want to indulge yourself, just say 'no'. Again, the point of this is not just a joyless self-denial, but rather a positive learning of self-control that will teach us to enjoy less more.

Get comfortable with being uncomfortable: One of the biggest enemies of our spiritual lives is the love of comfort. While it may not sound like much fun, the only real way to become temperate is through self-denial. In other words, you have to tell yourself 'no' now and then. If we practice temperance, we will find that we actually enjoy things more and not less. Temperance will lead us to a new gratitude and satisfaction that we could never find in self-indulgence.

Temperance must be learned through practice. It is peaceful when all of our appetites are controlled by reason and are working in harmony. We are not controlled by restless cravings and desires anymore. Instead, we are able to do what we really want to do rather than what our passions keep telling us to do.



Workshop Musings

What defines me? Integrity, courage, humility, resilience

What do I share? Respect, teamwork, collaboration

What can I discover? Responsibility, compassion, dedication

Here, we pay a tribute to the legends of Marvel and DC Comics by gleaning lessons from simple observational epidemiology!

1: On Integrity Who Shall Be Thy Leader?

2: On Courage Is The Dark Knight Brave or Batty?

3: On Respect Failing Femmes Fatales

4: On Teamwork Fantastic Teamwork

5: On Collaboration Beware Your Green Lantern Power

6: On Responsibility How Amazing Can You Be?

7: On Compassion Warrior Philosopher, Wonder Woman?

8: On Dedication Super Justice Leaguer for a Cause

9: On Humility Daredevil, Be Yourself

10: On Resilience How Wolverine Are You?

Super Bonus: Sage advice for aspiring live action heroes!

1: On Integrity



Who Shall Be Thy Leader?

Avengers, assemble and take me to your leader!

Of all the heroes in the Avengers, who would you trust as your leader? Thor? Iron Man? Captain America? Or Nick Fury? Studies show that most choose Captain America! What is it about his character? Those unfamiliar with comic book history may assume that Captain America is a simplistic flag-waving patriot and government supporter (like what the public thinks of us public health types). Comic book fans know better.

It goes back to why he was chosen to be a super-soldier in the first place—embodying moral courage, sincerity and honour long before he had obtained strength of body through the serum. More than any other action hero, he had shown integrity.

Here are the leadership alternatives. Thor, the most royal, used to relish how being a leader made people revere and worship him, before his pride was broken. Since then, he struggled with loyalties in two worlds.

Iron Man may have some of the best dialogue and toys, but Tony Stark is a tad too egocentric. Wealth, good looks, charisma, an impressive house and power only go so far.

Hulk is the biggest, the strongest and the easiest to anger. People with rage do not inspire. His alter ego, Bruce Banner, is also the smartest, but he keeps distancing himself.

Nick Fury is very well networked, but too mysterious and also too busy spying on everyone else's business. And Black Widow and Hawkeye are both extremely tough, hardened assassins who have innocent blood on their hands and consciences.

In summary, Captain America is not the strongest, nor richest, nor best networked, nor toughest, nor even the best dressed. But he symbolises something that people seek in a leader—integrity and the character it builds.

The embodiment of integrity is one who most understands duty, responsibility and honour. Integrity is about being consistently honest in what you do, whether anyone is watching. People with such character are the ones most willing to sacrifice and put themselves on the line. They are also the ones people can most likely trust to do what is right. And others follow by example.

Integrity. Don't leave home without it.



2: On Courage



Is the Dark Knight Brave or Batty?

Bruce Wayne is Batman, a founding member of the Justice League of superheroes, representing the brooding good and the evil in all of us. This action hero reminds us of our constant struggles in life and our fears hidden deep within. He also represents courage—the conviction to confront fear and to act rightly in the face of opposition, for the good of others.

Experiencing the tragedy of his parents' death as a young boy, Batman devoted himself to a lifetime mantra to defend the weak and innocent. Three of Batman's best lessons for public health leadership deal with courage.

Firstly, understand fear. Everyone is afraid of pain, danger or uncertainty, and rightly so. All creatures fear. We are all afraid, but the real test is getting on with our lives despite the fear. Batman embraced his fears and made villains share his dread.

Secondly, strive to know yourself better daily. Bruce Wayne and Batman are one complex—is his real face that of a billionaire playboy or a vigilante against crime? In front of our friends and co-workers, we too have adopted a persona. Just as Batman struggles to find his true identity, so must we.

Thirdly, be willing to sacrifice in order to achieve higher meaning. Batman sacrificed wealth to train for years to fight criminals. He sacrificed the love of others to prevent putting loved ones at risk. He did all this knowing he would never get recognition for his actions.

Batman does not have superhuman strength nor the ability to fly. Because he is just a human, his bones and heart can be broken. He struggles like we do in making choices between what is good for self and what is good for others. But Batman is a hero because of what he does.

Seek courage. You do not need superpowers to become a hero, just some skill and a will to overcome.

Be brave in your own way.



3: On Respect



Failing Femmes Fatales

Femmes fatales are seductive women whose charms ensnare lovers in bonds of irresistible desire, often leading them into compromised situations. They seem to gain power quickly and easily if they are willing to act without the constraints of morality.

Examples? Take Catwoman. She is a whip-carrying burglar with a taste for high stakes theft and an adversary of Batman, known for getting into complex love-hate relationships.

Black Widow is a cold and calculating ex-Russian agent trained as a superspy, martial artist and sniper, and outfitted with an arsenal of high-tech wrist weaponry. Elektra is a female ninja assassin who wields a pair of bladed sai as her trademark weapon and is characterised by her violent nature and mercenary lifestyle.

We live in a world where expediency has become an acceptable basis for action. Each person committing a heinous act has rationalised valid reasons why the result justifies the means. Respect for others as human beings is lost.

We need to be mindful of others, which includes the ability to understand and share the feelings of another before we do things. Empathy is not judgemental. Marcus Aurelius famously said, "Whenever you are about to find fault with someone, ask yourself the following question: What fault of mine most nearly resembles the one I am about to criticise?"

To build a relationship can take years but it takes only seconds to lose it, so never allow yourself to ever do anything expedient that would damage trust in you. A person's lack of consideration for others may not catch up with him or her today or for many more years, but there will be a moment of truth. That person has lost an ability to be trusted, which is a valuable quality in life.

Always show respect for others. Do what is right. The alternative only adds to society's loss of respect for each other's human dignity, and it is unsustainable.

Do what is right, let the consequences follow.



4: On Teamwork



Fantastic Teamwork

Teamwork only works when there is trust. The Fantastic Four, an iconic hero team, helped to usher in a new level of comic book realism in teamwork. But what makes a team fantastic? In a nutshell, trust and loyalty. Here are some pointers for us.

Be trustworthy yourself. Trust is achieved not by words or promises, but by the direct experience of others. In a team, our character is always on display. Over time, team members inevitably note what you do and if you adhere to what you say, and whether you share their core values. And if we let pride get the better of us, expect failure.

There is always a confidence building phase for team members who do not know each other well. One who trusts you will spread that trust to others. Others who now sense you will not harm them or their reputation, will go the extra mile with you.

Pay attention to what your team members are trying to tell you, directly or indirectly. Even if we already know everything (really, do we?), always be respectful and receptive. You might actually find a new view or solution to a problem plaguing you.

Keep your distance from people who are not trustworthy. Why? Because we become more like those we surround ourselves with in our day to day. If we go with people who are dishonest and willing to cut corners, then we'll surely find ourselves following a pattern of first enduring their behaviour, then accepting their behaviour, and finally adopting their behaviour.

And understand this, fantastic teamwork means working collaboratively for a common purpose, putting team interest above self-interest and going out of our way to make each other look good, feel good and be good. Most of us stop after the first part!

Trust and loyalty then brings along with it opportunities and possibilities. There is always something new you can contribute towards building teamwork. People will follow your lead and will be interested when it is evident that you understand the big picture.

Perhaps you can make plain the greater vision, nudge people back on course and do good quietly.

Remember, the trust others give you is priceless.



5: On Collaboration



Beware Your Green Lantern Power

The dynamics of the Justice League highlight how we need to have collaboration with others and be energised by something much larger than ourselves.

Green Lanterns are heroes from the DC Comics universe, all of whom are characterised by a power lantern and the ability to create solid constructs with its associated ring. Each Green Lantern protects a sector of the universe and exercises control over the physical world as long as the superhero has the willpower and strength to wield it.

Like the Green Lanterns, we are often thrust into situations of leadership even when we do not actively seek it. We must then learn to bring everything into a good light and energise others. Five talents for public health leadership are: (1) Knowing-interpreting; (2) shaping-organising; (3) networking-connecting; (4) mentoring-nurturing; and (5) advocating-impacting. They are useful in modelling the way, inspiring a shared vision, challenging the process, enabling others to act and encouraging the heart.

Collaboration is a cooperative working relationship of colleagues that let the others know they matter. The ability to energise is not a function of personality; it has to do with interaction. Even a shy person can energise. Energisers create a compelling vision of possibilities, learn from each other and help all to engage. They also maintain integrity between words and actions, and are open to progress in unexpected ways. Their energy influences the belief that common goals are worth attaining.

When colleagues hear a suggestion which they disagree with, instead of dismissing it outrightly, they will search for what is good in that suggestion. Do your best to be collaborative and respectful towards others, and you will exercise power.

Beware your power, Green Lantern's light!



6: On Responsibility



How Amazing Can You Be?

Peter Parker is just an average guy facing tough situations in life. We can relate to him. He loses his parents, then his uncle Ben (a father figure to him). He loses his job several times and his girlfriend. And he gains powers suddenly through a quirk of fate unlike the way many people become leaders.

The Amazing Spiderman's credo, "With great power comes great responsibility", is one that many comic book fans know. The selflessness and altruism that makes Spiderman a force for good in the world is pretty much the same one that can make leaders a force for good in any organisation.

You will always be accountable for the wellbeing of others, no matter how little power you have or think you have. Much as Peter wants to walk away from his responsibilities, he cannot. Generosity of spirit. You can probably relate to that.

As you acquire power in an organisation, you have increasing opportunities to make decisions and act in ways that are self-serving, short-sighted and reactive. This hurts others either personally or professionally. However, you can also choose to make decisions and behave in ways that are generous, far-sighted and thoughtful for other people's growth and success.

The altruist is faced with temptation every day. He or she has to make hard choices between doing what is in his or her own best interest and what is right for the organisation. Leaders know that at the end of every day, they will have to honestly judge themselves and be held accountable. And perhaps, take pride in being able to say, "Today I did the best I was capable of doing."

Great leaders know that they have a deep human obligation to use the gift of power for the greater good. Face up to it, stay the course and succeed. That is indeed amazing.

Exercise your power by being responsible.



7: On Compassion



Warrior Philosopher, Wonder Woman?

One of the original members of the Justice League, this superhero is a warrior philosopher who battles villains across the global stage, bringing justice and compassion to society, and capturing the popular imagination of comic book fans.

For a superhero with multigenerational and cross-cultural appeal, Wonder Woman is associated with female empowerment and is seen as an icon that fosters a clear sense of identification and brand awareness. What can we learn from her?

Wonder Woman represents a very tough society of women known as the Amazons—but one that embodies nurturing and compassion. As William Marston, the creator of Wonder Woman, has mentioned, “Not even girls want to be girls so long as our feminine archetype lacks force, strength and power. Not wanting to be girls, they don't want to be just tender, submissive, peace-loving as good women are. Women's strong qualities have become despised because of their weakness. The obvious remedy is to create a feminine character with all the strength of Superman plus all the allure of a good and beautiful woman.”

Wonder Woman is interesting because she is an alternative role model for girls. She is a symbol presaging the radically different future from the premodern times in which she was conceived. As movie director, Kristy Guevara-Flanagan has observed, “I think girls need heroes that are physical just as much as boys do. We need to take down our villains, too. And there are not a lot of female heroes out there who do that.” Wonder Woman is indeed an archetype for gender equality, justice and nurturing—the kind of woman who will eventually influence the world.

Compassion, expressed in more ways than one.



8: On Dedication



Super Justice Leaguer for a Cause

Commitment clearly requires forward-looking determination and thinking ahead with dedication. Superman, another Justice Leaguer, epitomises this in his pursuit of truth and justice. Through exemplary devotion to duty, and loyalty to the cause, he embodies some of the most enduring ideals embedded in our moral fabric.

A prominent theme in the movie, *Man of Steel*, has been to work at what is believed to be right. Clark Kent, an orphan whose Kryptonian name is Kal-El, does exactly this many times when making choices between humanity and his home planet Krypton.

Superman is the self-appointed defender of his adoptive planet Earth, so the world knows where his loyalties lie. He works hard to earn the good people's trust and prove that he is not a threat to them. He believes in defending humanity.

Like Superman, you too have to decide for yourself in public health which is the right path, and act accordingly. No one else can decide for you. Choose goals which best align with your personal beliefs and dreams. Dedicate yourself with determination. And be prepared to accept the consequences.

When you first meet people, whether colleagues or peers, they are not going to know what to expect from you. Can they count on you to do the job? Will you stick with them for the long-term? Whatever the circumstances, you need to prove yourself to be dependable. The amazing thing about Superman is that, after so many decades, his ideals remain relevant. He reminds us not to lose sight of the virtues and time-tested values of society.

We can agree between us on the importance of commitment, even as we agree to disagree on their interpretation.

We can agree that fairness and tolerance define us, even if we disagree on their balance.

And we can agree that devotion to duty has its place, even if we disagree on how far to go.

Commit yourself to shared public health values.



9: On Humility



Daredevil, Be Yourself

When Daredevil got catapulted into hero-dom, he struggled with his new identity to be responsive beyond self interests. It took him humility to figure out how to be himself—geeky, smart, compassionate, shy Matt Murdock—and still be an action hero.

Most of us who get thrown into public health leadership roles go through a similar struggle. Who am I as a leader? Do I have to be a different person? Must I pretend to know all the answers, never let them see me sweat, work till midnight and tell people what to do all the time?

Humility is knowing ourselves and not having an inflated self-image. We are comfortable in our own skin and are realistic in our own gifts or lack thereof, and this allows everyone to operate without pretensions. The leader must dare to be authentic because it otherwise feels awkward and fake.

Get this: Evil exists. Big time. And you better believe it. On occasion, you must stand alone for what you know is right. Evil, when it comes to your door, will probably look a lot like the good stuff. Do not be naive, neither be stupid. The right choices are not that easy, and not everyone you encounter would want to be your personal fan. But you know in your heart of hearts what you stand for, what you believe in and what you must do.

Good leaders realize that there are skills they must practice to be effective. Get more training. Attend classes, read books, write, talk to people in the industry, meet people in other industries. Like Daredevil, be aware of our limitations and never stop improving ourselves. Leave no doubt that you are the best version of you always. Then be exactly who you are.

You have much to contribute to the world. Do not sit on your gifts, nor wait forever to use them. A world that needs your help to change is waiting for you to arrive.

Respond, in humility, with exactly who you are.



10: On Resilience



How Wolverine Are You?

How adaptable are you? When it comes to resilience, defined as the ability to recover from adversity, Wolverine is right there among the most durable of characters. This brooding Marvel Comic anti-hero is as tough as one can get.

Wolverine possesses a healing factor that lets him recover from virtually any wound, disease or toxin at an accelerated rate. Like Wolverine, leaders too must be quick to bounce back. Leadership is not a popularity contest and no leader is going to get it right all the time, so they must be able to handle negative perceptions and setbacks.

Our friend also has animal-keen senses which allow him to perceive danger before anyone else. And is that not required of a good leader? They must be able to 'smell' danger or an opportunity whilst everyone else is going about the business of managing each day.

In addition, he enjoys enhanced physical capabilities. While leaders do not need to possess rippling muscles, the effective ones do project energy and persistence, which inspires others.

Wolverine is famous for his brooding nature with sharp blades that shoot from his hands to defend or attack. Many of us have the equivalent of sharp blades in the form of a sharp tongue. Our 'sharp blades' include a cutting comment, an incisive observation or come in the form of ferocious feedback. The wise among us learn to smile, use the 'sharp blades' sparingly and retract them when not needed, critical skills for leadership.

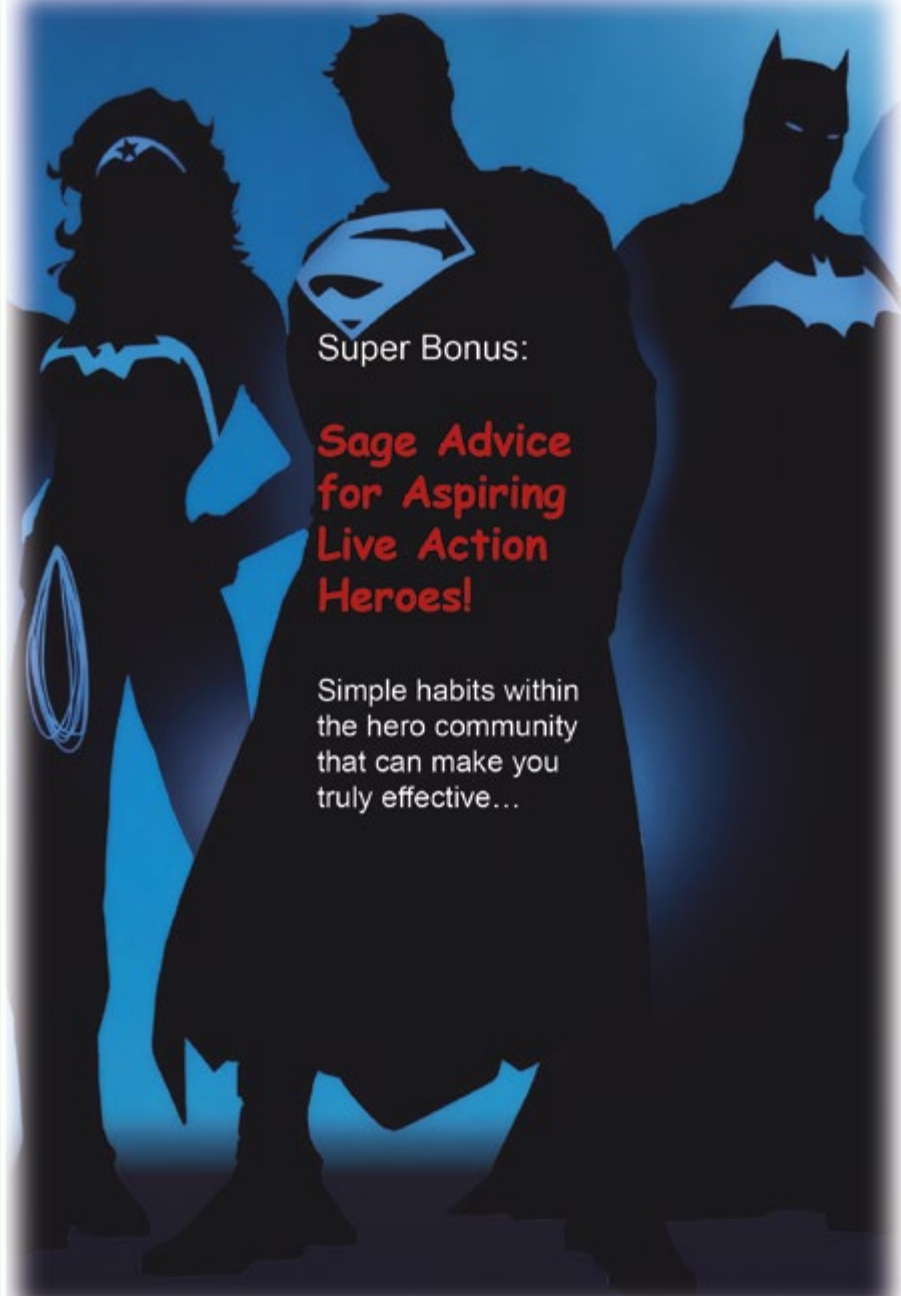
The Wolverine character appears in both *X-Men* and *Avengers*, showing that although he is a strong individual, he can also work as part of a team, which is essential for today's leaders.

But in public health, leaders are not Wolverine because Wolverine is prepared to use deadly force rather than diplomacy. Also, Wolverine is a mutant while public health leaders are humans with all the accompanying weaknesses.

Wolverine—*independent, proudly self-reliant and vicious when provoked. But also sensitive to others and the situation at hand, knowing when to hold back and when to unleash. Such a being can run out of things to live for, especially when he lives forever. Unless a higher calling brings meaning and fulfillment.*

So, ask yourself, how Wolverine are you?





Super Bonus:

**Sage Advice
for Aspiring
Live Action
Heroes!**

Simple habits within
the hero community
that can make you
truly effective...



**"First they ignore you, then
they laugh at you, then they
fight you, then you win."**

— Mohandas Gandhi

“We must prepare ourselves to shoulder our heavy responsibilities so that we and our future generations may benefit by it.”

– Yusof Ishak

“A society to be successful must maintain a balance between nurturing excellence and encouraging the average to improve.”

– Lee Kuan Yew

“When a tool controls someone, that person becomes a tool: a commodity on the market and, in turn, a piece of merchandise. Only genuine relationships and stable connections can build good lives.”

– Pope Leo XIV



“Our deepest fear is not that we are inadequate. Our deepest fear is that we are powerful beyond measure.

We ask ourselves who am I to be gorgeous, brilliant, talented, fabulous.

Actually, who are you not to be?”

– Marianne Williamson



Image retrieved from BuzzFeed

Can we self-transform from super zero to action hero?



Call on your ten professional traits when leading and you'll know what to do, anywhere!



***Leadership by Comic Book is a product of
Survivor School***



EPI-logue: Trainer-Mentor Guides

Introduction

The Trainer-Mentor Guides comprise of a series of three Guided Learning Road Maps providing insights into the core components of applied epidemiology training which we have worked on together for over 15 years.

We wish to place on record grateful thanks to all our colleagues, local and overseas, who have contributed to this document in one way or another and shared their valuable insights on integrated disease surveillance as well as on capstone projects. Their professionalism and collegiality help to maintain Singapore's high standards in the outbreak. It was a pleasure for us to work together.

In particular, our sincere appreciation goes to the US CDC's Global Health Center for their significant contributions to field epidemiology training and workforce development. Their curriculum development team at the Workforce and Institute Development Branch meticulously documented the FETP-Intermediate Guide to Participant Field Projects and other materials, which we have creatively adapted using the One Health approach to ensure comparable learning experiences.

We also acknowledge the indispensable contributions of the US Epidemic Intelligence Service (EIS). Their epidemiology competency-based curriculum team provided a valuable resource with the documentation of the US EIS Curriculum, from which we have incorporated critical elements to achieve equivalence in our epidemic intelligence proficiency.

Being part of the Global Field Epidemiology Partnership, NCID Academy serves as an incubator for multisectoral and transdisciplinary training using novel methods and shares its experiences on progressive educational innovations regionally and globally. We thank all who have contributed their subject matter expertise and untiring professional efforts towards global health protection. We adapted pertinent elements to modern urban lifestyle contexts, ensuring a relatable and aligned learning experience. Without the support and collaboration of our many partners, this ambitious goal would undoubtedly have not been attainable.

Steven PL Ooi
Alden Henderson

Communications and Reporting Primer

Guided Learning Road Map A

TRAINING OBJECTIVES

This learning road map provides resident trainees and their Trainer-Mentors with guidance on completing ten foundational tasks in communications and reporting. Public healthcare events are often unpredictable and arise from time to time for residents to opportunistically build their skill sets. Trainer-Mentors are expected to check in regularly with residents to ensure their resident acquires skills, experience and confidence.

Tasks	Learning Coverage
Surveillance Summary Report	Describes disease burden, trends and reports data quality indicators on a weekly basis for priority diseases at the local level.
Case Investigation Report	Timely and accurately summarises the methods and results of a case investigation, and comments on the potential for spread.
Data Quality Audit Report	Reviews the quality of data from a disease or public health event reporting source and evaluates the data reporting and data management processes.
Problem Analysis Report	Provides details of a surveillance data quality problem resulting from the Data Quality Audit Report and recommends potential solutions to help address the data quality problem.
Programme Evaluation	Describes a health programme's strengths and limitations and makes recommendations for improvement.

Tasks	Learning Coverage
Abstract Writing	Summarises study.
Oral Presentation	Delivering the results of an epidemiological investigation/study to a scientific audience.
Poster Presentation	Delivering the results of an epidemiological investigation/study to a scientific audience.
Epidemiological Bulletin Article	A brief report of an epidemiologic investigation/analysis for publication in a public health bulletin or peer-reviewed journal for fast public access.
Scientific Manuscript	A written document that communicates the relevant details of an epidemiological investigation/analysis that will be submitted for publication in a peer-reviewed journal.

The Trainer-Mentors help their residents by providing feedback and evaluating their performance on a variety of tasks as outlined in this guide:

- I. Surveillance Summary Report
- II. Case Investigation Report
- III. Data Quality Audit Report
- IV. Problem Analysis Report
- V. Programme Evaluation
- VI. Abstract Writing
- VII. Oral Presentation
- VIII. Poster Presentation
- IX. Epidemiological Bulletin Article
- X. Scientific Manuscript

I. SURVEILLANCE SUMMARY REPORT

Background

Residents are expected to generate surveillance reports that identify diseases or public health events to be tracked and analysed. Residents will then obtain at least three weeks of historical data to combine with three weeks of field data for the specific disease condition. After generating their report, residents will act on their recommendations to improve the system and present their findings to a scientific audience.

Recommended Format

The weekly reports should incorporate the following topics, when applicable:

Summary of the Week:

- Includes 2-3 key points about the week, such as:
 - Total number of cases of immediately reportable diseases or public health events
 - Number of facilities that provided the data
 - Expected trend focus for the upcoming week

Facility Weekly Reporting Table:

- Includes facility name and type (e.g., polyclinic, hospital)
- Details reporting status for each week by calculating the percentage of timely reporting by facility and verifying that zero reporting is truly zero, creating a table showing percentage of timely reporting statistics by facility and colour coding them appropriately

Weekly Disease or Public Healthcare Event Summary Report:

- Lists reportable diseases or public healthcare events for the district
- Shows current and cumulative data for the number of suspected and confirmed cases, deaths and case fatality rates
- Meets reporting requirements
- Includes comments to clarify cases and lists all reportable diseases or public health events

Graphs:

- Demonstrates cases and deaths of diseases or public healthcare events weekly

Comments:

- Includes important details not included in charts (e.g., confirmed and suspected cases recorded for specific diseases)
- Potential areas for comment include:
 - Describe what, where and when of each finding
 - Describe trends in previous reporting periods (i.e., is the trend declining/improving, plateauing, remaining the same, or escalating/worsening situation?)
 - Explain the observed trend (i.e., is there an established outbreak? Does the trend suggest an outbreak that requires an investigation? Does the trend occur from a course of action that has been taken? Does non-reporting occur or are there other possible reasons?)
 - Include the status and results of samples sent to the lab
 - Be clear about the numbers reported in the summary and the suspected/confirmed cases
 - Explain trends in morbidity and mortality
 - Describe any necessary public health action to be taken
 - Describe prior public health actions taken
 - Describe any surveillance challenges with compiling the report and with conducting any response activities (e.g., no lab ready to take samples, delay in receiving reports)

Trainer-Mentor Responsibilities

The following list of actions are how Trainer-Mentors can support their residents in developing a Surveillance Summary Report:

- Provide guidance to residents in creating the weekly report
- Provide technical assistance before, during and after data collection and analysis
- Review Surveillance Summary Reports and advise on issues regarding silent facilities, timeliness and event occurrence
- Evaluate the Surveillance Summary Report based on the Evaluation Criteria
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Surveillance Summary Reports that they receive.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable or outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
Summary of the Week	Includes 2-3 key points that summarise the week (5 = yes, 1 = no)
Facility Weekly Reporting Table	Includes facility name and type (dispensary or health centre) (5 = yes, 1 = no)
	Includes reporting status for each week
	Includes percentage of timely reporting statistics
	Improves readability by colour coding 'Late', 'Timely' and 'No Reporting' categories

Category	Criteria
Weekly Disease or Public Health Event Summary Report	Details reportable diseases or public health events for the district
	Demonstrates current and cumulative data for number of suspected and confirmed cases, deaths and case fatality rate
	Meets zero reporting requirements (5 = yes, 1 = no)
	Comments section includes important details not included in chart (i.e., confirmed and suspected cases recorded for specific diseases)
Graphs	Line graph includes descriptive title, legend, X and Y axis labels
	Graph plotting accurately reflects data from weekly reports
Comments	Includes additional clarifying comments on information presented if necessary
General Form and Clarity	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	The writing is in paragraph form and does not use bullet points as in a presentation (5 = yes, 1 = no)
	Provides a description of acronyms before they are used (5 =yes, 1 = no)

II. CASE INVESTIGATION REPORT

Background

The resident will need to develop a Case Investigation Report which accurately summarises the methods and results of a case investigation in a timely manner and comments on the potential for spread. To develop a report, the resident will interview potential cases and conduct a thorough investigation. The case investigation form may be provided by local public health authorities. A Case Investigation Report should notify proper authorities of inconsistencies in surveillance data and problems in reporting to improve timeliness, accuracy and completeness of reporting. After completing a Case Investigation Report, residents prepare an Oral Presentation to discuss their investigation. Residents will summarise their investigation findings using the format below:

Recommended Format

Residents should use a Case Investigation Form to record data for a reported case. If no form is available, residents can develop one. After interviewing the case, residents should submit a Case Investigation Report with the following information:

Background:

- Introduces the topic and includes objectives of the investigation

Methods:

- Details the approach taken to investigate cases

Results:

- Explains the findings from the case investigation using data collected

Conclusion:

- Summarises the case investigation process and its findings

Recommendations:

- Lists appropriate course of action to address identified needs

Public Healthcare Actions:

- Details what action has already been taken by the residents

Trainer-Mentor Responsibilities

The following list of actions details how Trainer-Mentors can support their residents in developing and using a Case Investigation Report:

- Provide tips on how to interview cases
- Assist residents with interpreting data if there are anomalies in the surveillance data
- Assist residents in preparing for a case investigation
- Help residents decide the report format they should use
- Review Case Investigation Reports and advise accordingly
- Evaluate the Case Investigation Report based on the Evaluation Criteria
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Case Investigation Reports that they receive.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable or outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
Methods of Data Collection	Case investigation form used (5 if yes, 1 if no)
	Includes multiple methods of data collection (chart review, case interview, interview family members, observation, etc.)
Case Investigation Execution	Investigation was timely, based on detection date
	Takes language and cultural barriers into consideration
	Includes ordered laboratory test and its results
	Includes timely case reporting to next level
	Includes feedback given to the health facility
	Completes follow up with case(s)
General Form and Clarity	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	The writing is in paragraph form and does not use bullet points as in a presentation (5 = yes, 1 = no)
	Provides a description of acronyms before they are used (5 =yes, 1 = no)

III. DATA QUALITY AUDIT REPORT

Background

The Data Quality Audit reviews the quality (completeness, timeliness, accuracy, etc.) of data from a reporting source. This includes an assessment of the data reporting and data management processes. Residents are expected to visit at least three facilities that report the disease or public healthcare events to conduct a data quality audit. The audit should be customised to fit the local setting and disease. The audit should include a list of recommendations to improve the data quality (methods are listed below). After completion of their report, the residents should give an Oral Presentation of the Data Quality Audit Report.

Recommended Format

To complete a Data Quality Audit Report that meets programme standards, the resident should submit a Microsoft Word document with the following information:

Introduction:

- Background:
 - Explains why the audit was necessary and worth doing
 - Describes objectives of the audit (i.e., to identify gaps in surveillance data quality and take necessary steps for correcting them)
- Methods:
 - Includes who was interviewed
 - How observations were made
 - Details the time and location of the audit
 - Describes the data flow, what is reported, by whom, when and to whom
 - Include the data collection instrument

Data Quality Audit Worksheet:

- Includes forms the resident completed at the facilities

SWOT Analysis/Results:

- Details Strengths, Weaknesses, Opportunities and Threats (SWOT) for each facility's ability to report cases and data available for completing Case Investigation Form

Recommendations and Outcome:

- Explains how to improve surveillance data quality at each facility

The resident should also follow the recommended format below for Oral Presentation:

- A summary of the introduction
- The facilities the resident visited and why
- The people that were interviewed
- A combined SWOT analysis across the facilities included
- Data quality improvement recommendations
- Actions the resident has taken thus far
- Improvements observed since resident intervention

Trainer-Mentor Responsibilities

The following list of actions details how Trainer-Mentors can support their residents in developing a Data Quality Audit Report:

- Ensure that the resident chooses an appropriate topic
- Ensure that the resident contacts the programme that will occur in the data audit and obtain their permission to conduct the data audit
- Work with resident to customise the standard Data Quality Audit Worksheet. The Trainer-Mentor should consider the local setting and assist residents with establishing a schedule to conduct the data quality audits
- Ensure each resident visits at least 3 sites and supports the resident by going with them on their first site visit
- Conduct an after action review of the first site visit and advise on improvements for subsequent visits
- Provide technical assistance throughout the audit and assists residents with the analysis of key findings using the SWOT tool
- Evaluate the Data Quality Audit using the evaluation criteria below
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Data Quality Audit Reports that they receive.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable or outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
General	Facility information includes: Officer Name, Facility Name (5 = yes, 1 = no)
	Includes name, title and signature of people met and interviewed for the audit (5 = yes, 1 = no)
	At least some questions are answered for each of the 5 activities
General Form and Clarity	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	The writing is in paragraph form and does not use bullet points as in a presentation (5 = yes, 1 = no)
	Provides a description of acronyms before they are used (5 = yes, 1 = no)

IV. PROBLEM ANALYSIS REPORT

Background

Problem Analysis Report documents a surveillance data quality problem. The resident maps the causes of the problem and lists potential solutions in the Problem Analysis Report. The resident also recommends improvements to the appropriate authorities and if possible, implements the recommendations. Residents should prepare an Oral Presentation of the analysis.

Recommended Format

The components of the Problem Analysis Report include:

Problem Statement:

- Visually describes the cause and effect of the problem using a fishbone diagram
- The problem statement should state the problem and where it occurs

Contributing Categories to the Problem:

- Includes the following areas (depicted as fish bones on the diagram):
 - People/Staff issues
 - Environmental issues
 - Processes, procedures, rules, administrative regulations
 - Equipment/logistics/materials/hardware, etc.
 - Funding

Problems Under Each Category:

- Conduct a Totally/Partially/Not (TPN) analysis to help determine which problems can be solved (i.e., inadequate number of functioning thermometers can serve as a problem statement)

Critical Cause:

- Represents the problem (either Totally or Partially), which when solved, will solve a greater part of the problem

Improvement Recommendations:

- Suggest actions and owners to solve the critical cause and one or two other minor causes
- Present recommendations that are achievable and clearly provides a solution to the problem statement

Trainer-Mentor Responsibilities

The following list of actions details how Trainer-Mentors can support their residents in developing a Problem Analysis Report:

- Help the resident identify and select a quality problem from the Data Quality Audit Report
- Ensure resident understands Problem Analysis and the process to complete it
- Ensure resident communicates findings to appropriate stakeholders
- Evaluate the Problem Analysis Report based on the Evaluation Criteria
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Problem Analysis Reports that they receive.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable or outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
Problem Statement	Describes the problem and where it occurs accurately
Contributing Categories to the Problem	The number and type of causes indicate a thorough discussion of the problem
Problems Under Each Category	Uses the TPN (Totally / Partially / Not) process correctly
Critical Cause	Supporting evidence adds to the critical cause of the stated problem
Improvement Recommendations	Directly relates to stated problem
	Includes achievable improvement recommendations
	Includes recommendations likely to improve surveillance practice
Overall Structure	Problem analysis includes problem, context, strengths and barriers
	Correctly executes the fishbone diagram technique
General Form and Clarity	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	The writing is in paragraph form and does not use bullet points as in a presentation (5 = yes, 1 = no)
	Provides a description of acronyms before they are used (5 =yes, 1 = no)

V. PROGRAMME EVALUATION

Background

Programme Evaluation collects, analyses and uses information about the effectiveness and efficiency of projects, policies and programmes. The resident will gain skills on understanding, reviewing and recommending improvements in a public healthcare programme. The resident will then summarise their findings in a written report and an Oral Presentation.

Residents can focus their evaluation on health education, health promotion, active disease prevention (e.g., nutrition, immunisation), screening, training and workforce development for a programme at the national level or at an institution. The programme can be directed at individuals, institutions, environment, etc., but should not have been previously evaluated in the past three years. This process of evaluation by the resident must be useful to the programme that is being evaluated and the resident must share the report with the official(s) responsible for the programme.

Recommended Format

The components of Programme Evaluation include:

Written Report:

- An introduction which describes the programme
- Objectives of the evaluation
- Methods used to evaluate the programme
- Describes the results of the evaluation
- Interprets the results
- Lists the limitations of the evaluation
- Includes recommendations regarding programme quality and effectiveness

Oral Presentation:

- An Oral Presentation should summarise the results of the written report

Trainer-Mentor Responsibilities

The list below contains actions of how Trainer-Mentors can support their residents in developing a Programme Evaluation:

- Meet with the resident to discuss programme being evaluated
- Assess the feasibility of the evaluation
- Ensure that the programme will support the evaluation
- Review the drafts of reports before they are final
- Ensure that officials responsible for the programme receive a copy of the report
- Arrange time for resident to present findings to those responsible for directing and, if possible, operating the programme (field supervisor and academic supervisor should also be present)
- Evaluate the Programme Evaluation based on the Evaluation Criteria
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Programme Evaluations that they receive.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable and outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
Structure and General Clarity	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	The writing is in paragraph form and does not use bullet points as in a presentation (5 = yes, 1 = no)
	Provides a description of acronyms before they are used (5 = yes, 1 = no)

VI. ABSTRACT WRITING

Background

An abstract helps the reader quickly understand the purpose of a research article or report. The abstract contains the main results, methods, results and conclusion of the study. The full text is consulted for details. Abstracts are required for Outbreak Investigation Reports, Scientific Manuscripts and Surveillance Summary Reports.

The resident learns how to:

- Summarise complex scientific work into a short coherent message
- Customise the abstract based on the audience, further promoting the sharing of scientific results

Abstracts help to facilitate a quick review of the technical parts of a report. Abstracts identify the main points of a report for readers to decide reading the full paper. They also help readers understand an epidemiologic finding through an outline of key points for quick search and recovery in electronic databases.

Recommended Format

An abstract usually contains 100–500 words depending on the discipline and publisher requirement (excluding subheadings, title, authors). A complete abstract contains: 1) Background and rationale for study, 2) methods, 3) results, 4) conclusions and interpretation of results, 5) significance to public health and 6) recommended intervention and estimation of the impact.

Authors:

- Includes first author's (presenter) full name: full first name, middle initial, last name in that order (e.g., Jorge L. Lopez)
- Includes co-authors and lists each co-author in the order of contribution by typing one initial followed by the last name (e.g., G. Díaz, S. Barajas)

Title:

- Should be kept brief and meet the guidelines of the journal being submitted
- Avoid subtitles if possible
- Capitalises major words and the second component of hyphenated terms
- Does not use abbreviations or acronyms
- Gives geographic location (country, state or city) and dates of data collected

Background:

- Addresses the public healthcare significance of the subject
- Addresses the scientific background and rationale or objectives for the study

Methods:

- Reflects a step-by-step description of the physical work that was done to obtain data included in the results
- Does not include results in methods section

Results:

- Only include results that are related to the objectives
- Does not interpret the results
- Does not contain recommendations

Conclusion:

- Explains how the results support the objectives

Key Words:

- Includes 4-6 key words and uses terms listed in the Medical Subject Headings (MeSH) from the Index Medicus
 - (<http://www.nlm.nih.gov/mesh/meshhome.html>)

Common Errors

Below is a list of common errors in abstracts.

General:

- Includes a neutral boring title and only a summary of the methods

Background:

- Is too long and repeats what may be in the title

Methods:

- Labels what was done instead of describing it
- Includes the software used for the analysis and not the methods used to analyse the data

Results:

- Lacks sufficient data to support the conclusion
- Includes results that appear first in the conclusion section

Conclusion:

- Repeats data already presented in the results
- Includes recommendations that are not based on the data presented

Format:

- Exceeds the word limit
- Does not follow the recommended structure or the recommended format
- Contains references
- Is not self-contained
- Is not written using complete sentences

Trainer-Mentor Responsibilities

The following lists how Trainer-Mentors can support their residents in developing an Abstract:

- Evaluate the Abstract based on the Evaluation Criteria below
- Discuss developmental feedback with the resident
- Help residents submit Abstracts to scientific conferences

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Abstracts that they receive.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable and outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
Background	Clearly states the public healthcare problem or question that the study will help to resolve
	Presents key preceding data or issues to set the stage for the study (if necessary)
	Clearly states the objective(s) of the study
Methods	Clearly states epidemiologic comparisons
	Clearly states critical definitions (e.g., case definitions, main exposure)
	Purpose of the study and the research questions correspond with selected methods
	Clearly articulates sequence of methods simply
	Describes methods with precision and without undefined terms or jargon
Results	Study results and methods are logically described
	Summarises study results quantitatively (e.g., number of individuals in study, major findings on time, place and person)
	Uses epidemiologic measures for all direct or implied comparisons
	Uses comparisons that are epidemiologically correct to limit misinterpretation (e.g., rates vs proportionate frequencies, numerical estimates of risk and impact measures vs 'high' or 'low')
	Presents enough adequate data so the reader can reach a conclusion
	Organises results to assist the reader to reach a conclusion

Category	Criteria
Conclusions and Interpretations of Results	Conclusions are based on data
	Integrated with the key results
	Answers the problem and objectives stated in the background
	Presents findings consistent with existing scientific knowledge
Public Healthcare Significance	The study details an obvious application to improving public healthcare and the application is obvious to the reader without the need for complex explanation or extrapolation
	The study is sound (clear and strong results) and can be the basis for taking public health action
	The findings solve an immediate problem or build on existing knowledge (do not repeat what is already known)
	Uses clear criteria to stress the public healthcare significance of the problem
Recommended Intervention and Estimation of Public Healthcare Impact	Includes practical actions/recommendations/control measures derived directly from study results
	Recommends or reports public healthcare actions (e.g., initiating or enhancing prevention or other public health programmes, developing procedures, policies or legislation, implementing and strengthening public health surveillance systems)
	The study effectively documents the potential or actual public healthcare impact (e.g., reporting on process or outcome indicators: Number of persons treated, amount of increased resources devoted to a prevention activity, evidence of improvements in the operation of a surveillance system, estimation of morbidity or mortality prevented or ways in which the public healthcare actions were innovative)

Category	Criteria
Structure and General Clarity	Demonstrates clear and brief writing
	Demonstrates a logical sequence and cohesiveness among all Abstract sections
	Uses complete sentences
	Uses proper and simple terms to describe methods and discuss findings
	The Abstract is 275 words or less (5 = yes, 1 = no)
	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	The writing is in paragraph form and does not use bullet points as in a presentation (5 = yes, 1 = no)
	Provides a description of acronyms before they are used (5 = yes, 1 = no)

VII. ORAL PRESENTATION

Background

Oral Presentations communicate the key findings of epidemiologic studies, surveillance analysis or surveillance evaluations to an audience. Presentations given at national or international conferences are usually based on acceptance of previously submitted abstracts and are often delivered via presentation slides or on a poster (see Poster Presentation section). By giving an Oral Presentation, residents develop skills such as: Designing and delivering a scientific message to multiple audiences, communicating the link between research and action, and using technology to convey a message.

Recommended Format

Oral Presentations usually last 10-15 minutes, but presentation length is determined by the conference or meeting organiser. During an Oral Presentation, the most important findings of the scientific work are discussed. Depending on the time allotted for the presentation, each component should be adjusted to fit the overall length of the discussion. For longer presentations, additional time should be reserved for a question-and-answer period. An effective Oral Presentation covers the following categories: 1) Background, 2) methods, 3) results, 4) discussion/conclusions, 5) question-and-answer session and 6) overall style and delivery.

Below is the structure for a 10 minute Oral Presentation accompanied with a Microsoft PowerPoint presentation:

Title Slide (10-15 seconds):

- Provides a concise description of the topic, location and dates of the study, surveillance analysis or surveillance evaluation
- Lists the speakers and their affiliations
- Includes co-authors
- Should not be confused with an acknowledgments slide
- Includes agency or company logos involved with study

Introduction (1-2 minutes):

- Engages the audience
- Includes a problem statement
- Provides the rationale
- Establishes the relevance to public health
- Communicates essential information about pathogens, diseases and other background information
- Explains the objectives of the study, surveillance analysis or surveillance evaluation

Methods (1-2 minutes):

- Describes the design of the study, surveillance analysis or surveillance evaluation
- Describes the population involved with the study
- Describes the data
- Highlights the statistical methods for the study, surveillance analysis or surveillance evaluation

- Describes methods with precision and avoids vague language or jargon
- Uses figures (e.g., flow diagrams, tables, charts) to communicate key points
- Describes how data in the results section was collected

Results (3-4 minutes):

- Emphasises the most important findings of the study, surveillance analysis or surveillance evaluation
- Includes text, tables, figures and occasionally photographs
 - Uses text and bullet points for qualitative results
 - Uses tables and figures for quantitative data
- Present results that support the conclusion

Discussion (2-3 minutes):

- Connects the results to the objectives of the study, surveillance analysis or surveillance evaluation
- States main findings, but does not simply restate results
- Incorporates references from other studies, analysis or evaluations
- Includes limitations that affect interpretation of the results
- Discusses the public health importance of findings
- Offers specific recommendations for future work and public health response

Acknowledgements Slide (10-15 seconds):

- Identifies contributors not listed on the title slide
- Includes the same logos used on the title slide
- Thanks the audience

Tips for Developing Presentation Slides

Effective slides are simple, clear and visible to the person sitting on the last row. Each slide has one message. The following are tips for developing slides for an Oral Presentation:

Use recommended typefaces and font sizes:

- Use a Sans Serif font, like Arial, Calibri and Tahoma
- Font size may vary according to typeface used
- Example: Arial
 - Titles 36-40 pt.
 - Main bullet points 28-32 pt.
 - Sub-bullet points 24-28 pt.

Limit each slide to have a single focus or take-home message:

- Use the slide title to point out the message
 - Example: “Polio cases are down in Eastern Province” instead of “Results”
- For multiple points, use multiple slides

Avoid having too much:

- Information
- Colour
- Use of unnecessary symbols
- Animation and clip art

When using bullet points, ensure that slides:

- Follow the order of script text
- Use consistent verb tense
- Use a consistent style of bullet point and spacing for each level
- Capitalise the first word of each bullet point and sub-bullet point
- Use special effects (italics, special colours) only for emphasis

Keep the following in mind when utilising slides with colour:

- Contrast the font colour with the background colour (e.g., dark blue background with yellow titles and white text)
- Keep the total number of colours used to a minimum
- Use colour to enhance the interpretation of the data and not for decoration
- Avoid combining red and green backgrounds and text

Avoid the following additional elements:

- Titles that aren't in the same location on each slide
- Too many bullet and sub-bullet points—use no more than 6 lines of text per slide
- Full sentences instead of key words or phrases
- Serif Fonts (e.g., Times New Roman)
- Unnecessary boxes and grid lines in tables and charts
- Different text styles from one slide to another
- Decorative symbols, such as fancy bullet points
- Shadow text and decorative fonts
- 3D graphs and pie charts

Tips for Delivering Oral Presentations

The following represents a list of best practices for developing Oral Presentations.

Rehearse:

- Practice your presentation in front of critical reviewers

Speak slowly and project your voice:

- Speak at a pace that is easy to understand
- Breathe between sentences, phrases or before advancing to the next slide to keep a good pace
- Articulate speech, speak with energy and project to reach the audience

Look at the audience:

- Maintain eye contact
- Speak as though talking directly to a person

Explain all figures to the audience:

- Explain what the figures are showing and their significance

Thank the audience:

- Thank the audience for their time

Answer questions briefly and directly:

- Anticipate questions and prepare an answer before the presentation
- Take time to make sure the questions are fully understood
- Avoid the urge to tell the audience everything
- Do not provide unrelated information
- Don't be afraid to say "I don't know"
- You can prepare back up slides as a response to questions

Common Errors

- Preparing too late and having errors on slides
- Not giving oral presentations to colleagues to critique prior to formal presentation
- Not timing the length of the presentation to ensure it is not too long
- Reading the slides instead of describing the study
- Speaking too fast

- Not wearing respectful clothing appropriate to the conference
- Not checking the sound system and the podium prior to the meeting
- Not ensuring that there is a light on the podium to refer to notes
- Being unprepared for the presentation if the slides are suddenly not available
- Coming late to the conference
- Not looking at audience
- Use of filler words such as 'um', 'uh', 'well', 'so', 'you know', 'like', etc.

Trainer-Mentor Responsibilities

The following lists how Trainer-Mentors can support their residents in developing an Oral Presentation:

- Meet with resident to discuss appropriate topic(s) for the Oral Presentation
- Provide guidance and review drafts as the resident prepares for the Oral Presentation
- Arrange for practice rehearsal(s) with suitable colleagues
- Evaluate the Oral Presentation based on the Evaluation Criteria
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Oral Presentations following their completion.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable and outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.

Score	Description
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
Introduction	Clearly identifies the public health question (or problem)
	Clearly outlines the objectives
	Speaker captures the interest of the audience
Methods	Explains the study, surveillance analysis or surveillance evaluation design
	Uses appropriate statistical methods for the study, surveillance analysis or surveillance evaluation design
	Describes essential methods accurately and avoids vague words or jargon
Results	Orders the findings logically and clearly
	Does not include the results in the methods section
Discussion/ Conclusion	Discusses findings in the context of the objectives of the study, surveillance analysis or surveillance evaluation
	Cites other studies, analysis or evaluations
	States conclusions clearly and orders them logically (e.g., most to least important)
	Includes conclusions that were consistent with the data presented

Category	Criteria
Discussion/ Conclusion	Explains the most important limitations
	Does not include elements of the discussion section in the results section
	Recommendations follow logically from the data presented
	Recommendations are based on the interpretation of the data
Acknowledgements	Recognises co-authors, contributors and thanks the audience
Question and Answer Session	Answers questions fully and appropriately
	Answers indicate knowledge of the subject
Overall Style and Delivery	The speaker stays within the allotted time
	The presentation is well rehearsed so that the speaker did not appear to be reading
	The presenter speaks clearly at an adequate volume and appropriate pace
	The speaker establishes and maintains good eye contact with the audience
	The slides were nicely presented and easy to read and follow
	Includes graphics and figures that are relevant and appropriate
General Form and Clarity	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	Uses proper spelling

VIII. POSTER PRESENTATION

Background

A Poster Presentation at a scientific conference discusses the findings of an investigation, analysis or other activity conducted by the resident as part of his/her professional experience. To prepare for a poster presentation, a resident must develop their own poster and abstract summarising an investigation, analysis or other activity. Abstracts must be submitted in advance of the scientific conference. Apart from the poster itself, residents should submit a printed copy of their investigation, analysis or other activity findings. For Advanced Level residents, Poster Presentations must occur at a regional, national or international conference with a scientific, clinical or public health audience other than the FETP and Ministry of Health. Some conferences ask of the poster presenter to give a short, about two minutes, oral presentation on their poster.

Recommended Format

The Poster Presentation should follow the standard format of 'Introduction', 'Methods', 'Results', 'Discussion' (IMRD) and include public health recommendations and/or potential implications. The exact structure of the format should match the abstract. Please check with the conference for poster requirements.

Trainer-Mentor Responsibilities

The following lists how Trainer-Mentors can support their residents in developing a Poster Presentation:

- Meet with the resident to discuss appropriate topic(s) for the Poster Presentation
- Provide guidance and review drafts as the resident prepares the Poster Presentation
- Evaluate the Poster Presentation based on the Evaluation Criteria
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Poster Presentations following their completion.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guideline and is of a remarkable and outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
Structure and General Clarity	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	Provides a description of acronyms before they are used (5 = yes, 1 = no)

IX. EPIDEMIOLOGY BULLETIN ARTICLE

Background

A Bulletin Article (sometimes referred to as a Brief Epidemiologic Report) summarises an epidemiologic investigation in progress or one that was recently completed. A Bulletin Article can be written quickly and is easily accessible by the public and public health colleagues. While the sections are like a peer-reviewed manuscript, such as IMRD, the requirements for a Bulletin Article are not as rigorous and shorter. The Bulletin Article should be written quickly, during a period of days instead of the months that it takes to write a manuscript. National or regional epidemiologic bulletins are ideal for submitting this type of article.

The Bulletin Article should contain no more than 1,500 words, which is usually more than an article in peer-reviewed journals. The Bulletin should be concise and easy to read, include the events that occurred/led up to the outbreak, explain methods and immediate control measures that have been taken and provide a justification of the recommended control measures.

By completing the Bulletin Article, the resident learns how to:

- Concisely communicate public health data to inform action
- Translate research into recommendations that benefit the public
- Effectively use tables and graphs to display data

Recommended Format

The following structure is recommended:

Opening Paragraph:

- Summarises the main points of investigation
- Like a newspaper article, responds to questions of 'who', 'what', 'where' and 'when'
- Should describe any actions that have been taken
- This information should be covered in three to five sentences

Introduction:

- Provides context about the disease or public health event
- Includes the details of the events leading up to the outbreak in chronological order

- Details recent trends of the disease or public health event
- Explains pertinent clinical information

Methods:

- Describes the study's design and how the data was obtained
 - Includes the collection of samples for analysis in the laboratory
 - Should be concise (not as technical as a manuscript)

Results:

- Includes the most relevant results from descriptive and analytical data
- Includes the results that support the conclusions and recommendations in the discussion section

Discussion and Recommendations:

- Interprets the data—answers the 'so what?'
- Identifies the limitations and the lessons learned
- Provides clear and concise recommendations
- If the investigation is active, describes the remaining activities that are planned or are already occurring

Acknowledgements, References and Tables:

- These sections may be deemed appropriate depending on the publication

Common Errors

Below is a list of common errors found across Bulletin Articles.

General:

- Is too long
- Order of events is not logical
- Information is neither timely nor pertinent

Introduction:

- Lacks an opening paragraph

Methods:

- Does not present methods concisely
- Does not describe the activities remaining to be completed

Results:

- Does not clearly link the results and the recommendations

Discussion:

- Describes the recommendations in very general terms
- Mixes sections together (e.g., the results are recorded in the discussion section)

Acknowledgements, Figures, and References:

- Lacks acknowledgements

Trainer-Mentor Responsibilities

The following lists how Trainer-Mentors can support their residents in developing a Bulletin Article:

- Meet with resident to discuss appropriate topic(s) for the article
- Review the article and provide feedback on scientific content, effective writing and policy implications
- Evaluate the Bulletin Article based on the Evaluation Criteria
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Bulletin Articles that they receive.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable and outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.

1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
General	The article was submitted for publication in a timely manner (5 = within a month, 4 = within two months, 3 = within three months, 2 = within 6-12 months, 1 = after a year)
	The article contains no more than 1,500 words (5 = yes, 1 = no)
	The article was published (5 = yes, 1 = no)
	The article has general clarity and organisation
	The elements in each section are correct (e.g., the results are not mentioned in the discussion section for the first time)
Opening Paragraph	Answers the questions of 'who', 'what', 'where' and 'when' in four to five sentences
	Describes the public health actions that have already taken place
	Captures the reader's attention so that he/she is motivated to continue reading
Introduction	Describes the order of events in detail
	Places the event in the appropriate context (i.e., describing previously related events or recent disease tendencies)
Methods	Provides a clear case definition
	Clearly states the study's design
	Describes the methods utilised for collecting data
	Describes the laboratory participation in testing samples
	Presents the methods concisely and not too technically

Category	Criteria
Results	Limits the results to the most pertinent positive or negative findings
	Contains descriptive and analytical information
	Describes the laboratory results well and identifies what still needs to be done
Discussion	Discusses how the results are related to the study's hypothesis
	Describes the limitations of the study
	Clearly presents the recommendations which are practical
	Clearly justifies the recommendations regarding the interpretation of the results
	Discusses pending efforts regarding public health control and prevention
	If the investigation study is in process, describes what will need to happen in order to complete the study
Acknowledgements, Figures, and References	Includes clear and precise tables, maps, or other graphs
	Lists the acknowledgements (5 = yes, 1 = no)
	Presents references in a consistent format
Structure and General Clarity	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	The writing is in paragraph form and does not use bullet points as in a presentation (5 = yes, 1 = no)
	Provides a description of acronyms before they are used (5 = yes, 1 = no)

X. SCIENTIFIC MANUSCRIPT

Background

Manuscripts inform the scientific community about what happened in a scientific study, why it was done, how it was done, the results of the study and the meaning of the study. A manuscript is the most difficult piece of a resident's coursework to develop. Manuscripts require substantial individual effort to be published. However, manuscripts provide the most benefit to residents because the scientific community recognises their contribution to the knowledge of the epidemiology and public health.

Format and style are important considerations for a manuscript and must be decided early. Formatting should be compatible with recognised standards such as the Vancouver Group, further elaborated by the International Committee of Medical Journal Editors (ICMJE) and follow the journal's guidelines. Published manuscripts contribute to the global body of knowledge that can further improve public health worldwide.

By developing a manuscript, a resident learns how to:

- Communicate scientific achievements in an internationally recognised format
- Communicate ethical and logistical considerations of co-authorship with fellow scientists
- Describe clear and concise articulation of complex issues
- Communicate with editors of journals

Recommended Format

The following format structure components should be applied to all manuscripts. In addition, refer to the guidelines for authors for the journal you are submitting the manuscript.

Format:

- Uses IMRD structure (introduction, methods, results and discussion)
- Uses double spacing, column in vertical design, 12 point font, A4 or letter size white paper
- See journal for guidelines on word count, tables, figures, and references
- Includes numbered pages and lines

Style:

- Uses the past tense in methods and results section, present tense in introduction and discussion
- Is brief, using sequential sentences
- Chooses one idea per sentence
- Is specific
- Does not use bold type or underline
- Does not include footnotes that refer to the text in the pages (footnotes are only used for tables and figures)

Recommended Structure

The following is the recommended structure for writing a manuscript:

Title: Reflects the study with precision. The title:

- Entices readers to read the manuscript
- Helps the reader understand the nature of the study

Authorship: Includes contributors that have made a substantial intellectual contribution to the study that is going to be published. The ICMJE recommends the following criteria for authorship:

- Provided contributions to the idea and design, acquisition of data or analysis and interpretation of data
- Drafted the article or provided critical revision of content
- Gave final approval of the published version
- The acquisition of grants or funds, the collection of data or general supervision of the research group by itself does not constitute authorship

Abstract: Typically, 150-250 words are allowed

Key Words: Includes keywords for Medline searches

Introduction: Describes the current situation, the problem being the subject of research and the work already done in the same area

- Identifies gaps in the current knowledge and shows the necessity of the study
- Outlines the goals/objectives of the study and the hypothesis to be tested
- It is not necessary to mention all references

Methods: Provides the reader enough detail so that they could replicate the study. Components of methods include:

- Study Design describes the design utilised in the study and should include sampling methods (convenience vs randomised)
- Ethical Considerations meets approval standards from the Ethics Committee of the Institutional Review Board (IRB) and describes how consent was received for the study
- Subjects detail the inclusion and exclusion criteria
 - For human subjects, demographic information is included (e.g., age, sex, race and health status)
 - Exact number of subjects recruited and the breakdown of their age, race and sex belongs to the results section
- Setting describes the context (rural vs urban; academic vs community-based; level of care such as outpatient, hospital or emergency department) in which the study is carried out
 - In studies carried out in the emergency department, it should indicate the number of patients seen annually
 - More detail is required for new methods or models (the author should establish the validity of a new model in a separate article)
 - Authors should list generic names of medication utilised, the manufacturer, the dose and concentration
 - Authors should describe the sedation methods used for animals
- Interventions describe the experimental protocol to allow the replication of the study by another investigator
 - Lists prior methods if the study has been conducted before
 - Describes the baseline conditions/measures/manipulations of independent variables and conditions/measures/manipulations of dependent variables
 - Describes clinical procedures not controlled by the protocol
 - States assumptions of experimental procedures
- Calculations and Measurements describe the variables that are measured and how the measurements are performed
 - Lists instruments used and the instrument manufacturer (including city and state, and instrument and model)
 - Justifies why and how variables are measured
- Data Analysis Plan describes how the data will be analysed and presented (e.g., the average as opposed to the median) and what statistical tests were used to create inferences from the data

- Indicates the significance level (type I error)
- Describes how the sample size was calculated
- Help from a professional statistician is recommended

Results: Includes only data, not background or methods. It should include all the main results obtained, including the negative results. Unexpected results should be presented at the end of the section. Authors must be clear and concise throughout and use tables and figures when appropriate. The data included in the tables or figures should not be repeated in detail in the body of the text. Data should not be interpreted, and results should not be presented for which the methods were not described in the methods section.

- Paragraph 1 includes: A description of the population; the subgroups of the population; data pertinent to the principal research question
- Paragraph 2 includes: The main results; secondary results or analysis of subgroups
- Data Requirements includes effects of the independent variables on the dependent variables; univariate comparisons; multivariate analysis or interaction effects

Discussion: Explains the significance of the results and includes a summary of the main findings

- Substantiates the results section
- Relates results to similar studies and how this study differs from similar studies
- Convinces reader on the merits of the study
- Selects pertinent references
- Outlines alternative explanations for findings
- States clinical relevance or the implications of the findings
- Links hypothesis, results and conclusions directly with the data

Acknowledgements (list of contributors): Lists all the contributors that do not meet authorship criteria (e.g., recognising a person that has provided technical assistance, assistance in drafting the manuscript or a department chief that has provided only general support)

References: Compiles a list of the sources cited in the text

- Authors should limit the list of references to those most relevant for the study being presented
- The Vancouver System is the most common method utilised for citing references in medical journals

Tables and Figures: Presents the most relevant data and relationships

- Tables and figures should be included throughout the document
- The first table should describe the baseline characteristics of the study sample group and the comparison group
- The second table and subsequent tables and figures should present the results of the study
- Tables and figures may not be required if the results are limited
- Authors should ensure that the numbers in tables and figures correspond to the numbers in the text

Common Errors

Below is a list of common errors in manuscripts.

Title:

- Lacks an appealing title or includes a title that does not reflect the study

Introduction:

- Lacks a connection between the objective, methods, results and conclusions
- Literature review goes beyond topic of manuscript. A literature review reads “Disease X is the X cause of death at a global level” and proceeds to focus on the area of study.

Methods:

- Is biased
- Includes a poor literature review (e.g., “Disease X is an important health problem”), fails to provide enough detailed information to repeat the study
- While percentages are presented, does not include numerator and denominator used to calculate percentage
- Reports data twice (in the tables/figures and in the text)
- Shares opinions in the results section
- Repeats information from the introduction in the discussion

Results:

- Speculates unjustified interpretation of results
- Exaggerates the importance of the results
- Includes speculation in the discussion without support

References:

References are not cited and formatted according to journal guidelines

Tables and Figures:

- Measures of association do not use 95 per cent confidence intervals
- Tables and figures do not correspond to numbers in the text

Format and Style:

- Uses the passive voice denoting a lack of ownership and is vague
 - Authors should use the active voice
 - Active voice is precise and reflects responsibility for the actions taken
- Uses the common phrase 'Further study is needed'
 - This phrase suggests the study is not final and should be avoided

Phrases to Avoid in a Manuscript:

- Qualifiers (e.g., "This was a huge outbreak.")
- Exaggeration (e.g., "This is the biggest outbreak to date in which thousands and thousands of people have been affected.")
- Accusations (e.g., "The irresponsible behaviour of health workers drove the spread of this outbreak of yellow fever.")
- Apologies (e.g., "Due to lack of resources I was not able to..." "Clearly")

Trainer-Mentor Responsibilities

The following lists how Trainer-Mentors can support their residents in developing a manuscript:

- Meet with the resident to discuss appropriate topic(s) for his/her manuscript
- Review manuscript and provide feedback on scientific content, effective writing and policy implications
- Evaluate the manuscript based on the Evaluation Criteria
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate manuscripts that they receive.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable and outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
Beginning Pages	Includes a brief title and reflects the exact format of the study
	Lists the authors and collaborators (including their roles)
	The abstract follows standardised format
Introduction	Follows brief structure (three or four paragraphs)
	Describes the current state and gives a brief description of the problem
	Includes the gaps in the current knowledge and justification of the study
	Includes statements of the study's objectives or the hypothesis that will be tested
	Documents the facts with references

Category	Criteria
Methods	Discussed study's design and temporality
	Discusses research subjects (inclusion and exclusion criteria, and basic demographic information)
	Explains location/setting where the study was conducted
	Describes what was done in enough detail to replicate the study
	Provides a description of the variables measured and how the measurements occurred
	Defines the dependent variable along with the appropriateness to the study's objective(s)
	Describes how the data was analysed; and if there were standardised procedures or tools, a reference is provided
Results	Explains the results in simple terms
	Details the total numbers and percentages
	Supports statements with data ("Incidence is high" vs "Incidence is high, at X%")
	Does not present information twice (results presented in tables and figures are not duplicated in the text)
	Does not repeat the methods or include any analysis
	Describes the information from the tables as text subheadings. For example, "The cases and controls did not differ in respect to baseline characteristics. (Table 1)"

Category	Criteria
Discussion	Emphasises the most important findings and explains them
	Discusses in a focused manner (discusses three or four points)
	Compares findings with those of other authors
	Presents precise and specific conclusions
	Presents study limitations
	Discusses the importance of the study with suggestions of new ideas for research
References	Numbers references and orders them as they appear in the text
	Includes an appropriate number of references for the content of the report
	Incorporates references that are up-to-date and related to the content
	Formats references using Vancouver Style
Tables & Figures	Presents total numbers along with the percentages
	Uses consolidated tables. For example, prevalence is shown by gender and age
	The numbers coincide with those provided in the text and the rows of tables are totalled
	Uses footnotes in standard format (*, †, ‡, §)
	Displays charts and graphs in black and white

Category	Criteria
Structure	Includes a title (briefly and accurately reflects the outbreak)
	Includes authors and contributors (including institutions)
	Uses IMRD format
	Reflects results in the methods
	Does not include methods in the results
	Does not repeat results in the discussion or conclusion
	Bases recommendations on the findings
Format & General Clarity	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	The article is written in paragraph form and does not use bullet points as if it were a presentation (5 = yes, 1 = no)
	Acronyms are described before they are used (5 = yes, 1 = no)

Health Security Signature Projects

Guided Learning Road Map B

TRAINING OBJECTIVES

This learning road map provides resident trainees and their Trainer-Mentors with guidance on completing a series of three health security signature (capstone) projects which are important for training in health security and skills building in applied epidemiology:

- **Lead a field investigation** of a potentially serious public health problem that requires a timely response
- **Evaluate a health surveillance system** with public healthcare attributes
- **Conduct an epidemiologic analysis** by designing, interpreting and using figures/tables to illustrate scientific findings

These projects provide service to public healthcare by using data for evidence-based recommendations that improve disease detection, response and prevention. Residents learn best by doing and, after being introduced to concepts of surveillance system evaluation, outbreak investigation, data analysis, abstract and report writing, and oral presentations, they have the opportunity to put principles into practice.

Undertaking these projects with Trainer-Mentors, residents develop the task, writing and communication proficiencies listed below. They gain experience through mistakes and learn from them, and will continue with these activities into their professional work.



Health security signature projects are integral to progressive field epidemiology training in Singapore

The Trainer-Mentors help their residents by providing feedback and evaluating their performance on a variety of tasks as outlined in this guide:

Suggested Beginner Steps

- I. Lead in a Field Investigation**
 - Learning Road Map, Deliverables
 - Writing Guidelines–Rationale, Structure
 - Checklist and Scoresheet
- II. Evaluate a Health Surveillance System**
 - Learning Road Map, Deliverables
 - Writing Guidelines–Rationale, Structure
 - Checklist and Scoresheet
- III. Conduct an Epidemiologic Analysis**
 - Learning Road Map, Deliverables
 - Writing Guidelines–Rationale, Structure
 - Checklist and Scoresheet

SUGGESTED BEGINNER STEPS

You will gain confidence and continue with these activities throughout your professional working life:

Choosing the projects

You should do a literature review and reach out to subject-matter experts to determine whether similar studies have been conducted elsewhere and get copies of questionnaires and background literature.

Selecting the design and sample size

The study should be a survey or an observational, descriptive cross-sectional study. An analytic study (e.g., case-control) is also recommended, while the focus is still on conducting good descriptive epidemiology. Data collection by interview is encouraged, giving participants experience in approaching and interviewing people. The sample size should be sufficient to provide adequate epidemiology power and give residents ample interviewing experience. If the trainees will collect data as a group in a single location, then factors which influence sample size may include how many interviews can residents conduct, working individually or in pairs, during the limited days devoted to data collection.

Considering the approach to data collection

Two options can be used for data collection at location—group data collection in a single location or individual data collection in the participants' work region. The option chosen may be based on time, logistical and resource considerations:

Option 1: Group data collection and entry

You travel together to a predetermined area and conduct a survey. The data are entered into a common database at the end of each day of data collection, and the dataset is cleaned and ready for analysis. This option is best for studies such as an outbreak investigation at a school or business.

Option 2: Individual data collection and entry

You use a common data collection tool to collect data from individuals and enter data at or near their home or work sites. Participants enter their data into a computer database such as Epi Info during the field visit or nearest

opportune moment and clean it as best they can. The individually collected databases are merged and cleaned for group analysis.

Planning the operations

Logistics: If the project is to be conducted as a group data collection in a single area, then transportation, lodging (if overnight), maps and workspace must be arranged. If possible, you should operate as near to the data collection site as possible so time is spent collecting data, not riding in vehicles. The workspace should be identified where computers can be set up for data entry and the group can discuss progress. Maps of the data collection area should be secured in advance.

Protocol and sampling methodology: In drafting the project protocol, you are encouraged to review and suggest revisions to the protocol during discussions. The protocol should specify the approach to data collection (Option 1 or Option 2), sampling strategy and other elements of survey or study design.

Data collection: As part of project protocol development, you should identify existing, validated questionnaires or other data collection tools and draft a first version for the group exercise. You can review and suggest modifications to the questionnaire and pilot-test the questionnaire. You should also decide in advance whether data will be collected using paper forms or electronic devices such as a tablet and which software will be used.

Approvals: Approvals may be needed for even a relatively simple analytical epidemiology study, such as a knowledge-attitudes-beliefs-practices survey. In some situations, the protocol must be submitted to and approved by a local Institutional Review Board. You should determine how long approval may take and work backwards to ensure that enough time is available to conduct and complete data collection, analysis and reporting.

Data management: A data manager should be identified in advance. This person will create the data entry screens, troubleshoot data entry problems, merge data from the participants, provide security for the data, and perform other tasks of data management.

Teamwork: The project details should be discussed with all members of the team. You should reasonably allow participants to modify the project slightly

by, for example, expanding the scope and adding a question or two to the data collection tool.

Finalising the protocol

The final project protocol should be reviewed with all the field team participants. You should allow participants to modify the protocol, data collection tools and data entry processes for practical reasons if deemed appropriate. If tablets will be used, participants should be given an opportunity to become comfortable with them before they are expected to use them in the field. Each participant should pilot-test the data collection tool in his/her own area with a few interviewees. The participant should document difficulties with questions or flow or other aspects of the tool and suggest improvements.

Implementing the plan

If group data collection is used, you should confirm that transportation, lodging, meals and other arrangements are secured. Maps of the data collection area should be obtained. In some jurisdictions, a local community leader or member of the local health staff should accompany the interviewers during data collection. These arrangements must be made in advance.

Collecting the data

The final tool should be based on input from the participants' pilot test experience. If data will be collected on tablets, ensure that all participants (or pairs) have tablets and that the data collection tool is loaded and working properly. Participants must have copies of the data collection tools and know how to administer them before they leave the Workshop. They should understand how to follow the sampling scheme to identify the appropriate households or individuals for enrollment and interview:

Option 1: Group data collection and entry

On the day or evening before data collection is scheduled to begin, you should meet with participants to review:

- Sampling approach: Where to start, which houses or individuals to approach, etc.
- Interview technique: How to introduce oneself (some programs provide a letter of introduction from the Ministry of Health), how to respond to reluctant subjects, etc.
- Data collection tool: Review the entire tool, but in particular, review modifications made after the pilot testing.

- **Supplies:** Ensure that participants have copies of the tool or working tablets, maps or GPS coordinates, working phones, water and snacks, and other necessary supplies.
- **Teams:** Match teams with drivers. Teams should coordinate data collection. If local health staff or community leaders will accompany the participants, these arrangements need to be confirmed.
- **Timing:** Ensure that participants know where and when to meet in the morning and at the end of the day.
- **Data entry:** Ensure that participants know when and where to enter the day's data or share data if using tablets.
- **What to do if problems arise:** Ensure that participants have telephone numbers of FETP staff.

Then, participants will collect data in the field following the prescribed protocols. If data are collected using a paper form, participants must enter the data into laptops in the evening.

Option 2: Individual data collection and entry

Participants should collect and enter data within their own areas following the prescribed protocols. The timing of data collection should be coordinated so that data collection is completed in a timely way. You will need to monitor data collection activities and be available to troubleshoot problems.

Scrubbing the data

Regardless of data collection method, you should review and run basic data edits (check for duplicate records, missing data, out-of-range values, typos, corrupt data/records, inconsistent data entries, etc.) on the data that have been entered. If Option 2 (individual data collection) is used, participants should send their cleaned datasets for the data manager to pool the data and perform additional data cleaning. The data manager should have developed a plan for pooling and running additional data quality edit checks on the data. He or she must then share the pooled, merged data with participants. Data should be split into different sections for different groups to analyse. For example, Group 1 could analyse Response Rate and Demographic Data, Group 2—Knowledge, Group 3—Attitudes, Group 4—Practices, etc. Alternatively, if Data Collection Option 2 is used, data could be divided into 4–5 regions and different groups could analyse data from different regions.

Always keep a master file of the raw data. Do not make any changes to this file and do not analyse this file. Make changes and corrections to a working file and document every change. You can use this file to analyse the data.

Analysing the data

Begin with a descriptive analysis such as frequencies of each variable. Create tables and graphs of this data. You must properly analyse all assigned sections of the data collection tool. Every member of the team should be involved in providing feedback and interpreting at least some of the data, although some participants will be more engaged than others. As the analysis proceeds, the team should identify and agree on their most important findings. They should also consider the strengths and weaknesses of the data and get inputs about their analysis and interpretation from others in the team.

Presenting the data

You must draft a written report and a slide presentation. These responsibilities can be shared among members of the team to ensure that everyone is engaged in one way or another. Each team must finalise its oral presentation. Members should agree on who will give the presentation (usually one person per analysis team). The presenters should practice their presentations. In drafting the written report, coordinate with members of the oral presentation team to ensure that both products are consistent in findings and interpretation. The final oral presentation should be delivered by the resident-to-be as professional and polished as possible, given that officials from the Ministry of Health and, perhaps, other authorities will be in attendance.

If the project has gone well and identified interesting findings, you may decide that it is worthy of publication in an epidemiological bulletin or newsletter, or even a peer-reviewed journal. This requires substantial additional work from participant authors. At the end of the project, debrief with Trainer-Mentors about what went well and what did not, as well as what lessons were learned. These deliberations should be documented in a report that will be available to future group project organisers.

Take pictures to document what you have done, the location of the outbreak, symptoms of cases, animal reservoirs, environmental conditions, etc.

I. LEAD IN A FIELD INVESTIGATION

Learning Road Map, Deliverables

Learning Road Map

When an outbreak is reported, or when analysis of surveillance data reveals a sharp rise in cases or an unusual event, you need to confirm this observation. Verifications that occur promptly can minimise economic and social disruption as well as reduce the number of deaths and illnesses. The resident should participate in as many field investigations as possible and have an active role in the investigation (e.g., interviewing patients, field visits, entering data, etc.). The resident can be principal investigator or lead in part of the investigation activities:

- Conduct an outbreak epidemiologic investigation
- Determine the cause of the outbreak
- Identify other cases (case finding)
- Determine if the outbreak is spreading
- Write an outbreak investigation report with response actions and recommendations

For this project, the resident should discuss with their Trainer-Mentor regularly to participate in an outbreak investigation which can have a major impact on public healthcare. Give the Trainer-Mentor an early heads up about the outbreak so that he/she may provide guidance as needed. The Trainer-Mentor may also be able to speak to your supervisor to encourage your participation if your supervisor is reluctant for you to participate in a field investigation.

Deliverables

An outbreak investigation report is a technical report summarising an outbreak that requires an immediate response to an acute health threat. Through outbreak investigations, the resident gains expertise in:

- Building skills in descriptive statistical methods
- Developing a good case definition
- Generating and testing a hypothesis
- Using analytical statistical methods during a health emergency
- Organising data in tables and graphs
- Using laboratory support
- Engaging stakeholders to respond to a health emergency

- Designing studies
- Making recommendations based on investigation findings
- Critical thinking

The outbreak investigation report shares findings on the cause of the outbreak and details how to control the outbreak and prevent recurrence. The report also examines existing prevention strategies to understand what did/did not work. The outbreak investigation should focus on identifying the etiologic agent, the source of the outbreak, the mode of transmission and the risk factors for the disease or public healthcare event. The report should provide specific recommendations to safeguard the community.

Writing Guidelines–Rationale, Structure

Rationale

A field investigation report is a technical report of an outbreak investigation. Residents are expected to participate in one or more field investigations of an outbreak or other health emergencies. The investigation should be monitored by the supervisor and Trainer-Mentor, either in person or from a distance during all stages of the investigation.

The outbreak should be a problem requiring an immediate response (i.e. a local or national threat). The objectives of the outbreak investigation should be identifying the extent, etiologic agent and source of the outbreak, the mode of transmission and/or the risk factors for disease, and whether the outbreak is expanding. The report should provide specific recommendations, based on the analysis of data from the investigation, that have an impact on the public health of the community.

To conduct an effective outbreak investigation, the resident should:

- Know all the steps of an outbreak investigation
- Master descriptive statistical methods
- Develop a good case definition
- Be familiar with the epidemiologic triangle
- Know how to appropriately organise data in tables and graphs
- Know how to generate and test a hypothesis
- Know how to use analytic statistical methods appropriately
- Know how to use laboratory support
- Know how to make recommendations based on the findings of the investigation

- Know when to ask for additional help
- Work as a a team

Public Healthcare Importance

Prompt identification and investigation of an outbreak can reduce morbidity and mortality, and minimise economic and social disruption. Field investigation reports can serve to share the cause of the outbreak, how to control the outbreak and prevent similar outbreaks in the future, and evaluate existing prevention strategies.

Structure and Content

Introduction

- Clearly explain when the outbreak notification was sent, where it was sent from, from whom it was sent and why; explain who received it and what actions were taken to assess whether a response is appropriate
- Describe the background of the outbreak, describe the index case(s), their symptoms, onset date, possible exposures, travel and food history, etc.
- Describe the disease that was notified, what is known about its transmission, other outbreaks of this disease and potential for spread for this event

Objectives

- List the objectives of the investigation regarding the agent, source of infection, mode of transmission and risk factors

Material and Methods

- Describe where the event occurred, the population and the process for data collection
- State the case definition
- Describe the questionnaire, variables used and laboratory methods (sample type and test type, who was sampled and why they were sampled)
- Explain the study design and statistical analysis performed
- Include laboratory tests and sample collection

Results

- Describe person, place and time clearly and completely
- Include maps and graphs where necessary
- Include number of cases and attack rates
- In the analytic phase, describe two x2 tables and their results with confidence intervals, Chi-square and the p-value
- Present laboratory results
- Construct an epidemic curve

Discussion

- In the order given in the results section, discuss the reason for the results and the similarities and differences to similar outbreak research
- Support the discussion with references
- Do not include results
- Address the objectives; did the investigation meet the objectives?

Study Limitations

- Indicate problems encountered during the outbreak investigation

Conclusions

- Base on the findings
- Do not repeat the results

Recommendations

- List based on the results and conclusions

References

- Include references on disease, methods, similar studies, etc.

Common Errors

General:

- Does not follow the structure of introduction, methods, results and discussion
- The title does not describe the investigation
- No bibliography

Introduction:

- Lacks organisation, a chronology of events and background of the outbreak
- Lacks objectives of the outbreak investigation or hypotheses
- Does not include problem statement, or objectives are not clear or too broad

Material and Methods:

- Describes methods poorly (there is no case definition, it is poorly written or insufficient details to replicate investigation)
- Does not describe selection of controls
- Insufficient details on how sampling was done

Results:

- Does not reflect the methods
- Does not describe the main results
- Narrative of tables repeats data in tables

Discussion:

- Lacks description of study limitations and its impact on the study findings
- Includes new results not previously mentioned
- Presents conclusions as very general (they are not linked to the investigation or repeat the results)
- Recommendations do not reflect the study findings
- Lacks references

Checklist and Scoresheet

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the instructions and provided in the classroom, and is of a remarkable/outstanding quality.
4 = Good	The element is present and consistent with the standard described in the instructions and provided in the classroom.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
N/A = not applicable	The element is not relevant to this study.

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
Introduction	Describes the events that led to the outbreak/how was the outbreak initially reported/how the team was put together/when the investigation began						
	Describes the situation (person, place, time)						
	Describes the organism or illness (agent, clinical characteristics, endemicity or seasonality)						
	Explains the reasons for investigating the outbreak or specifies the investigation hypothesis						
	Clearly describes the objectives of the outbreak investigation						
Methods	Includes a case definition and eligibility criteria						
	Describes the methods of case finding/subject recruitment						
	Describes the method of collecting data from participants						
	Explains the type of sampling and calculates the sample size						
	Explains data analysis procedure, including statistical methods and software used						

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
	Describes the clinical and environmental sampling and laboratory test methods						
	Includes the process used to protect human subjects (confidentiality, risks, informed consent)						
Results	Provides the number of participants with the response rate, if appropriate						
	The information is descriptive and clinical, including place/geographic distribution						
	Provides the epidemiologic curve or a description by time						
	Provides the attack rates by age, sex and other relevant variables						
	Demonstrates the effect size with measures of precision (confidence intervals) and adjusted for confounding (where appropriate)						
Discussion	Key findings are based on results						
	Conclusion is supported by the literature: explains data that do not support the conclusion						
	Describes the limitations of the data, the study design, the location of the investigation, noting possible biases						

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
	Reports immediate control measures used to prevent additional cases						
	Discusses the external validity of intervention study findings (e.g., to what degree can the results be generalised to other populations or places)						
	Discusses the feasibility and sustainability of a long term intervention						
	Makes suggestions on how to prevent similar outbreaks in the future, or on additional studies needed to resolve the current outbreak						
Bibliographic References	References are numbered and in the order they appear in the text						
	The number of references are adequate for the content of the report						
	The references are up-to-date and relevant to the topic						
	The references conform to Vancouver Style						
Structure	Title (briefly and accurately reflects the outbreak)						
	Authors and contributors (including institutions)						

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
	Uses IMRD format						
	Results are reflected in the methods						
	Methods are not included in the results						
	The results are not repeated in the discussion or conclusion						
	Recommendations are based in the findings						
General form and clarity	Uses adequate punctuation and grammar						
	Uses proper spelling						
	Work is original with no evidence of plagiarism						
	The writing is in paragraph form and does not use bullets as in a presentation						
	Acronyms and abbreviations are described						

II. EVALUATE A HEALTH SURVEILLANCE SYSTEM

Learning Road Map, Deliverables

Learning Road Map

The evaluation of a surveillance system promotes the best use of public health-care resources and ensures surveillance systems are operating as intended. The resident should conduct a surveillance system project to understand surveillance and to assess the performance of the surveillance system. Alternatively, the resident can design and implement a new surveillance system.

- Describe the operation, including the flow of data, of a surveillance system in the country
- Write a surveillance report using the data from the system
- Identify problems with the surveillance system
- Evaluate the problem identified with the surveillance system and use the appropriated attributes to troubleshoot the system
- List recommendations to improve the surveillance system
- Take actions to improve the surveillance system
- Write a report and give an oral presentation of your surveillance system project

Deliverables

A report on a surveillance system project documents the performance of a surveillance system and if it meets its goal and objectives. The report should provide recommendations for improving the quality, efficiency and usefulness of the system. The report should include the following sections:

- **Introduction:** Briefly describe the surveillance system you selected and why you chose that surveillance system to evaluate. State your purpose and objectives of the evaluation.
- **Methods:** Describe the steps that you used to evaluate your surveillance system. How did you assess quality? What data did you use for the evaluation? Whom did you interview and why? What questions did you ask?
- **Results:** Please include a *diagram* of the flow of data in the surveillance system that you selected. Then describe your main findings.
- **Discussion:** Based on the evaluation, what can you conclude in your assessment? What specific actions would you recommend to improve this surveillance system?

Writing Guidelines–Rationale, Structure

Rationale

A report on a surveillance system project documents key characteristics of and data from the surveillance system, how well a surveillance system operates, and to what extent it meets its purpose and objectives. The recommendations provide suggestions for improving the quality, efficiency and usefulness of the system.

A surveillance system project is a useful activity that benefits both the resident and the public healthcare authority. The resident learns:

- The value of conducting surveillance and uses of surveillance data
- Challenges in conducting surveillance
- Strengths and limitations of the data
- Strengths and limitations of the surveillance system
- Staff attitudes toward providing, collecting and using surveillance data

Communicating the findings and recommendations of the project to those who are responsible for overseeing and maintaining the surveillance system is essential.

The public healthcare authority benefits because recommendations to strengthen (or occasionally stop) the surveillance system can be discussed, considered and implemented. The surveillance system selected for evaluation should be a priority for the public healthcare authority or organisation for whom the trainee works, with the understanding that they would take action based on the findings and recommendations.

Public Healthcare Importance

The purpose of evaluating a surveillance system is to ensure that the system is addressing an important disease or health condition, that the system is operating efficiently and effectively, and that the data are being used for evidence-based decision-making at all appropriate levels.

Structure and Content

Executive summary

- Usually between 400 and 500 words and typically written after completing the report.

- Structure should include:
 - Brief description of the surveillance system reviewed, including the goal and objectives of the surveillance system
 - Objectives of the evaluation
 - Brief description of methods
 - Evaluation of usefulness plus selected attributes
 - Recommendations

Introduction

- Give rationale (objectives) for surveillance of the disease or condition.
- Brief description of surveillance system, including illness/condition and geographic area/population covered, and goal of the system
- Indicate if the surveillance system has been evaluated previously, and if so, provide the most important findings from these evaluations
- Conclude with the justification for evaluating this system and the objectives of the evaluation

Methods

- Identify the sources of data for numerators (surveillance system) and denominators, if used to calculate rates (usually population data)
- Describe the evaluation methods used (reference MMWR, WHO or other evaluation guidelines), including interview methods, data analytic methods, etc.
- If a limited number of attributes were evaluated, list those attributes

Results

- a. Surveillance system description
 - i. Geographic/population coverage of the system
 - ii. Health-related event(s) under surveillance. Note: Surveillance system can focus on a single disease or health condition, multiple diseases or health conditions, injuries, adverse exposures/risk factors/behaviours, mortality, etc., but evaluation should focus on one disease or condition
 - iii. Case definition(s) used
 - iv. Stakeholders (persons or organisations that contribute to the surveillance data or utilise the findings)
 - v. Public healthcare importance of the health-related event(s) under surveillance (describe in terms of frequency [incidence, prevalence, mortality rates], severity [hospitalisation, disability, case fatality], etc.)

- vi. Purpose of the surveillance system (purpose and objectives, uses)
 - vii. Data flow, preferably illustrated with diagrams
 - viii. Resources (monetary, personnel, IT, etc.) used to operate the surveillance system
- b. Summary of recent trends and patterns. Consider including a table or graph, accompanied by a brief description, for each of the following:
- i. **Clinical features**, e.g., common symptoms, percentage hospitalised or dead, laboratory results such as percentage confirmed or distribution by species or subtype (usually presented in a table)
 - ii. **Time**, e.g., by year, month, week, or other appropriate interval, to show patterns or changes over time. Can be stratified by age group, sex, region, person or place characteristic (usually presented in a graph). Point out important changes, seasonal trends, aberrations (e.g., outbreaks), or other unusual patterns.
 - iii. **Place**, e.g., by geographic area (usually presented with a map or table). Numbers and rates may both be important.
 - iv. **Person**, e.g., by age group, sex and other relevant characteristics (usually presented in a table). Numbers and rates may both be important.
 - v. If relevant, number of **outbreaks** that were identified, and how many of those were investigated.
- c. Evaluation
- i. **Usefulness**: Describe the usefulness (value) of information generated by the surveillance system. Are the data or summary of the findings being used to identify cases and possible outbreaks, detect changes in trends or patterns, help make decisions about action such as field investigation or change in policy or practice?
 - ii. **Attributes**: Describe the surveillance system attributes in terms of simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness, and stability of the system. For each attribute, support the results with evidence. You may focus on three attributes—timeliness plus two others you judge to be important based on analysis of the data or discussion with stakeholders.
 - iii. **Practice**: Based on site visits and interviews with key stakeholders, describe how the surveillance system is implemented at each level:

- Reporting sites: Do the key staff know what and how to report? Do they know and use appropriate case definitions? Do they reliably have forms (if using a paper-based system)?
- Local health department: Do they routinely review the surveillance reports as they come in, or at least weekly? Do they collate/summarise the data from all reporting sites? Do they assess timeliness and completeness? Do they share the results with the reporting sites?
- Middle and national levels: Do they routinely review the surveillance reports as they come in, or at least weekly? Do they collate/summarise the data into a report? Do they share the results with the MOH level that sends reports to them?

Tables and Figures

- Includes a maximum of 5 tables and figures
- The format of each table and figure includes a title with time, place and person
- Each table and figure should be referred to in the report and numbered in the order it appears

Discussion

- Summarise the strengths and weaknesses of the surveillance system.
- Based on the results, suggest specific recommendations, and justify them. Recommendations could be to strengthen or modify system usefulness, attributes, or practice, continue operating the system as is, replace the system, or discontinue the system.
- Discuss what is needed to implement the recommendations, such as leadership buy-in, resources, and training.

References and Appendices

- Includes relevant references and appropriate information related to the evaluation.

Common Errors

Shortcomings are when the surveillance system evaluation report:

- Lacks clearly presented surveillance system objectives
- The scope of evaluation is too narrow
- Poorly describes the methods used

- Does not describe the surveillance system
- Does not identify key attributes of the surveillance system to be evaluated
- Poorly documents the attributes evaluated
- Confuses the surveillance system's limitations and the limitations of the evaluation
- Lists weak recommendations
- Incorrectly calculates predictive value positive, sensitivity and representativeness

Checklist and Scoresheet

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the instructions and provided in the classroom, and is of a remarkable/outstanding quality.
4 = Good	The element is present and consistent with the standard described in the instructions and provided in the classroom.
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2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = not applicable	The element is not relevant to this study.

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
Executive Summary	Provides a brief description of the surveillance system						
	States the objectives of the evaluation						
	Summarises the methods used in a few sentences						
	Presents the evaluation results						
	Provides conclusions, including recommendations for improving the surveillance system						
Introduction	Describes the surveillance system, including condition(s) under surveillance and the reason for carrying out surveillance						
	Provides sources of the surveillance data and describes how the data are used						
	Presents the results from previous evaluations of this surveillance system or the potential limitations of the surveillance system						
	Indicates the intended objectives (2-5 objectives suggested) of the current evaluation (aspects of the surveillance system to be evaluated, i.e., timeliness)						

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
Methods	Describes methods for the system evaluation by addressing timeliness and up to 2 other of the following attributes: data quality, stability, simplicity, acceptability, flexibility, sensitivity, predictive value positive, representativeness						
	Was the information acquired in a systematic way (i.e., using a survey instrument)?						
	Presents the measures used to answer the evaluation questions						
	Clearly specifies the sources that supplied data used to respond to the evaluation questions						
	Clearly defines the methods used to analyse the evaluation data						
	Are methods appropriate and realistic for completing stated objectives of the evaluation?						
Results	Surveillance system is well described–population under surveillance, case definition(s), the system type, the data flow structure, indicators used, resources						
	Recent trends and patterns by time, place, person, are presented						

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
	Data are summarised using appropriate tables, figures, and text						
	Usefulness of the system is assessed						
	Required number of attributes are assessed (of simplicity, acceptability, flexibility, sensitivity, predictive value positive, representativeness, timeliness, cost)						
	Attribute evaluations are supported by the evidence						
	Surveillance practice is described and assessed						
Discussion	Provides conclusions that focus on the evaluation questions and are supported by the findings						
	Formulates recommendations that flow logically from the evaluation findings						
	The recommendations are realistic and achievable						
	The recommendations are specific, including the time period proposed and other points of reference						
	Addresses the limitations in the evaluation design and implementation						

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
Bibliographic References	The references are numbered and in the order of how they appear in the text and in the bibliography						
	The number of references are adequate for the content of the report						
	The references are relevant to the topic						
	The references conform to Vancouver Style						
General Form and Clarity	Uses adequate punctuation and grammar						
	Uses proper spelling						
	Work is original with no evidence of plagiarism						
	The writing is in paragraph form and does not use bullets as in a presentation						
	Provides a description of acronyms before they are used						

III. CONDUCT AN EPIDEMIOLOGIC ANALYSIS

Learning Road Map, Deliverables

Learning Road Map

For this project, the resident will select, analyse and interpret at least two years of surveillance data available on any important disease or event. This project can comprehensively complement the surveillance system evaluation project if selection involves the same system providing these surveillance data.

- Analyse data by time, place, and person using tables, graphs and maps
- Summarise data using measures of central tendency and disease frequency
- Interpret analysed data (applied analytical epidemiology)
- Generate a written report with recommendations

Deliverables

Applied analytical epidemiology output can take the form of a surveillance summary report or an expanded surveillance report. These reports should display the patterns and trends of a disease or public healthcare event occurrence in a population based on the descriptive analysis of surveillance data. Through this report, the resident learns the value of conducting proper surveillance and the correct uses of such surveillance data. The resident also learns about the strengths and limitations of the data and of the surveillance system. To complete this report, the resident has to work on data management skills, descriptive epidemiologic analysis skills, and the use of tables and graphs.

The disease or health event of the surveillance report should be a priority for the public healthcare authority or equivalent institution. The purpose of analysing data from a surveillance system is to ensure that problems of public health importance (e.g., infectious diseases like measles, chronic diseases like diabetes, unintentional injury) are being monitored. This helps public healthcare officials make evidence-based decisions about interventions.

Writing Guidelines–Rationale, Structure

Rationale

The analytical epidemiology report displays the burden, patterns and trends of disease occurrence in a population based on the descriptive analysis of surveillance data. Typically, this surveillance report focuses on a specific disease or health problem under surveillance in a particular geographic region.

Residents are expected to begin their descriptive analysis of surveillance data and write the surveillance summary report early in the programme. This activity provides several benefits to the trainee and to the public healthcare authority. The trainee learns:

- The value of conducting surveillance and the uses of surveillance data
- Strengths and limitations of the data
- Strengths and limitations of the surveillance system
- Data management skills
- Descriptive epidemiologic analysis skills
- The use of tables and graphs to display data

The public healthcare authority benefits because surveillance refers not only to collecting data, but also to analysing the data and communicating the results to those who are responsible for taking appropriate action. Communicating the results in a surveillance summary report to those who provide the raw data is also recommended, as it demonstrates that their data are actually looked at and used.

The selected disease or health event should be a priority for the public healthcare authority or other health institution for whom the trainee works, with the understanding that they will take action based on the results of the analysis. Depending on the sponsoring programme or project (e.g., influenza, tuberculosis, foodborne disease, injury, chronic disease), the trainee should carry out the surveillance analysis focusing on the relevant health problem. If the sponsoring programme conducts surveillance for all diseases in the municipality, district, or health region, the event used for the analysis should be prioritised with the trainee's mentor.

Public Healthcare Importance

The purpose of analysing data from a surveillance system is to ensure that problems of public healthcare importance (e.g., infectious diseases like measles, chronic diseases like diabetes, unintentional injury) are being monitored efficiently and effectively, and that the data are used for evidence-based decision-making.

Structure and Content

Executive summary

- Usually between 400 and 500 words and typically written after completing the report.
- The structure of the summary for the report is different from the structure of the abstract that is submitted to a scientific conference (i.e., IMRD format). The summary of a surveillance analysis report should have the following structure:
 - Problem or condition
 - Time period which the report covers
 - Description of the system
 - Results
 - Interpretation
 - Public health actions

Introduction

- Give rationale (objectives) for surveillance of the disease or condition.
- Describe the area or district/department where the surveillance analysis was carried out: the population under surveillance and the key data about the area/region and the environment (depending on the disease under surveillance).
- Give a brief description of the surveillance system analysed (including a flow chart and relevant aspects of the system) and of the chosen disease or condition.
- Explain the background surveillance data over the previous years, in the context of the objectives of the surveillance analysis.

Methods

- Identify the sources of data: include the distribution of the population by age, sex, department, for subsequent calculation of rates.
- State the definition of health events.
- Describe database cleaning and the process to confirm that the variables are appropriately coded and categorised.
- Describe the statistical methods used (descriptive and analytic).
- Describe the surveillance data collection instruments as well as the variables used.

Results

- The results section should include tables and graphs of each of the following categories. These tables and graphs should be accompanied by brief descriptions of the most important patterns or features.
- **Clinical features**, e.g., common symptoms, percentage hospitalised or died, laboratory results such as percentage confirmed, or distribution by species or subtype (usually presented in a table).
- **Time**, e.g., by year, month, week, or other appropriate interval, to show patterns or changes over time. Can be stratified by age group, sex, region, or person or place characteristic (usually presented in a graph). Point out important changes, seasonal trends, aberrations (e.g., outbreaks), or other unusual patterns.
- **Place**, e.g., by geographic area (usually presented with a map or table). Numbers and rates are equally important.
- **Person**, e.g., by age group, sex, and other relevant characteristics (usually presented in a table). Numbers and rates are both important.
- Record the number of **outbreaks** that were identified, and how many of those were investigated.
- **Other** salient results that do not fall in the categories listed above. For example, many surveillance summary reports include data on the completeness and timeliness of reporting from each reporting source.

Discussion

- Interpret the observed patterns with respect to short and long term trends, including by place and person characteristics, to identify problems or areas that require epidemiologic investigation or public healthcare action.
- Identify or calculate the expected or projected level of reported disease.
- Compare the current report with the expected or projected levels of disease.
- Based on the analysis, consider important public health actions.
- Optionally, state hypotheses and possible analytic studies to address them.
- Suggest specific recommendations, based on the results.
- Include the limitations of the surveillance analysis, highlight key conclusions, and state the most important recommendations based on the data.

References

- The references should be relevant to the surveillance analysis. The references should be referred to in the text of the report. Typically, references are cited in the introduction and discussion sections.

Appendices

- **Glossary:** Include all definitions used.
- **Summary of each of the outbreaks reported:** Indicate the date of the outbreak, department where it occurred, the number of cases, the number of deaths and a brief description of the event.

Common Errors

Introduction

- Failure to state the objectives of the surveillance analysis.
- Failure to describe the surveillance system, especially the source of data and the flow of data from the source to the government agency.

Methods

- Failure to describe the methods used in enough detail, especially the source and time frame of the data.

Results

- Time: Failure to include an appropriate graph (secular trend line graph, epidemic curve histogram, etc.) to display time data, or inappropriate choice (e.g., bar graph) or construction (e.g., three dimensional or poor titles).
- Place: Failure to display place data in a map or table, or poor choice of categories or colours.
- Person: Failure to present person data or poor choice of categories or summary statistics.
- Inadequate analysis, e.g., failure to present rates, or absence or poor choice of summary statistics.
- Inadequate description of the key findings, e.g., changes in the distribution or substantial differences in disease occurrence between age groups, sex, place, or over time.

Discussion

- Insufficient documentation or review of the literature in the discussion (did not compare the findings with those of other publications).
- Confusion between analysis and evaluation of a surveillance system.
- Confusion between limitations of the surveillance system and limitations of the analysis; or the failure to identify the limitations of the analysis.
- Poor recommendations (too general or not related to the findings).

Checklist and Scoresheet

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1 = Absent	The element is absent from the report.
NA = not applicable	The element is not relevant to this study.

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
Executive summary	Gives a brief summary of the problem/conditions under surveillance						
	Includes the time period covered by the report						
	Gives a brief description of the surveillance system and the objectives of surveillance						
	Mentions the principal findings						
	Interprets and discusses the results obtained in the evaluation based on the data from the surveillance system						
	Recommends actions based on the results obtained in the analysis						
Introduction	Gives the clinical and biological background of the condition/organism						
	State the public healthcare importance of the disease or condition (burden of disease, mortality, morbidity, outbreak/epidemic potential, burden to the medical system, whether the problem is increasing or decreasing)						
	Describes the system analysed (flow chart and relevant aspects of the surveillance system) and the objectives of the system						

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
	States the importance of the disease or condition (cost, social burden, political importance, international importance, actual expenditures for prevention)						
	Gives the objectives of the current analysis						
Methods	Gives procedures for reporting the disease, population under surveillance, databases used, clinical and laboratory sources of information						
	Gives the case definition, defines important terminology about the disease/condition with the purpose of informing the reader about the situation						
	Gives a brief description of any laboratory procedures used for the disease or condition (if appropriate)						
Results	Statistical calculations are adequate and important calculations are not missing						
	Given in terms of person, place, and time						
	The main results are clearly and succinctly presented						

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
	Provided in the relevant categories and subcategories (demographics, level of illness, species of agent, etc.)						
	Addresses the objectives described in the introduction						
	The graphs and tables summarise and illustrate the results						
Discussion	Summarises the key results						
	Gives the public healthcare implications of the results						
	Compares the results with previous years and/or the literature						
	Discusses the limitations of the analysis and the data						
	Gives recommendations about the disease/condition and its control						
	Gives recommendations about surveillance for the disease/condition						
References	The references are numbered and in the order of how they appear in the text and in the bibliography						
	The number of references is adequate for the content of the report						

Category	Criteria	1-Absent	2-Poor	3-Satisfactory	4-Good	5-Excellent	NA
	The references are current and relevant to the topic						
	The references conform to Vancouver Style						
General form and clarity	Uses adequate punctuation and grammar						
	Uses proper spelling						
	Work is original and there is no evidence of plagiarism						
	The writing is in paragraph form and does not use bullets as in a presentation						
	Ideas are presented with a logical flow						
	Provides a description of acronyms before they are used						

Epidemic Intelligence Proficiencies

Guided Learning Road Map C

TRAINING OBJECTIVES

This learning road map provides resident trainees and their Trainer-Mentors with guidance on completing the post-graduate proficiencies in applied epidemiology that are equivalent to the US CDC's epidemic intelligence service (EIS) training to function domestically and internationally.

EIS officers are selected among highly qualified applicants comprising physicians, scientists, veterinarians, and public health and healthcare professionals who are drawn to public health service and interested in applying their epidemiology skills. They work in a wide range of topical fields. Take a good look at the Core Learning Activities which spells out in some detail the development of your proficiencies.

In your progression over 2-3 years as an EIS officer, you will gain varied specialist learning experiences that cover a breadth of outbreak epidemiology practice.



Progressive training trajectory of the Singapore EIS Officer

The Trainer-Mentors help their residents by providing feedback and evaluating their performance on a variety of tasks as outlined in this guide:

- I. Officership Overview**
- II. Core Competencies**
- III. Curriculum at a Glance**
- IV. Core Learning Activities**
- V. Some Textbook Resources**
- VI. Training and Upskilling Others**
- VII. Workforce Development Protocol**

I. OFFICERSHIP OVERVIEW

Successful applicants are willing to accept assignments in a wide range of topical fields and have a record of high academic achievement, teamwork, innovation, service orientation and leadership. Successful applicants demonstrate how EIS is a logical step in their career path and in what ways they will benefit from the applied training through service that defines the EIS officership.

Prior to applying to EIS, we strongly recommend applicants consult their seniors and EIS graduates to understand the EIS training's rigours.

Officership Requirements

- Must be undertaking training in infectious diseases, preventive medicine or epidemiology by time of application submission, AND
- Strongly encouraged to have a postgraduate qualification by the time of application:
 - Professional certification, MPH or an equivalent degree in addition to your basic degree, OR
- At least one year of relevant full-time public healthcare work experience. Examples of relevant public healthcare work experience include:
 - Employment at a government public agency
 - Employment at an international governmental or non-governmental organisation involved with public health
 - Post-doctoral work in public health sciences

The Epidemic Intelligence Service's (EIS) mission is to:

1. Increase the response capability of health systems by providing competency-based epidemiologic training and experience to EIS officers as they enter the healthcare workforce; and
2. Staff a broad-based team of epidemiologists who can be deployed by health agencies to investigate wide ranging events associated with disease outbreaks or other health threats.

What We Do

EIS officers serve on the frontline of vulnerable populations, protecting them from infectious diseases and training under the guidance of seasoned mentors. When disease outbreaks or other health threats emerge, EIS officers investigate, identify the cause, rapidly implement control measures and collect evidence to recommend preventive policy and actions.

What We Learn

During these 2-3 years of hands-on service, EIS officers serve the country while learning applied field epidemiology and gaining practical skills to become future health leaders.

How We Serve

EIS officers serve in a variety of locations, including field and headquarters assignments, and play a major role in the implementation of health missions. While serving on the front-line of national and international epidemiologic activity, EIS officers will:

- Conduct or participate in field investigations
- Design, conduct and interpret epidemiological analyses
- Evaluate public health surveillance systems
- Give public health talks about their work
- Give oral presentations to scientific audiences
- Write scientific manuscripts for peer-reviewed journals
- Write concise public health updates communicating timely information
- Write abstracts
- Communicate complex scientific concepts to lay audiences

II. CORE COMPETENCIES

The EIS is a post-doctoral training programme in applied epidemiology with the main purpose of increasing the epidemiology skills and experience of our healthcare workforce. EIS is built on a foundation of learning through service and incorporates a variety of learning strategies to acquire epidemiologic competence through the completion of the EIS core learning activities, otherwise known as CLA. However, EIS officers focus on developing the skills and experience they need to graduate from the programme rather than completing a specific project in a CLA.

Working with partners, the US EIS has developed core competencies as a consensus set of skills for the broad practice of applied epidemiology that reflects foundational skills desirable for public healthcare professionals. These core competencies are organised into eight topical fields, reflecting skill areas that need to be mastered successfully by these professionals. The competencies have been adapted from the EIS and serve as critical components for

the training process. These competencies and their sub-competencies are listed below.

Field 1: Assessment and Analysis

Identify public health problems pertinent to the population

- Use critical thinking to determine whether a public health problem exists
- Collaborate with others inside and outside the agency to identify the problem and form recommendations (discuss next steps)
- Articulate the need for further investigation or other public health action on the basis of results of literature review and risk assessment of identified public health problem

Conduct surveillance activities

- Describe surveillance for the particular health issue under consideration
- Summarise surveillance data to describe disease burden, trends, etc.
- Evaluate a surveillance system

Investigate acute and chronic conditions or other adverse outcomes in the population

- Explain investigative processes
- Generate hypotheses
- Assist in investigation (e.g., disease investigations, studies, or screening programmes)
- Use investigation techniques consistent with the public health problem

Apply principles and practice as they relate to study design and data collection, dissemination, and use

- Follow ethics guidelines and principles when planning studies; conducting research; and collecting, disseminating, and using data
- Describe the relevant laws to data collection, management, dissemination, and use of data and information
- Describe the differences between public health practice and public health research
- Describe human subjects research
- Describe institutional review board processes as necessary
- Manage conflicts of interest as necessary
- Describe knowledge of privacy laws to protect confidentiality
- Describe agency procedures for handling information requests
- Apply ethical principles in preparing and submitting publications

Manage data from surveillance, investigations, or other sources

- Define database requirements, if indicated
- Create and manage databases

Analyse data from an epidemiologic investigation or study

- Create analysis plans for data
- Analyse and interpret data

Summarise results of the analysis, and draw conclusions

- Apply knowledge of epidemiologic principles and methods to make recommendations on the field study
- Identify and list key findings from the study

Recommend evidence-based interventions and control measures in response to epidemiologic findings

- Establish a framework for recommendations or interventions
- Use scientific evidence in recommendations for action or interventions

Field 2: Basic Public Health Sciences

Use current knowledge of causes of disease to guide epidemiologic practice

- Relate basic aetiological processes for human diseases to subject matter areas of interest (i.e., Bradford Hill Criteria)
- Apply understanding of human and environmental biology as well as behavioural sciences and principles to determine the mechanisms of disease as bio-cultural phenomena
- Explain how genetics and genomics affect disease processes and public health policy and practice
- Consider principles of the host/agent/environment model to disease causation, prevention and control
- Consider the role and influence of sociobehavioural factors (including community, political, social, family and individual behavioural factors) in health risks and health status
- Describe etiologic principles needed for the development of disease prevention and control strategies

Use laboratory resources to support epidemiologic activities

- Identify the roles and capabilities of public health laboratories and other laboratories and how they are used in epidemiologic investigations

- Coordinate laboratory and epidemiologic activities, including test selection, sampling, communication and reporting results during the investigation
- Interpret laboratory data, accounting for factors that influence the results of screening and diagnostic tests
- Implement appropriate specimen collection, storage and transportation measures

Apply principles of informatics, including data collection, processing and analysis, in support of epidemiologic practice

- Use information technologies and communication tools necessary to support epidemiologic investigations and surveillance
- Use software tools that support online searching, public health data acquisition, entry, abstraction, management, analysis, planning, mapping and reporting
- Apply procedures and technical means to ensure the integrity and protection of confidential information in electronic files and computer systems
- Combine data and information from multiple sources to create new information to support public health decision-making
- Participate in the development of data models to ensure representation of epidemiologic needs in associated databases and information systems

Field 3: Communications

Prepare written and oral reports that communicate necessary information to professional audiences, policy makers and/or the general public

- Identify the audience, methods and content for communication of epidemiologic findings
- Communicate epidemiologic work to professional audiences and agency staff through written reports and oral presentations
- Communicate epidemiologic information to the general public, the news media and/or policy makers through oral presentations or contributing to the development of written documents (i.e., press releases)
- Tailor surveillance information content and periodicity of dissemination for specific audiences and their uses
- Demonstrate the ability to explain or teach basic epidemiologic principles to non-epidemiologists and lower-level epidemiologists

Demonstrate the basic principles of risk communication

- Participate in developing risk communication messages that convey epidemiologic information to particular public health problems
- Use basic risk communication principles to communicate epidemiologic messages

Incorporate interpersonal skills in communication with personnel, colleagues, and the public

- Demonstrate the ability to listen effectively when epidemiologic findings are presented or discussed
- Demonstrate professional interpersonal, interdisciplinary, cross-disciplinary and multi-disciplinary communication

Use effective communication technologies

- Participate in the development of the design and content of Web-based communication
- Use policies that address security, privacy and legal considerations when communicating epidemiologic information through e-mail, health alert networks or other potentially public documents
- Use effective educational and behavioural techniques along with technological tools to promote public health (e.g., through community education, behaviour modification, collaborative policy development, issue advocacy, and community mobilisation)

Field 4: Community Dimensions of Practice

Provide epidemiologic input into epidemiologic studies, public health programmes and community public health planning processes

- Use information from the community and from health status assessments to aid in the design, interpretation, and conduct of epidemiologic studies
- Provide epidemiologic input into an assessment of the local public health system to aid in planning

Participate in the development of community partnerships to support epidemiologic investigations

- Identify partners and stakeholders necessary for epidemiologic investigation
- Use community-specific participation strategies in the planning, implementation and evaluation of epidemiologic investigations when indicated

- Clarify the roles of partners and stakeholders in the epidemiologic investigation
- Participate in the development of epidemiologic studies, including incorporating input from task forces and other target audiences

Field 5: Cultural Competency

Describe population by social determinants

- Consider population social categories or subcategories (e.g., race; ethnicity; culture; societal, educational, and professional backgrounds; age; gender; religion; disability; and sexual orientation) when performing data analysis

Design surveillance systems to consider groups subject to health disparities or other potentially underrepresented groups

- Consider standard categories when defining special populations
- Identify historical, social and political contexts of standard categories
- Identify limitations of standard categories
- Work with the community as necessary to develop new categories if standard categories are unavailable
- Design data collection tools to capture information needed to assess health disparities
- Design the sampling plan to ensure that the sample size is large enough to provide stable estimates in the populations of interest
- Avoid potential adverse impacts of data collection on special populations

Conduct investigations using languages and approaches tailored to the population

- Identify the primary language of the populations
- Use knowledge of specific socio-cultural factors in the population

Use knowledge of specific socio-cultural factors in the population to interpret findings

- Identify cultural factors that may have influenced the outcome of the investigation populations

Recommend public health actions that would be appropriate and relevant to the affected community

- Describe alternative actions that have been shown to be effective in similar populations

- Recommend action strategies that will address the issues identified in the investigation while meeting the needs of the community populations
- Consider the culture and local conditions when making recommendations

Field 6: Operational Planning and Management

Use skills that foster collaborations, strong partnerships and team building to accomplish epidemiology programme objectives

- Build collaborative relationships with key personnel relevant to the particular epidemiologic activity populations
- Work well with other epidemiology project team members of varied backgrounds and education populations
- Describe roles and responsibilities of all participants in epidemiologic activities populations
- Design and implement a communication plan between team members that includes meetings for updates and discussions

Field 7: Leadership and Systems Thinking

Promote ethical conduct in epidemiologic practice

- Demonstrate ethical conduct in personal behaviour and epidemiologic practice
- Make expectations of ethical conduct clear to team members, when necessary
- Follow the organisation's policies and practices related to ethical conduct

Prepare for emergency response

- Participate in emergency response planning for the epidemiology unit
- Present epidemiologic perspective in the development of an agency emergency response plan
- Respond to public health emergencies, as necessary

Field 8: Policy Development

Bring epidemiologic perspective in the development and analysis of public health policies

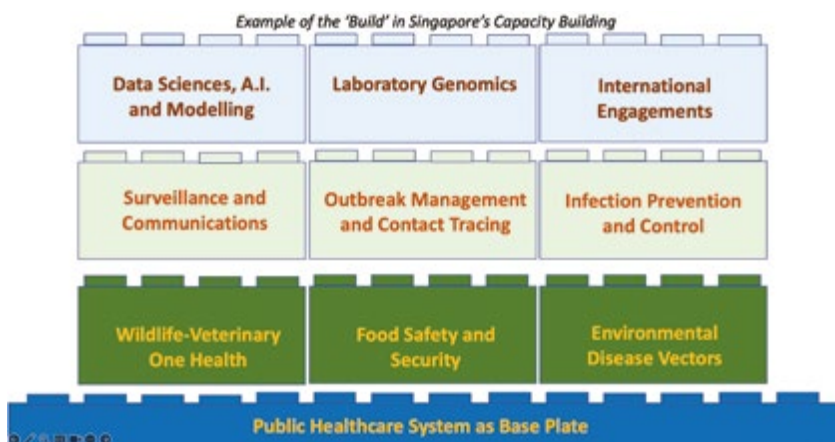
- Describe public health policies and policy development from an epidemiologic perspective
- Support development of policies based upon epidemiologic studies
- Participate in the translation of public health policies into epidemiology roles in programmes or plans

- Adhere to rules and laws applying to public agencies regarding lobbying and community health advocacy

III. CURRICULUM AT A GLANCE

The curriculum summary below provides a snapshot of the required programme activities, i.e., what constitutes epidemic intelligence in the SG EIS, epidemic intelligence training, core learning activities (CLAs), progressive model for learning and didactic activities.

What Constitutes Field Epidemiology in the SG EIS



Epidemic Intelligence Training

Epidemic intelligence training is currently embedded within the field epidemiology training programme and constitutes an important line of defence for the world against infectious diseases and other emergent threats. A vital partnership exists between the National Centre for Infectious Diseases (NCID) and the National University of Singapore's (NUS) Saw Swee Hock School of Public Health with the Ministry of Health's Communicable Diseases Agency (CDA) on creating national training initiatives to allow for stepwise grooming of professionals to meet outbreak epidemiology needs.

The Singapore field epidemiology training programme currently trains a pool of health professionals to meet a need for epidemiologists who can conduct field investigations and disease control. We are a founding member of the ASEAN+3 Field Epidemiology Training Network (FETN) and joined the Training

Programs in Epidemiology and Public Health Interventions Network (known as TEPHINET) in 2010.

A successful outcome of epidemic intelligence training would be the graduation of a cadre of highly competent professionals who, having been cross-trained in field epidemiology with other institutions, hospitals and agencies, can provide domain expertise in applied epidemiology with the skills and knowledge for outbreak management and pandemic response. We have established ties with the WHO-FAO-WOAH-UNEP Quadripartite on One Health, ASEAN+3 FETN, SAFETYNET and TEPHINET networks as well as with counterparts in other countries. Regular exchange with international partners also helps to secure relevant global health experiences for our trainees.

CLAs – Core Learning Activities

This is a list of CLAs each epidemic intelligence officer will be required to compete.

- **Field Investigation:** Conduct or participate in a field investigation of a potentially serious public health problem that requires a timely response.
- **Epi Analysis:** Design, conduct and interpret an epidemiological analysis.
- **Surveillance Project:** Describe and evaluate a public health surveillance system.
- **Long Presentation:** Give an in-depth public health talk on the officer's original work or on their field of study.
- **Short Presentation:** Give a 5–15 minute oral presentation to a scientific audience.
- **Peer-reviewed Manuscript:** Write and submit, as the first author, a scientific manuscript for a peer-reviewed journal.
- **Concise Public Health:** Write and submit, as the primary author, a concise public health update communicating timely information.
- **Abstract:** Write and submit, as the first author, an abstract.
- **Lay Audience:** Communicate complex scientific concepts to a lay audience.
- **Service to Agency:** Provide service to the CDA or other public health agency.

Our Progressive Model

Didactic Learning Activities

In our bespoke progressive model of applied epidemiology, organisation-specific concerns such as contact tracing, infection prevention and control, outbreak

management, business continuity planning, surveillance and communications, food safety, urban health security, environmental disease vectors, and wildlife and veterinary epidemiology, can be set out clearly at the start so as to provide a checklist for trainees to document and itemise progress. Operating out of the NCID for field practice and NUS for academics, this training programme is designed to meet the challenging needs for responding to outbreaks.

Foundational Tier

For staff engaged in rapid response teams or on the frontlines of an outbreak, a primer in field epidemiology practice plus classroom groupwork to complement applied on-the-job (OTJ) learning experiences is provided. According to the needs of each organisation, five-day workshops with over 40 hours of instruction and practice enable the trainees to acquire an understanding of rapid response methods and teamwork to prepare them to conduct and complete field studies. Successful participants will receive NCID-NUS certificates of competency.

Intermediate Tier

For upcoming supervisory staff, cross-training on the fundamentals of surveillance, epidemiology and response is provided. Teaching comprises approximately 120 hours of instruction and practice interspersed with on-the-job learning and applied epidemiology projects. This proficiency level provides the trainee the opportunity to acquire the essential knowledge and skills to conduct field studies with minimal supervision. Successful participants will receive professional certification by NCID-NUS.

Advanced Tier

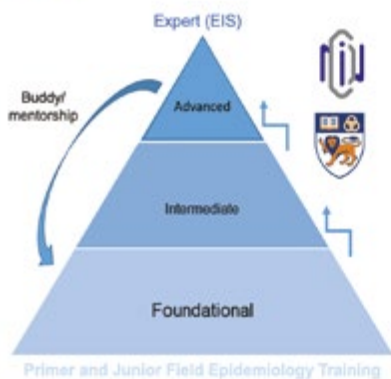
For trainees who complete the intermediate tier and seek further field experience with environmental and social-behavioural components, this level of proficiency requires 2-3 years of rigorous learning with sufficient acquisition of knowledge and skills to guide and mentor other epidemiologists. Advanced trainees must exercise situational field leadership and business continuity planning. Successful participants attain advanced practice recognition by NCID on subject matter expertise.

Course Learning Curriculum

There is progressive upskilling for trainees in our stackable tiered courses (customisable for agencies and communities with different goals), future-

readying them to conduct field epidemiology under complex and challenging circumstances. Our programme trains public healthcare professionals utilising a tripartite collaboration between NUS, NCID and CDA which taps on each institution's strengths. Apprenticeship with the buddy-and-mentoring system is emphasised throughout the learning journey.

Build progressive FETP as an innovative public health training platform for multi-sectoral risk analysis and response to outbreaks



Methods in field epidemiology...

- Fundamental Field Epidemiology
- Multisectoral (One Health) Field Epidemiology
- All Hazards Urban Field Epidemiology

Outbreak epidemiology and practice...

- Basic Outbreak Rapid Response
- Urban Outbreak Management
- Infectious Disease and Outbreak Management*

Health emergency preparedness for cities...

- Urban Epidemiology and Emergency Preparedness
- Urban Pandemic Response in Cities*
- Urban Health Security*

What does success look like for participants? Based on individual organisation needs, trainees should be able to:

- Identify infectious diseases of public health importance
- Describe the steps in investigation and reporting
- Know how to access and review PH literature
- Create tables, epidemic curves and spot maps
- Describe roles and operate different surveillance systems
- Understand the role of lab-based surveillance
- Analyse and interpret surveillance data
- Respond appropriately to surveillance findings
- Assist in outbreak interventions and communications

What if EIS officers want to go further? The programme is flexible enough to customise core curriculum, which is based on the US CDC's EIS curriculum document to develop participants in the domains and instructional goals that constitute competencies for their continuing professional development.

IV. CORE LEARNING ACTIVITIES

All SP EIS officers must complete the following applied on-the-job (OTJ) experience of core and didactic learning activities to graduate.

CLA 1: Community Service

The primary purpose for the community service is to help the officer be confident on the ground in community-centred ways.

CLA	Provide service to the community through an agency
Deliverables	150-word Summary
Requirements	To receive credit for this activity, it must provide service activities for about 5 per cent of time during the 2-year EIS assignment (approximately 2 weeks)
Options to Fulfil	Officers should consult with their supervisor and take into consideration their career development needs when choosing activities to fulfil this activity. Examples include: ☐ Course lecturer or case study facilitator, panelist ☐ Youth leader ☐ Peer reviewer ☐ Public health committee member ☐ Short-term student mentor ☐ Other activities might be approved in advance by EIS Programme
Recommended Time Frame	By the end of the first year
Competency Domains	☐ Assessment and Analysis ☐ Communications ☐ Leadership and Systems Thinking

Considerations

- The activities selected should support the overall career goals of the officer whenever possible (e.g., if the officer plans to return to academia, participating in a grant review or a journal manuscript review might be helpful).

- If public health events make it necessary, officers must still fulfil emergency response activities as required by the agency, even if involvement exceeds the time requirement.

CLA 2: Field Investigation

The field investigation emphasises investigative techniques, critical thinking, decision-making skills, cooperation and collaboration. The field investigation remains a signature activity for SP EIS officers.

CLA	Conduct or participate in a field investigation of a potentially serious public health problem that requires a timely response
Deliverables	Summary report
Requirements	To receive credit for this activity, it must include the following components: ❑ Collect original data (e.g., interviews, chart reviews) ❑ Work with local, regional or international partners ❑ Commit at least 10 working days to the project (including planning, field work, data collection, data analysis and follow-up)
Options to Fulfil	❑ Local, regional, international field investigations ❑ Health hazard evaluation (One Health) ❑ Other field investigations might be approved in advance by the EIS Programme
Recommended Timeframe	By the end of the first year
Competency Domains	❑ Assessment and Analysis ❑ Basic Public Health Sciences ❑ Communications ❑ Community Dimension of Practice ❑ Cultural Competency ❑ Financial and Operational Planning and Management ❑ Leadership and Systems Thinking

Considerations

- The collection of data can be by telephone, online survey, in person or be a chart abstraction.
- Officers must interact with public agencies, stakeholders and the community at multiple points during the investigation.
- The 10-day duration includes any preliminary and follow-up work upon the officer's return from the field.
- A timely response does not necessarily mean an emergency response.

CLA 3: Surveillance Project

For the surveillance project, officers will evaluate a public health surveillance system, develop objectives for the evaluation of a surveillance system, present their findings, communicate with stakeholders and follow-up to assess the objectives.

CLA	Evaluate a public health surveillance system
Deliverables	1. Surveillance evaluation report, including surveillance objectives 2. Slide set from surveillance evaluation oral presentation 3. Follow-up evaluation of objectives one year after initial surveillance evaluation
Requirements	To receive credit for this activity, it must include the following components: 4. Conduct an original evaluation that contributes to the assessment of a surveillance system of significance 5. Write a report and give an oral presentation 6. Include use of appropriate graphics in the presentation 7. Include public health recommendations or potential implications 8. Surveillance objectives 9. Communicate plan to stakeholders 10. Follow-up to assess objectives one year after initial surveillance evaluation

Options to Fulfil	Potential types of surveillance systems include: ❑ Disease surveillance ❑ Morbidity surveillance ❑ Mortality surveillance ❑ Risk factor surveillance ❑ Syndromic surveillance ❑ Other surveillance systems
Recommended Time Frame	By the end of the first year
Competency Domains	❑ Assessment and Analysis ❑ Communications ❑ Community Dimensions of Practice ❑ Financial and Operational Planning and Management ❑ Leadership and Systems Thinking ❑ Policy Development

Considerations

- The intent is that each officer will complete a novel evaluation. An original evaluation can be done on a system previously evaluated if the officer is making a substantially different contribution, which will ensure that the information studied and presented will be of service.
- Officers should communicate the findings and recommendations of the surveillance evaluation to the stakeholders.
- Officers may design and develop a surveillance system and evaluate the system per recommended guidelines.
- To help ensure that surveillance projects address meaningful issues, officers are expected to report how findings from their evaluation were used for public health action (i.e., evaluation of the objectives).

CLA 4: Epidemiologic Analysis

The goal of the epidemiologic analysis is to learn new analytical epidemiology skills or improve existing skills.

CLA	Design, conduct, and interpret an epidemiologic analysis
Deliverables	1. Data analysis plan 2. Data analysis summary report (including study design, sample size, software, descriptive findings)
Requirements	To receive credit for this activity, it must include the following components: ❑ Develop a data analysis plan involving descriptive and analytical statistics ❑ Use software to manage data ❑ Use epidemiologic methods that account for study design, sample size, bias, power, confounding and effect modification, as appropriate ❑ Interpret the analyses and make public health recommendations or describe potential implications
Options to Fulfil	Potential data sources include: ❑ Field investigation data ❑ Research study data ❑ Surveillance system data ❑ Other sources might be approved in advance by the EIS Programme
Recommended Time Frame	By the end of the first year
Competency Domains	❑ Assessment and Analysis ❑ Basic Public Health Sciences ❑ Cultural Competency ❑ Financial and Operational Planning and Management ❑ Policy Development

Considerations

- Officers should meet with their supervisors prior to beginning the analysis to review the data analysis plan.
- Supervisors should provide feedback to ensure the plan is appropriate for the study.
- Supervisors should review the final analysis for completeness and accuracy.

CLA 5: Scientific Short Presentation

The purpose of the short presentation is for officers to identify and present the most salient points of their work to a scientific audience in an oral presentation.

CLA	Give a 15-minute oral presentation to a scientific audience
Deliverables	Slide set used for oral presentation
Requirements	To receive credit for this activity, it must include the following components: ❑ Present to a scientific, medical or public health audience beyond officer's branch or team ❑ Give a focused, formal presentation on officer's original work conducted during the 2-year EIS assignment (e.g., data analysis, field investigation) ❑ Provide information about background, methods, results and public health recommendations or potential implications of work ❑ Answer questions not known in advance ❑ Include appropriate graphics
Options to Fulfil	❑ Public health conferences ❑ National or regional epidemiology conferences ❑ TEPHINET, SAFETYNET conferences ❑ Other presentations might be approved in advance by the EIS Programme
Recommended Time Frame	By the end of the second year
Competency Domains	❑ Assessment and Analysis ❑ Basic Public Health Sciences ❑ Communications

Considerations

- Supervisors should review the presentation before delivery to the larger audience.
- This presentation must be a focused summary of the officer's original EIS work.
- Posters do not meet the criteria for this activity.

CLA 6: Scientific Long Presentation

The purpose of the long presentation is to provide officers an opportunity to practice creating and delivering a lengthy (≥30 minutes) scientific public health lecture to a relevant audience. These talks will typically include a more thorough discussion of the context of an activity and the implications of the public health recommendations than the short scientific presentation.

CLA	Give an in-depth public health talk on the officer's original work or in their field of study
Deliverables	Slide set used for oral presentation
Requirements	To receive credit for this activity, it must include the following components: ❑ Present to a scientific, medical or public health audience beyond officer's branch or team ❑ Give a formal presentation lasting ≥30 minutes ❑ Include appropriate graphics ❑ Answer questions not known in advance (Q/A section) ❑ Provide public health recommendations or potential implications of work ❑ Invite a minimum of 25 attendees
Options to Fulfil	❑ Public health conference, scientific session, workshop or master class ❑ Grand rounds at a medical school, school of public health ❑ Invited guest lecturer at a school of public health or other scientific gathering (see criteria above) ❑ Other venues might be approved in advance by the EIS Programme
Recommended Time Frame	By the end of the second year

CSTE Competency Domains	☐ Assessment and Analysis ☐ Basic Public Health Sciences ☐ Communications
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Considerations

- The presentation should be at least 30 minutes, not including the question-and-answer session.
- The lecture can be broadly focused in a public health area relevant to the officer's EIS work and does not have to include information about their original research, although discussion of their original work is preferable.

CLA 7: Scientific Peer-Reviewed Manuscript

Writing and submitting a scientific peer-reviewed manuscript is a critical skill and activity for EIS officers. It is important to note that at least one first-authored manuscript must be submitted to a journal prior to the end of the officer's tenure in the programme.

CLA	Write a scientific manuscript
Deliverables	Electronic copy of the cleared manuscript.
Requirements	To receive credit for this activity, it must include the following components: ☐ Officer must be the first author on the manuscript ☐ Present officer's original work conducted during the 2-year EIS assignment (e.g. data analysis or field investigation) ☐ Include language corresponding to background or introduction, methods, results and discussion sections ☐ Include public health recommendations or potential implications of findings ☐ Submit cleared manuscript to peer-reviewed journal

Options to Fulfil	Articles with two first authors will be considered on a case-by-case basis and must be approved in advance by the EIS Programme. A single document cannot fulfil both the peer-reviewed manuscript and the concise public health update CLAs. However, a single activity (e.g., outbreak investigation) might be used to create two different manuscripts that fulfil these two activities.
Recommended Time Frame	By the end of the second year
Competency Domains	☐ Assessment and Analysis ☐ Communications ☐ Financial and Operational Planning and Management ☐ Leadership and System Thinking

Considerations

- A manuscript submitted to a peer-reviewed journal is preferred although a full-length Infectious Disease Intelligence report will fulfil the CLA.

CLA 8: Concise Public Health Update

The purpose of the concise public health update is to have officers write a public health report to learn how to present a public health communication message with a word limit.

CLA	Write a concise public health update communicating timely information
Deliverables	Copy of Infectious Disease Intelligence report, newsletter/update, health bulletin, WHO report

Requirements	To receive credit for this activity, it must include the following components: ❑ Officer must be the primary author of the public health update ❑ Write a brief public health update with no more than 1400 words for an external scientific, medical or public health audience based on original work conducted during the 2-year EIS assignment ❑ Include text describing background/ introduction, methods, results and discussion ❑ Include public health recommendations or potential implications of findings ❑ Undergo editorial review ❑ Submit cleared public health update to publication
Options to Fulfil	Write and submit to at least one of the following: ❑ Infectious Disease Intelligence report ❑ Newsletter/update for a national, regional or international publication ❑ Short journal report ❑ WHO Weekly Epidemiologic Report (WER) ❑ Other options might be approved in advance by EIS Programme
Recommended Time Frame	By the end of the first year
Competency Domains	❑ Assessment and Analysis ❑ Communications ❑ Financial Planning and Management ❑ Leadership and Systems Thinking

Considerations

- The report should be timely. A timely update does not necessarily have to be associated with a public health emergency such as an outbreak or disaster.

CLA 9: Abstract Writing

The focus of the abstract writing is for officers to write and submit an abstract for a conference presentation.

CLA	Write a scientific abstract
Deliverables	Electronic version of submitted abstract
Requirements	To receive credit for this activity, it must include the following components: ❑ Officer must be the first author of the abstract ❑ Write and submit an abstract based on the officer's original work conducted during the 2-year EIS assignment ❑ Submit cleared abstract to conference
Options to Fulfil	Write and submit to at least one of the following: ❑ Public health conferences ❑ National or regional epidemiology conferences ❑ TEPHINET, SAFETYNET conferences
Recommended Time Frame	By the time EIS abstracts are accepted during the second year
Competency Domains	❑ Assessment and Analysis ❑ Communications ❑ Financial and Operational Planning and Management ❑ Leadership and Systems Thinking

Considerations

- All officers are required to submit at least one abstract to a scientific conference over the course of the two-year EIS assignment.

CLA 10: Lay Audience Outreach

The purpose of the lay audience outreach CLA is for each officer to communicate complex scientific information to a lay audience. The response can be either written or oral.

CLA	Communicate complex scientific concepts to a lay audience
Deliverables	150-word summary, including audience description
Requirements	To receive credit for this activity, it must include the following components: ☐ Written or oral presentation material ☐ Communicate the message with the appropriate level and style ☐ Disseminate the message to the public, media or target lay audience
Options to Fulfil	☐ Fact Sheet ☐ Local community meeting (e.g., school, community group) ☐ Media interview ☐ Media office of a regulatory agency ☐ On-call response to public queries ☐ Policy brief book ☐ Press releases ☐ Web material preparation ☐ Other options might be approved in advance by EIS Programme
Recommended Time Frame	By the end of the first year
Competency Domain	☐ Communications

Considerations

- Officers are encouraged to practice both verbal and written responses, although the activity will be fulfilled by either one.
- The message should be free from scientific jargon and terminology. All written materials should be written on an appropriate level for the lay audience.

Didactic Learning Activities

Learning Road Map

Epidemic intelligence training is built on a foundation of learning through service and is designed to incorporate a variety of learning strategies. This includes classroom training, though the proportion of didactic training is small compared to the proportion of applied on-the-job experience. Through didactic learning, the officers gain knowledge and develop skills that help them conduct field studies. The classroom experience also affords officers the opportunity to learn from and interact with experts in their fields, as well as with each other. A suggested trajectory of required didactic learning activities which has been applied for residents can be as follows:

Foundational Tier

Learning objectives

Graduates at the foundational level should be able to:

- Recognise transmission dynamics in the emergence of disease outbreaks and epidemics
- Adopt an evidence-based scientific approach when conducting outbreak field investigations
- Collaborate across disciplines under the One Health framework for outbreak management

Eligible officers

Residents will have to understand basic public healthcare and field epidemiology practice and be prepared to serve in frontline roles as rapid response team members.

Teaching methods

A foundational course conducted by NCID in collaboration with our core faculty who will provide a combination of classroom teaching, field experiences and interactive sessions. This course culminates with a follow up workshop on public healthcare practice.

Curriculum topics

Skills Domain	Competencies
Public Healthcare Practice	Learn to apply an evidence-based scientific approach to collect information and describe the problem, report and compare risks
Biostatistics	Understand basic terms in quantitative epidemiology and the use of statistical tests, p values and confidence intervals
Surveillance Systems	Recognise the attributes of surveillance systems, measures of dispersion, association and central tendency, use of graphs and other techniques to depict data
Epidemiologic Methods	Collect, manage and organise data to produce information, harness information technologies to process and present information to different audiences
Disease Control	Identify causality in the associations between host, agent/vector and the environment, and how to prevent spread by breaking the chain of transmission
Urban Health Security	Recognise health security concerns in the urban setting and global health obligations under WHO's International Health Regulations (2005)
Outbreak Operations	Appreciate the importance of operational planning, implementation and evaluation cycles to produce intended outcome and energise teamwork
Communications	Understand the role of media channels for public health messaging and how to package information to achieve objectives
Policy and Leadership	Assist management in engaging policymakers and political stakeholders by demonstrating ethical choice, values and professional practices

Assessment and certification

The officer must demonstrate basic skills to perform field epidemiology objectives under supervision as well as understanding of the above competencies. Subject to satisfactory professional assessment, each participant will be issued a certificate of completion by NCID.

Intermediate Tier

Learning objectives

Graduates at the intermediate level should be able to:

- Understand how to evaluate surveillance findings and assess public health risk
- Conduct field epidemiology work in outbreak management, prevention and control
- Demonstrate effective communications with stakeholders, scientists, policy makers and members of the public

Eligible officers

Residents who would like to pursue further training in the public health track and to fulfil career roles in communicable diseases control, including epidemiologic investigation, surveillance and policy.

Teaching methods

Mentorship along with classroom interactions by NCID interspersed with on-the-job learning over one year at a public healthcare agency or equivalent institution with significant assignments to complete in five key areas:

- Leading field investigations in a major outbreak or incident
- Designing and evaluating a system for surveillance monitoring
- Providing the basis for a policy decision using epidemiological study
- Writing up a scientific report for publication as first author
- Presenting epidemiological findings at a public healthcare conference

Curriculum topics

Skills Domain	Competencies
Public Health Practice	Understand the principles and practice of public health as applied to emergencies, epidemic control, at-risk populations and community engagement

Skills Domain	Competencies
Biostatistics	Be able to use univariate testing and multivariate analyses when dealing with data and apply statistical tools in risk assessment and scientific writing
Surveillance Systems	Design and evaluate a surveillance system to monitor, evaluate and deal with clusters of unusual symptoms and issues related to a food/ environmental/animal health threat
Epidemiologic Methods	Document relevant field epidemiology experiences as first author of one scientific journal manuscript in a peer-reviewed international public health/medical publication
Disease Control	Understand the all-hazards approach in disease control and apply strategies to identify and mitigate risk factors
Urban Health Security	Assist in pandemic preparedness and investigate into outbreaks of uncertain aetiology or emerging infectious diseases of global health importance
Outbreak Operations	Perform as team leader conducting field investigations into an outbreak or other major incident involving an animal/food/environmental hazard
Communications	Present epidemiological findings at an international public health/medical conference and be able to justify recommendations to the scientific community
Policy and Leadership	Conduct an epidemiological study to gather data for a scientific evidence-based approach to policy and decision-making

Assessment and certification

The officer must be proficient with field epidemiology knowledge and skills as well as a proper mindset so as to be able to work independently or with minimal supervision. Subject to satisfactory professional assessment, each participant will be issued a certificate of completion by NCID. If residents have not yet done

so, they will also be encouraged to undergo relevant didactic components in master's level modules.

Advanced Tier

Learning objectives

Graduates at the advanced 3 level should be able to:

- Exercise effective public health leadership and influence the community amidst change
- Apply the principles and practice of risk assessment and management for all hazards
- Appreciate fully implications of global health security and international health regulations
- Advocate a whole-of-society approach in addressing public health emergencies

Eligible officers

Residents who have shown passion for infectious diseases epidemiology work and would like to continue after completing the intermediate tier to train as epidemic intelligence service officers. He/she will be groomed as a subject-matter expert for situational field leadership roles.

Teaching methods

In addition to methods employed in the foundational and intermediate tiers, this level will expose the trainee to significant epidemic intelligence work, including being operationally ready for regional attachments, global health exposures and international training stints involving ASEAN+3 FETN, US CDC, WHO GOARN, SEARO and WPRO.

Curriculum topics

Skills Domain	Competencies
Public Health Practice	Synthesise the understanding of public health principles and practice with knowledge of disease causation to guide epidemiologic practice
Biostatistics	Manage data from all sources and undertake proper assessment and analytics in order to define the public health issues, including limitations of available knowledge

Skills Domain	Competencies
Surveillance Systems	Know how to initiate indicator-based as well as event-based surveillance in order to monitor illness trends and guide public health actions
Epidemiologic Methods	Be familiar with epidemiologic methods (e.g., observational and analytic study designs) to document outbreak events in a timely and accurate manner
Disease Control	Lead multi-disciplinary efforts in disease prevention and control interventions on the basis of epidemiologic findings and scientific evidence
Urban Health Security	Play an active role in regional outreach, preparedness planning and response to pandemics and public health emergencies of international concern
Outbreak Operations	Supervise logistics and operations mounted in response to all kinds of outbreaks involving different modes of transmission
Communications	Develop and deliver effective public health communications to professional audiences, policy decision makers and the general public
Policy and Leadership	Develop teamwork and community partnerships to support field epidemiologic investigations, policy-making and stakeholder engagement

Assessment and certification

This level of proficiency requires in-depth experience of field epidemiology along with sufficient application of specialist knowledge and skills to guide and mentor others as seniors. Residents would be encouraged to develop subject matter expertise in ways that are meaningful for them. Subject to satisfactory professional assessment, each participant will be issued a certificate of completion by NCID. If residents have not yet done so, they will also be encouraged to undergo relevant didactic components in master's level modules.

V. SOME TEXTBOOK RESOURCES

Because our EIS officers enter the programme with varying backgrounds in public health, epidemiology and clinical knowledge, we provide a wide-ranging recommended resource list covering cross-cutting issues. For resources specific to your assignment, we recommend that EIS officers consult with your assignment supervisors and coworkers.

Provided Texts

Ooi PL, Boudville I, Chan M, Tee N, eds. *Communicable Diseases Control*. Singapore: S-FETP; 2020.

Epidemiology

Basic Epidemiology

- Centers for Disease Control and Prevention. *Principles of Epidemiology in Public Health Practice*. 3rd ed. <https://stacks.cdc.gov/view/cdc/13178>. 2012. [Note: very basic; great place for newbies or EIS officers that haven't used their basic epidemiology skills for a while to start]
- Ashengrau A, Seage GR. *Essentials of Epidemiology in Public Health*. 2nd ed. Sudbury, MA: Jones & Bartlett; 2007.
- Friis R, Sellers T. *Epidemiology for Public Health Practice*. 4th ed. Sudbury, MA: Jones & Bartlett; 2008.
- Gordis L. *Epidemiology*. 4th ed. Philadelphia, PA: Saunders Elsevier; 2008.
- Hennekens CH, Buring JE. *Epidemiology in Medicine*. Boston, MA: Little Brown; 1987.
- Rothman K. *Epidemiology: An Introduction*. New York, NY: Oxford University Press; 2002.

Field Epidemiology

- Gregg MB, ed. *Field Epidemiology*. 3rd ed. New York, NY: Oxford University Press; 2008.
- MacDonald PDM. *Methods in Field Epidemiology*. Sudbury, MA: Jones & Bartlett; 2011.

Intermediate Epidemiology

- Kleinbaum DG, Kupper LL, Morgenstern H. *Epidemiologic Research: Principles and Quantitative Methods*. Belmont, CA: Lifetime Learning Publications; 1982.

- Rothman KJ, Greenland S, Lash TL. *Modern Epidemiology*. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2008. [Note: this text is relatively academic per reviewers]

Advanced/Specialty Epidemiology

- Higgins JPT, Green S, eds. *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration; 2011.
- Nelson KE, Williams CM. *Infectious Disease Epidemiology: Theory and Practice*. 2nd ed. Sudbury, MA: Jones and Bartlett; 2007.
- Remington PL, Brownson RC, Wegner MV. *Chronic Disease Epidemiology and Control*. 3rd ed. Washington, DC: APHA Press; 2010.
- Thomas JC, Weber DJ. *Epidemiologic Methods for the Study of Infectious Diseases*. New York: Oxford University Press; 2001.

Public Health Surveillance

General Guidelines and Guidance

- Centers for Disease Control and Prevention. Updated Guidelines for Evaluating Public Health Surveillance Systems. *MMWR*. 2001;50(RR-13): 1–35. <http://www.cdc.gov/mmwr/pdf/rr/rr5013.pdf>
- Centers for Disease Control and Prevention. Framework for Evaluating Public Health Surveillance Systems for Early Detection of Outbreaks. *MMWR*. 2004;53(RR-05):1–11.
- Gregg MB, ed. *Field Epidemiology*. 3rd ed. New York, NY: Oxford University Press; 2008. *Provided text
- Lee LM, Teutsch SM, Thacker SB, St. Louis ME, eds. *Principles and Practice of Public Health Surveillance*. 3rd ed. New York, NY: Oxford University Press; 2010.
- World Health Organization. Communicable disease surveillance and response systems: Guide to monitoring and evaluating. 2006. https://iris.who.int/bitstream/handle/10665/69331/WHO_CDS_EPR_LYO_2006_2_eng.pdf?sequence=1

Focused Topics

- Jajosky RA, Groseclose SL. Evaluation of reporting timeliness of public health surveillance systems for infectious diseases. *BMC Public Health*. 2004;4(29). doi: 10.1186/1471-2458-4-29.

- Grenier D, Doherty J, MacDonald D, et al. Canadian Paediatric Surveillance Program evaluation: An excellent report card. *Paediatrics & Child Health*. 2004; 9(6): 379–384. <https://doi.org/10.1093/pch/9.6.379>
- Committee on Public Health Strategies to Improve Health; Institute of Medicine. For the Public's Health: the role of measurement in action and accountability. <http://iom.edu/Reports/2010/For-the-Publics-Health-The-Role-of-Measurement-in-Action-and-Accountability.aspx>
- World Health Organization. Communicable disease surveillance and response systems: Guide to monitoring and evaluating. 2006. https://iris.who.int/bitstream/handle/10665/69331/WHO_CDS_EPR_LYO_2006_2_eng.pdf?sequence=1
- WHO Regional Office for Africa. Technical Guidelines for Integrated Disease Surveillance and Response in the African Region, 2nd Edition. https://www.afro.who.int/sites/default/files/2017-06/IDSR-Technical-Guidelines_Final_2010_0.pdf
- Nsubuga P, Brown WG, Groseclose SL, et al. Implementing integrated disease surveillance and response: Four African countries' experience, 1998–2005. *Glob Public Health*. 2010;5(4):364–80. <https://doi.org/10.1080/17441690903334943>

Biostatistics

Basic Biostatistics

- Gerstman BB. *Basic Biostatistics*. Sudbury, MA: Jones & Bartlett Learning; 2008.
- Gonick G, Smith W. *The Cartoon Guide to Statistics*. Harper Collins; 1993. (This one is a fun and simple explanation of stats for you newbies!)
- Hinton P. *Statistics Explained: A Guide for Social Science Students*. 2nd edition. New York, NY: Routledge; 2004.
- Motulsky H. *Intuitive Biostatistic: A Nonmathematical Guide to Statistical Thinking*. New York, NY: Oxford University Press; 2010.

Intermediate Biostatistics

- Hosmer D, Lemeshow S. *Applied Logistic Regression*. 2nd ed. New York, NY: Wiley, 2001.
- Kleinbaum DG. *Logistic Regression: A Self-learning Text*. 3rd ed. New York, NY: Springer-Verlag, 2010.
- Kleinbaum DG. *Survival Analysis: A Self-learning Text*. 3rd ed. New York, NY: Springer-Verlag, 2011.

- Levy P, Lemeshow S. *Sampling of Populations Methods and Applications*. 4th ed. New York, NY: Wiley; 2008.

SAS

- Cody RP, Smith JK, eds. *Applied Statistics and the SAS Programming Language*. 5th ed. Prentice Hall; 2005.
- Delwiche LD, Slaughter SJ. *The Little SAS Book*. 4th edition. Cary, NC: SAS Institute, Inc.; 2008.
- Note that most reviewers indicated that the best resources for SAS were internet resources (such as those recommended on the instructions for accessing SAS training)

Useful Websites for Manuscript Preparation

- Oxford Academic. AMA Manual of Styles. <https://academic.oup.com/amamanualofstyle>
[Note: CDC has a subscription for this manual, so this link is available only through CDC network or CITGO. Open up your browser and go to any intranet page. Then copy and paste the link above into the address bar. If it worked, you will see the following message below the “Go directly to this section:” drop down box: “You are browsing courtesy of your institution or library: CDC Public Health Library %26amp; Information Center”]
- International Committee of Medical Journal Editors. Uniform Requirements for Manuscripts Submitted to BioMedical Journals. www.icmje.org/urm_main.html.
- Patrias K, Wendling D, eds. *Citing Medicine*. 2nd ed. Bethesda, MD: National Library of Medicine; 2007. <http://www.ncbi.nlm.nih.gov/books/NBK7256/>.

Journal Articles

- CDC. Ten Great Public Health Achievements—United States, 2001–2010. *MMWR*. 2011;60(19):619–23.
- <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6019a5.htm>
- Centers for Disease Control and Prevention. Law and Public Health at CDC. *MMWR*. 2006;55(Suppl 2):29–33.
- <http://www.cdc.gov/mmwr/preview/mmwrhtml/su5502a11.htm>
- Goodman RA, Foster KL, Gregg MB, eds. Highlights in Public Health: Landmark Articles from the *MMWR*, 1961–1996. <http://www.cdc.gov/mmwr/PDF/other/highlite.pdf>

Reference Books

- *Dorland's Pocket Medical Dictionary*. 29th ed. Philadelphia, PA: Elsevier Health Sciences; 2012. [Good reference for non-clinicians to look up medical terminology]
- Heymann DL, ed. *Control of Communicable Diseases Manual*. 19th ed. Washington, DC: American Public Health Association; 2008. *Provided text
- Porta M, ed. *A Dictionary of Epidemiology*. 5th ed. New York, NY: Oxford University Press, 2008. [This is the dictionary formerly edited by John Last]
- Centers for Disease and Control and Prevention. *CDC Health Information for International Travel 2012*. New York, NY: Oxford University Press; 2012. <http://wwwnc.cdc.gov/travel/page/yellowbook-2012-home.htm>
Also known as "CDC's Yellow Book"

Nonfiction Books

- Buck C, Llopi NE, Terris M, eds. *The Challenge of Epidemiology: Issues and Selected Readings*. Washington, DC: PAHO; 1988.
- Coughlin S, Beauchamp T, Weed D, eds. *Ethics and Epidemiology*. 2nd edition. New York, NY: Oxford University Press; 2009.
- Dworkin M. *Cases in Field Epidemiology: A Global Perspective*. Sudbury, MA: Jones & Bartlett Learning; 2010.
- Foege W. *House on Fire: the Fight to Eradicate Smallpox*. Oakland, CA: University of California Press; 2011.
- Greenland S, ed. *Evolution of Epidemiologic Ideas: Annotated Readings on Concepts and Methods*. Chestnut Hill, MA: Epidemiology Resources, Inc.; 1987
- Garrett L. *The Coming Plague: Newly Emerging Diseases in a World Out of Balance*. New York, NY: Viking Penguin; 1995.
- Harr T. *A Civil Action*. New York, NY: Vintage Books; 1996.
- Jones JH. *Bad Blood: The Tuskegee Syphilis Experiment*. New York, NY: Free Press/Collier Macmillan; 1993.
- Marmot M. *The Status Syndrome: How Social Standing Affects Our Health and Longevity*. New York, NY: Times Books; 2004.
- McCormick JB, Fisher-Hoch S. *Level 4: Virus Hunters of the CDC*. New York, NY: Barnes & Noble Books; 1999.
- McKenna M. *Beating Back the Devil: On the Front Lines with the Disease Detectives of the Epidemic Intelligence Service*. New York, NY: Free Press; 2008.

- Pendergrast M. *Inside the Outbreaks: The Elite Medical Detectives of the Epidemic Intelligence Service*. Boston, MA: Houghton Mifflin Harcourt; 2010.
- Peters CJ, Olshaker M. *Virus Hunter: Thirty Years of Battling Hot Viruses Around the World*. New York, NY: Anchor Books; 1997.
- Preston R. *The Hot Zone*. New York, NY: Anchor Books; 1995.
- Roueche B. *The Medical Detectives*. New York, NY: Times Books; 1984.
- Shilts R. *And the Band Played On*. New York, NY: St. Martins Press; 1987.
- Skloot R. *The Immortal Life of Henrietta Lacks*. New York, NY: Random House; 2011.

VI. TRAINING AND UPSKILLING OTHERS

EIS officers lead in a wide range of topic areas involving communicable and non-communicable diseases, and leadership skills are core to your effectiveness. This document has been prepared to give you an understanding of the preparedness and capacity building needs required for applied epidemiology in the field. In your progression over 2-3 years, you will gain varied specialist learning experiences that hone your skills in public health leadership. The Trainer-Mentors help residents by providing feedback and evaluating performance on a variety of tasks as outlined in this progressive guide. As epidemiologists, we engage with communities. During the pandemic, various groups like religious organisations, businesses, social enterprises, nursing homes, shelters, welfare and private groups worked with health authorities to understand and address their challenges. They are a strong tool for making improvements. Building strong, lasting relationships based on trust can help gather resources, influence systems, change how partners work together and encourage the adoption of new policies and practices. International development partners can also be part of these efforts.

Recommendations

Strengthen Surveillance Systems:

- Enhance the surveillance programme to detect diseases that require timely control and decision-making.
- Include animal surveillance for zoonotic diseases from wildlife and environmental surveillance for breeding sites.
- Utilise various surveillance methods like syndromic, viral, serological and molecular approaches.

Enhance Epidemiologic Investigation and Response:

- Ensure competent officers handle national surveillance programmes, field epidemiologic investigations and epidemic responses.
- Improve collaboration among agencies for early disease detection.
- Communicate information accurately and promptly to healthcare practitioners and the public.

Improve Travel Health and Hospital Control Measures:

- Provide pre-travel consultation and post-travel management as part of primary healthcare.
- Adapt clear and effective policies and standard operating procedures for infection prevention and control in hospitals.

Strengthen Control of Zoonoses and AMR:

- Combine health surveillance with data from other sectors to assess risks comprehensively.
- Use information from multiple sources to increase the credibility of public health signals.

Develop Joint Risk Assessment Capability:

- Investigate identified hazards, such as zoonotic EID agents, to understand associated risks.
- Conduct joint assessments involving the human-animal-environment interface within a population and geographical area.

Build Skills for Risk Communications and Community Engagement:

- Engage stakeholders from various sectors to ensure wide acceptance and effective implementation of public health decisions.

Intensify Pandemic Health Security:

- Train professionals in field epidemiology and One Health to strengthen community health protection.
- Set clear competencies for different agencies and provide a checklist for trainees to track their progress.

Enhance Multi-Sectoral Skills-Building:

- Develop capacity in crisis communications and other essential areas of public health response.

Develop One Health Field Epidemiology Training:

- Strengthen a three-tiered training framework to build competencies for disease control and community health protection.
- Collaborate with global health institutions and international partners to share knowledge resources and stay relevant and effective.

VII. WORKFORCE DEVELOPMENT PROTOCOL

Background

Using EIS as the training platform, the officer is to prepare a NextGen Workforce Development protocol as an applied epidemiology training proposal that can serve as capacity building for a recipient institution. The aim is to help the recipient institution achieve some of the recommendations set out in the previous section, *Training and Upskilling Others*. This project helps the officer to develop planning skills and leadership in preparedness, and the recipient institution to understand the challenges of pandemic preparedness and response with the need for capacity building.

Using the points provided below to help develop the Protocol, the resident should choose only elements that apply. Through this work, the officer learns:

- Creation of clear objectives and deliverables
- Appropriate use of epidemiologic methods to address issues
- Collaborative practice with stakeholders in the recipient institution
- Values, processes and ethical considerations

Steps in Developing a Protocol

Identify the Protocol Purpose

- Identify the research topic, question and objectives in the context of the public health need

Write a Concept Paper

- List the basic elements of the Protocol
- Elicit suggestions from colleagues as well as subject-matter experts

Determine Data Needs

- Anticipate the data needed and how it will be used
- Create data tables before developing the data collection instrument

Write a Complete Draft

- Write a complete draft of the Protocol
- Incorporate suggestions from colleagues and subject-matter experts received on the concept paper

Prepare to Collect Data

- Create data collection instruments based on data needs

Prepare Consent Forms

- Develop consent forms to present the Protocol to the relevant ethics committees
- Use predefined templates (if necessary)

Review Protocol

- Solicit comments and suggestions from colleagues and subject-matter experts

Present to the Ethics Committee

- Incorporate suggestions from colleagues and subject-matter experts
- Validate the Protocol with partners to create the final version

Recommended Format

Study Overview

- **Title** summarises the main idea of the research and should be able to “stand alone” in explaining the study. It is brief, specific and consistent with the topic of the research and contains no more than 15 words.
- **Protocol Abstract** describes the study and includes objectives, the research question/hypothesis to be tested, the population, the methods and expected benefits.
- **Investigators/Collaborators/Sources of Funding** includes the names and degrees of all investigators and their roles for the project as well as the participating institution and any possible conflict of interest.

Introduction

- **Literature Review/Current State of the Knowledge of the Research Topic** synthesises the current research or studies on the subject, with the goal of giving the reader a sense of what has been done previously. This states the problem, and clarifies, judges and interprets the health problem presented.

- **Justification for the Study** explains the scientific and public health importance of the study and the problem being addressed (i.e., magnitude, overarching importance, feasibility and amenability to intervention).
- **Anticipated Use of the Results of the Study** defines the principal audience(s) for study and discusses the expected uses of the study results.
- **Study Design and Location(s)** describes the study design and gives the location where the study will be carried out.
- **Objectives** lists clear and concise goals of the study.
- **Hypothesis or Research Questions** lists clear, focused questions or hypotheses the study will address.
- **General Focus** describes the focus of the study, whether it will be a descriptive /exploratory (hypothesis-generating), analytic (hypothesis-testing) or focus on testing the implementation of interventions.
- **Practicality and Feasibility of the Research** outlines the availability of financial resources, materials and human resources (and time available).

Procedures and Methods

- **Study Design** addresses the research questions and objectives previously indicated. This section justifies using the proposed study design for addressing the research questions and objectives indicated previously. It distinguishes between procedures that are experimental and those that have been done previously. It also identifies the specific elements that characterise the study design (e.g., a cross-sectional survey, case-control, cohort, focus groups, clinical record review, etc.).
- **The Public and Stakeholders** defines the audience for the research. It assesses who the stakeholders are and describes the ways in which they can (or cannot) participate in the study. It explains the process by which they can express their opinions, state their needs and contribute to the project.
- **Timeline of the Study** provides a calendar with the estimated dates for beginning and completing the major activities of the study.
- **Expedited Review Protocol** describes the need for a rapid review of the Protocol (e.g., if there is an outbreak in progress or there is a disaster or other emergency).

Population Studied

- **Description and Source of the Study Population and Target Study Area** defines the population from which the participants, the sample or the subjects under surveillance were drawn (including demographics).

- **Case Definition** provides criteria for the disease or public health event.
- **Inclusion Criteria** describes the characteristics or conditions used to identify, select and include participants for the study.
- **Exclusion Criteria** describes the characteristics that disqualify potential study subjects from participating.
- **Justification for Excluding a Population Group** gives the reasons that any subgroup of the population (e.g., defined by race/ethnicity, gender or age) is excluded from the study.
- **Estimated Number of Participants** estimates the number of participants in the study.
- **Sampling (including sample size and statistical power)** describes the sampling method (e.g., convenience, population based or other specified method), specifies the sampling units (e.g., individuals, cluster, neighbourhood, etc.), and estimates the size necessary to answer the research questions/hypothesis based on available information from pilot studies or previous reports. It also estimates the statistical power and explains the conditions in which the sampling estimates would have to be revised.
- **Enrolment** describes how potential participants will be contacted, checked for compliance with inclusion criteria and enrolled in the study. It also describes the procedures for tracking the number of dropouts and explains the procedures for assigning participants to different groups.
- **Consent Process** describes the procedures used to inform the participants about the study and to obtain consent.

Variables/Interventions

- **Variables** lists and describe the categories, topics or fields of information to be explored and the variables that should be collected. It clarifies the consistency of the defined variables among data obtained from multiple sources, defines variables and explains how they will be used.
- **Study Tools (including questionnaires, laboratory instruments and analytic tests)** describes the strategies used to obtain information (i.e., laboratory techniques, instruments) and an explanation of how this information will be used. It should describe the attributes of these strategies/instruments as demonstrated in other studies; including the suitability, validity and reliability among the study population and sensitivity and specificity of the instruments among studies that have obtained results that can be replicated; and whether there is any

controversy about the methods being used. It also includes a description of how changes in study instruments will be handled and documented.

- **Intervention or Treatment** describes the types of interventions or treatments to be tested (including dose, administration schedule, etc.)
- **Results and Minimum Significant Difference** lists the anticipated results from the exposure or intervention of interest to the study (i.e., results) and the clinical or epidemiologic differences in the result measurements that are important to detect
- **Training of all Study Personnel** describes the type of training provided to study personnel (e.g., interviewing techniques, data collection and processing methods, or informed consent)

Analysis and Data Management

- **Data Analysis plan (including statistical methodology)** describes sampling methods; procedures for the collection of information, methods used to maximise response rate, test procedures and relevant statistics (i.e., variance, confidence intervals, and power based in the study data); the methods should include enough detail to be reproducible. This includes the calculation of relevant quantitative measures of tests and instruments, such as sensitivity and specificity. In outbreak investigations, it is common to use an iterative process in the analysis (which consists of hypothesis development and testing and the planning and evaluation of the intervention) to identify the source of the outbreak and its control. For projects that establish or use data from a surveillance system, this can include how and how often the surveillance system will be evaluated.
- **Data Collection** describes the data collection procedures, processes, frequency, and documentation
- **Information Management and Analysis Software** provides the names of the software packages and programming languages for study
- **Data Entry, Editing and Management (including the handling of data collection forms, different versions of data, and the storage and disposal of data)** describes the general procedures for handling collected data. In the description, it should include the process for entry and editing of the data. It should also describe how the study materials, including the questionnaires, statistical analysis, notebook entries, computer programs and other electronic information systems, whether used to publish or not, will be kept available to allow future access for analysis and revision. The authors should document the operating procedures for management

and access of different versions of the data sets. The authors should also specify to whom the data belongs and the access rights and restrictions of all primary and secondary data analysis and publications. This section should also document the related procedures regarding confidentiality of the data, including how confidentiality will be maintained during transfer, use and storage of data, and the names or positions of those responsible for the technical and administrative management. Finally, it should document the final disposal of the records, data, computer archives and samples, including the location of any relevant information to be stored. Records should be stored in compliance with agency directives.

- **Quality Assurance and Control** describes the steps taken to ensure there are no unforeseen consequences that can affect the quality of the data (i.e., methods for entering all data exactly as it is received; ensuring logical consistency among all parts of a record; ensuring that the handling or transformation of the data does not produce undesired changes; and the statistical verification of calculations are performed as proposed in the analysis plan). This process includes verification of the diagnosis and confirmation of the outbreak and lists current quality control procedures for the data to ensure that the information is appropriate; is collected with the same depth, breadth and specificity; continues to be consistent within and among personnel over time; and achieves acceptable attribute levels such as validity, reliability, repeatability, sensitivity and specificity.
- **Bias in the Collection, Measurement and Analysis of Data** describes the types of bias that may occur during the collection, measurement, or analysis phases of the data; and the steps which should be taken to avoid, minimise or account for the presence of these biases. Authors should also include any randomisation or blinding procedures used to eliminate or minimise bias by the investigator, other study personnel or study participants (e.g., participant selection, treatment group assignment, treatment provided or received).
- **Review and Analysis During the Process** describes the processes will be monitored and how the study will be evaluated.
- **Study Limitations** explains the factors which reduce the applicability of the study results. These include weaknesses or criticisms of the study, including alternative methods that could have been used.

Management of Adverse or Unexpected Events

- **Responding to New/Unexpected Findings and Changes in the Study Environment** describes the procedures for identifying and managing new or unexpected findings and responding to changes in the study environment
- **Identification, Management, and Reporting of Adverse Events** describes the types of adverse events that may arise and how study personnel will be trained to react, including methods used to track adverse reactions and their possible implications on the study
- **Emergency Care** explains steps in case an emergency develops during the study

Dissemination, Notification, and Report of Results

- **Participant Notification Regarding Individual Results** explains the process used to notify participants about their results, including circumstances that would drive the dissemination of urgent results and whether counsellors will be used.
- **Participant Notification Regarding Study Conclusions** explains if participants will be offered the option to receive general study findings and how this will be accomplished
- **Expected Products or Inventions Resulting from the Study and Their Use** lists the products, including inventions, derived from the study and how they will be used
- **Dissemination of the Results to the Public** defines the channels of effective communication and the best ways to disseminate the project information and results to specific audiences
- **References** lists bibliographic information for all sources used in the Protocol
- **Appendices** aggregates excess information, not directly needed
- *Data Collection Forms* includes all forms and documents used to collect data or extract the data (e.g., questionnaires, medical records, etc.)
- **Suggested Tables and Figures** provides health tables, examples of data presented, and study results
- **Other Relevant Documents** includes other complementary documentation

Common Errors

- Introduction of Protocol too long and ineffective
- Objectives unclear
- Procedures and methods poorly defined

- Operational definitions are unclear
- Provides insufficient documentation of process (i.e., what data should be collected and what methods should be used to collect the data)
- Lacks a solid and previously defined analysis plan
- Does not include quality assurance measures
- Insufficiently documents measures taken for the protection of human subjects

Trainer-Mentor Responsibilities

The following list of actions details how Trainer-Mentors can support their residents in developing a Protocol:

- Meet with the resident to discuss the topic and type of analytic study
- Meet with the resident to review their proposal and analytic plan, and provide feedback
- Evaluate the Protocol based on the Evaluation Criteria
- Discuss developmental feedback with the resident

Evaluation Criteria

Below is a checklist to help Trainer-Mentors evaluate Protocols that they receive.

Score	Description
5 = Excellent	The element is present, consistent with the standard described in the guidelines and is of a remarkable/outstanding quality.
4 = Good	The element is present and consistent with the standard described in the guidelines.
3 = Satisfactory	The element is present and may be used even though it may not completely follow the standard described in the instructions and provided in the classroom.
2 = Poor	The element is present but flawed or of poor quality.
1 = Absent	The element is absent from the report.
NA = Not Applicable	The element is not relevant to this study.

Category	Criteria
Overview of the Study	Demonstrates appropriate title
	Includes acceptable Abstract
	Includes a list of investigators, their collaborative roles and funding sources
Introduction	Includes a literature review/current state of knowledge of the research topic
	Presents the justification of the study
	Gives the purpose or intended use of the findings
	Includes the study design and location(s) of the study
	Presents the objectives
	Presents the research questions or hypothesis
	Provides a generally appropriate focus
Procedures and Methods: Design	Includes how the study design addresses the hypothesis or fulfils the objectives
Procedures and Methods: Study Population	Includes a description and source of the study population and the recruitment area
	Shows the case definitions
	Describes the exclusion criteria of participants
	Describes the inclusion criteria of participants
	Describes the estimated number of participants
	Gives sampling methods, including sample size and statistical power
	Outlines the appropriate recruitment procedures
	Describes the consent process

Category	Criteria
Procedures and Methods: Variables and Interventions	Provides a description of the variables
	Describes the study instruments, including questionnaires, laboratory instruments and analytic tests
	Provides intervention procedures or appropriate treatment
	Describes the anticipated results and minimum for significant differences
	Describes the training of study personnel
Procedures and Methods: Analysis and Data Management	Provides an analysis plan, including statistical methodology
	Clearly outlines data collection procedures
	Shows the management and analysis procedures for data and the software to be used
	Outlines the procedures used for data entry, editing and management, including the handling of data collection forms, different versions of data, and the storage and disposal of data
	Describes quality assurance and control procedures
	Notes potential biases in the collection, measurement and analysis of data
	Describes study limitations
Procedures and Methods: Management of Adverse or Unexpected Events	Describes the management and reporting of potential adverse events, if applicable

Category	Criteria
Procedures and Methods: Dissemination, Notification, and Reporting of results	Defines individual notification of participant results
	Shows participant notification of study findings
	Clearly outlines the expected products or inventions from the study and their use
	Outlines the dissemination of the results to the public
Appendices	Includes appropriate data collection forms
	Includes appropriate tables and figures
	Includes relevant documents
References	Numbers references and orders them as they appear in the text
	Includes an appropriate number of references for the content of the report
	Incorporates references that are up-to-date and related to the content
	Formats references using Vancouver Style
Structure and General Clarity	Uses adequate punctuation and grammar
	Uses proper spelling
	Work is original and there is no evidence of plagiarism (5 = yes, 1 = no)
	The writing is in paragraph form and does not use bullets as in a presentation (5 = yes, 1 = no)
	Provides a description of acronyms before they are used (5 = yes, 1 = no)

From the early signal of a crisis...
a breakthrough that changes EVERYTHING!

I've got it! The anti-viral lattice
is binding! The biosensor data from
the filtration anomaly wasn't a warning,
it was the KEY! We've designed
a universal cure.

You did it, Eve!
We've turned their attack
into our greatest victory.
The 'E' Challenge is not
just a defence anymore;
it's a new beginning!



Afterword

Please do not expect to be the expert immediately after reading this handbook! Keep an open heart and an eager mind, and you'll find that training is not just a process but a beautiful journey of self-discovery and achievement. With every bit of opportunity, you become a better version of yourself, ready to conquer new challenges and inspire those around you. Embrace it with enthusiasm, for every lesson learned and skill acquired is a step towards a brighter, more empowered future!



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We have made strenuous efforts to align the concepts in our handbook with what has been expressed in documents of the World Health Organization, including terminology. Our appreciation goes to the US CDC's Global Health Center, WHO-GOARN, TEPHINET, SAFETYNET and ASEAN+3 applied epidemiology training networks. Together, we have engaged in collaborative efforts to develop training materials such as curriculum and documents supporting NextGen Workforce Development.

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And to you who have gone on this Survivor School journey with us, we hope that it has been an experience of empowerment and transformation. Every learning experience, no matter how big or small, brings us one step closer to unlocking our full potential. Embrace each learning opportunity with enthusiasm, for it is through learning that we grow, adapt and become the best version of ourselves. Go beyond... keep learning, keep growing and keep believing in your capacity to help humanity!

*“Pay attention to
the little things
around us!”*



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“Survivor School for Infectious Disease Outbreaks unfolds as a comprehensive guide, providing insights into the core components of applied epidemiology training. It explores the nuances of outbreak investigations, the art of surveillance and the critical importance of effective communication in the realm of public health.”

— Prof. Joseph Sung

Senior Vice President (Health and Life Sciences), Nanyang Technological University,
and Dean, Lee Kong Chian School of Medicine

“Wow, so impressive and so noble! May it inspire, inform and invigorate all those who embark on the noble pursuit of unravelling the mysteries of disease and safeguarding the health of our global community.”

— Dr Maria Consorcia Lim-Quizon

Executive Director of SAFETYNET, Asia-Pacific regional training network,
headquartered in Manila

“Heartiest congratulations on this great endeavour, which testifies to your unflinching hard work and dedication. Our future will be a time like no other, and TEPHINET is ever mindful and appreciative of the support of its members, partners, stakeholders and other entities involved in building global field epidemiology capacity.”

— Dr Carl Reddy

Director of TEPHINET, Global field epidemiology training network,
headquartered in Atlanta

“Survivor School for Infectious Disease Outbreaks deals with the unpredictable nature of infections, the significance of global interconnectedness and the importance of pandemic preparedness and resilience. We are heartened to offer Singapore’s perspective through this publication which has the support of the National University of Singapore’s School of Public Health.”

— Prof. Teo Yik Ying

Vice President (Global Health), National University of Singapore,
and Dean, Saw Swee Hock School of Public Health