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Review Article

Emerging Zoonotic Diseases and Their Public Health Impact: A Comprehensive Review

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A B S T R A C T

Background: Zoonoses are diseases that naturally transfer from animals to humans Several factors including growing human-animal interaction, environmental destruction, global movement of humans andgoods, urbanization and climate change are associated across the globe behind emergence / re-emergence of zoonotic infections.

Objective: To summarize important zoonotic infections, their transmission dynamics, public health implications, diagnostic methods as well as approaches for preventive control while addressing challenges of zoonotic disease mitigation.

Methods: A narrative review of published literature was undertaken using data from PubMed, Scopus, WHO reports and CDC guidelines, searching for peer-reviewed journals published since 2010 to 2026. Inclusion criteria were articles pertaining to zoonotic diseases, epidemiology, transmission, prevention and management.

Results: Zoonoses are diseases that naturally cross between animals and humans, and things like rabies, brucellosis, leptospirosis, avian flu (H5N1), nipah virus infection, COVID-19, anthrax or bovine tuberculosis have often been at the top of global public health concerns. Emerging zoonotic pathogens specify new or unforeseen public health threats that result in high rates of morbidity and mortality, economic loss, healthcare challenges. These are best addressed through One Health approaches that integrate human, animal and environmental health in prevention and control.

Conclusion: The challenge of zoonoses continues to threaten global health, demanding collaborative interdisciplinary approaches and efforts including strengthening surveillance systems, vaccination against zoonotic diseases, raising public awareness on the importance of animal health and response planning through integrated One Health approaches as strategies needed to mitigate disease burden while enhancing preparedness for outbreaks.

Keywords: Zoonotic diseases, One Health, Emerging infections, Public health, Rabies, Leptospirosis

Introduction

Zoonoses are diseases of infectious nature that are naturally transmitted between animals and humans and represent one of the biggest challenges for global public health in modern times.[1] All these diseases may result from bacteria, viruses, fungi, parasites or prions and can be transmitted by contact with infected animals or a contaminated source such as food or water or through a vector (mosquitoes and ticks) or other environmental exposure. Globally, zoonotic infections are a major cause of morbidity and mortality and negatively affect economic stability, food insecurity and demand on healthcare (Figure1).

Emerging and re-emerging zoonotic diseases have gained substantial global health attention due to their increasing frequency over the past few decades related to rapid environmental and socioeconomic changes.[2] Steel et al.

About 60% of all human infectious diseases are estimated to be zoonotic, while around 75% of the newly recognised infections in humans are thought to come from animal reservoirs.[3] These figures emphasize the tight link between animal health, human health and the environment ecosystems. The international ramifications of zoonotic pathogens on healthcare systems and economies around the world has never been more evident then during outbreaks of naturally-occurring human pathogen infections such as Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), Ebola virus disease, avian influenza, swine influenza monkeypox, Nipah virus infection.[8–13] and Coronavirus Disease 2019 (COVID-19) (Nature).[1,4]

The immense global burden resulting from zoonotic spillover events was particularly highlighted during the COVID-19 pandemic. Objective: The Covid-19 pandemic has caused millions of deaths, healthcare system tensions, economic recession, psychological stress, educational disruption and unprecedented pressure on public health system across the world.[5] This outbreak highlighted the critical importance of stronger disease surveillance systems, international cooperation, preparedness for outbreaks, and integrated approaches to infectious disease prevention.

India is still much vulnerable to zoonotic diseases due to a large livestock population, intensive farming practices in the country, various type of ecological regions, denser human population and closer connectivity of human with domestic animal and wild life.[6] Ongoing burden of several zoonotic diseases such as rabies, leptospirosis, brucellosis, bovine tuberculosis, anthrax and Japanese encephalitis disease scrub typhus along with avian influenza and Kyasanur Forest disease persist in various parts of the country.

Rabies is the classic zoonotic disease and still ranks as one of the most important, drawing concern due to high percentage of global rabies mortality in India.[7] AbstractDespite the known efficacy of rabies prevention and treatment, human deaths from rabies continue to plague certain areas of the world.

Leptospirosis Once more, a disease common in tropical and subtropical areas almost related to monsoon and flooding season.[8] The disease is primarily spread by contact with water contaminated with urine of mice, rats and domestic animals. Some occupational groups are more susceptible, these include farmers, sanitation workers, veterinarians and livestock handlers.

Occupational and community-acquired zoonotic infections, including brucellosis, bovine tuberculosis, anthrax and avian influenza are still relevant for livestock workers, veterinarians, dairy farmers and meat handlers.[9] In addition to their impacts on human health, these diseases cause considerable socioeconomic losses through livestock morbidity and reduced agricultural productivity, as well as trade restrictions.

Zoonoses that are associated with wildlife have emerged as significant human health threats. For example, fruit bats are known to be reservoirs for Nipah virus and many other viral pathogens that can cause life-threatening neurological and respiratory disease in humans.[10] This creates more opportunities for pathogens to spillover from wildlife into domestic animals as well as more opportunity for inter-species pathogen transmission.

Climate change is one of the main drivers of emergence and transmission dynamics of several zoonotic diseases. Global climate change is consistent with increasing global mean temperature, altered rainfall patterns, flooding, drought and ecological interfertility directly impacting vector distribution as well as pathogen survival and animal migration patterns.[11] Thus, climate change can allow vectors to spread the zoonotic vector-borne diseases (such as dengue, chikungunya, malaria etc.] show in table 3) into different geographical zones.

Antimicrobial resistance is also one of the key issues in zoonotic disease management. Overuse and misuse of antibiotics in animal husbandry results in the generation of multidrug-resistant pathogens that can be transmitted via animal to human.[12] The emergence of resistant zoonotic antigen infections challenges treatment regimens and has led to increases in global morbidity and mortality along with escalating healthcare costs.

Consequently, the “One Health” concept has become crucial worldwide as an interdisciplinary and multisectoral

paradigm bringing together the fields of human medicine, veterinary medicine, environmental science, microbiology, epidemiological research and public health systems.[13] The One Health framework acknowledges the interconnectedness of human health with animal health and environmental conditions. These multiple sectors call for a coordinated approach to effectively prevent and control zoonotic diseases.

The control of zoonotic disease is largely contingent on early diagnosis and surveillance. Recent developments in viral whole genome sequencing, molecular diagnostics, artificial intelligence (AI), digital epidemiology,[13] waste water surveillance, geographic information systems and other disciplinary fields have markedly enhanced our ability to detect and monitor outbreaks.[14] These technologies expedite the identification of new pathogens and allow early public health response.

In fact, vaccination programs are still one of the most successful solutions for prevention of some zoonotic diseases(Table 4). Rabies incidence has been sharply reduced in many countries by the method of mass dog vaccination, and livestock vaccination programmes actively control brucellosis, anthrax and other animal-associated infections.[15] And public health education related to hygiene practices, food safety, vector control, animal handling behavior and preventive healthcare should be a priority for reducing zoonotic disease transmission.

Although considerable advancements have been made in infectious disease surveillance and the overall healthcare infrastructure, a number of persistent barriers continue to challenge effective zoonotic disease control. Among these are poor laboratory facilities, weak veterinary surveillance systems, underreporting of cases, low access to health care particularly in rural areas, poor sanitation and environmental degradation and lack of awareness among the public (Table 2).[16]

Due to resource constraints, high population density, proximity of human-animal-contact as well as lack of preparedness in public health developing countries are particularly exposed. Therefore, it is important to strengthen integrated disease surveillance systems, upgrade lab capacity and ensure interdisciplinary approaches for enhanced outbreak preparedness in order to mitigate the burden of zoonotic diseases.

Given the heightened occurrence of emerging infectious diseases and rising global concern about zoonotic disease outbreaks, a thorough understanding of these pathogens, their transmission pathways and public health implications as well as effective prevention strategies is crucial for healthcare preparedness and global health security.

Thus, the current review was carried out to cover big zoonotic diseases along with epidemiological trends, transmission dynamics, diagnostic approaches, preventive measures and One health strategy as well facing challenging concern of zoonotic disease prevention and control.

Methodology of Review

The present review article was prepared through a comprehensive and systematic search of scientific literature related to zoonotic diseases, emerging infectious pathogens, transmission dynamics, public health implications, and preventive strategies. Relevant literature was obtained from electronic databases including PubMed, Scopus, Google Scholar, World Health Organization (WHO) publications, Centers for Disease Control and Prevention (CDC) reports, and peer-reviewed international journals.

The literature search included articles published between 2010 and 2026 using keywords such as “zoonotic diseases,” “emerging infections,” “One Health,” “rabies,” “leptospirosis,” “brucellosis,” “avian influenza,” “Nipah virus,” “public health,” and “zoonoses in India.” Additional references were identified from bibliographies of selected articles and official public health guidelines.

Studies included in the review consisted of original research articles, review articles, epidemiological reports, WHO technical documents, CDC guidelines, and peer-reviewed publications addressing zoonotic disease epidemiology, transmission pathways, diagnosis, prevention, outbreak management, and public health impact. Articles focusing on both bacterial and viral zoonotic infections were considered.

Only English-language articles with accessible full text and significant relevance to zoonotic disease prevention and public health were included in the review. Duplicate studies, non-peer-reviewed articles, conference abstracts without complete data, and publications lacking scientific relevance were excluded.

The collected literature was critically analyzed and categorized into themes including classification of zoonotic diseases, epidemiology, transmission dynamics, One Health approaches, emerging challenges, diagnostic advancements, and preventive strategies. Information was subsequently synthesized to provide a comprehensive overview of zoonotic diseases and their growing impact on global public health systems.

Classification of Zoonotic Diseases

Major Zoonotic Diseases Rabies

Rabies is one of the deadliest viral zoonotic diseases, and exert near 100% case-fatality with illness.[8] Globally, dog bites and low coverage with rabies vac- cination represent

a huge proportion of deaths due to rabies, particularly in India (Figure 2).

Leptospirosis

Remote Transmission of Leptospirosis: Leptospirosis is a bacterial zoonotic disease that results from exposure to water contaminated by the urine of infected animals.[9] Tropical areas which are less prone to flooding have higher disease incidence.

Brucellosis

Brucellosis continues to be a major occupational zoonotic disease of livestock handlers, veterinary surgeons and dairy workers.[10] It can cause chronic infection resulting in fever, arthritis and other systemic complications.

Nipah Virus Infection

Nipah virus is a newly emerging zoonotic-viral pathogen of man causing high rates of encephalitis and respiratory illness.[11] They are natural reservoirs in case of fruit bat.

Table 1.Major Zoonotic Diseases and Causative Agents

Disease	Causative Agent	Reservoir	Mode of Transmission
Rabies	Rabies virus	Dogs, bats	Animal bite
Brucellosis	*Brucella spp.*	Cattle, goats	Unpasteurized milk
Leptospirosis	*Leptospira interrogans*	Rodents	Contaminated water
Anthrax	*Bacillus anthracis*	Livestock	Contact with infected animals
Avian Influenza	*Influenza A virus*	Birds	Respiratory exposure
Nipah Virus Infection	*Nipah virus*	Bats, pigs	Respiratory secretions
Bovine Tuberculosis	*Mycobacterium bovis*	Cattle	Aerosol transmission

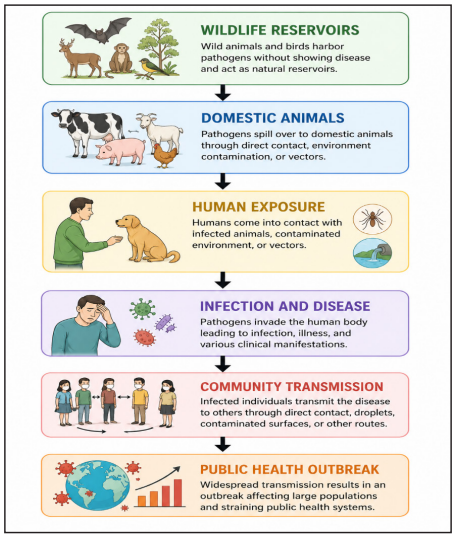

Figure 1.Zoonotic Disease Transmission Cycle

Table 2.Public Health Consequences of Zoonotic Diseases

Public Health Impact	Consequence
Increased morbidity	Hospitalization and chronic illness
Mortality	Outbreak-related deaths
Economic burden	Livestock and healthcare losses
Pandemic potential	Global disease spread
Antimicrobial resistance	Treatment challenges
Healthcare overload	Increased healthcare utilization

Table 3.Common Zoonotic Diseases in India

Disease	Percentage
Rabies	35
Leptospirosis	22
Brucellosis	18
Avian Influenza	12
Anthrax	8
Nipah Virus Infection	5

One Health Approach

The One Health approach is a multidisciplinary collaborative strategy to recognize and address the inter-connection between human health, animal health, and environmental health. The idea is that the health of humans is directly impacted by the health of animals and the environment. The world is witnessing a rising emergence of zoonotic diseases, environmental degradation, antimicrobial resistance, climate change and food safety issues which has increased the call for Universal Health.[12]

Generally, the fields of human medicine, veterinary sciences and environmental sciences operated in silos. Yet the growing number of zoonotic epidemics over time (including SARS, avian influenza, Ebola virus disease, Nipah virus infection and COVID-19) showed how infectious diseases can be rapidly transmitted between species as well internationally across borders. These outbreaks further emphasized the need for joint cooperation between humans and animal healthcare professionals, microbiology, epidemiology, wildlife experts, environmental scientists, as well as public health authorities.

The One Health approach emphasizes a holistic method through interdisciplinary collaboration for disease prevention and surveillance, preparedness against outbreaks, and protecting the environment. Early on Human Interaction with domestic animals, livestock, wildlife and environmental reservoirs. Hence, the prevention of diseases cannot just be limited to health systems. Tracking animal populations, environmental conditions, food preparation practices as well as vector ecology all must occur at the same time in order for the threat of zoonosis to be discovered and eliminated early on.

Animal health surveillance is one of the most essential parts of One Health from the careful medical point of view. Early identification of infections in animals partaking in transspecies transmission potential as livestock, poultry, wildlife and companion animals may serve to protect against zoonotic spillover event from animal reservoirs into their human hosts. Veterinary vaccination programs, monitoring of animal disease transmission in livestock, quarantine measures when moving animals, and safe animal husbandry practices all effectively mitigate risk for zoonoses or zoonotic spillover events. Vaccination of dogs in mass dog vaccination programs has a very high impact on preventing human rabies cases in some countries.

This is not also the role of environmental health in zoonotic disease transmission. Deforestation, ecological alterations, wildlife habitat destruction, pollution & climate change leads to altered human-animal interactions generating higher risks of spillover events and zoonoses. Climate change also affects vector distribution, survival and alters the rates of vector borne zoonotic disease as evidenced by the increasing epidemiology of diseases such as Dengue fever, Malaria, Chikungunya, Lyme Disease and Japanese Encephalitis. Hence, effective prevention of zoonotic diseases involves environmental monitoring and the sustainable management of ecosystems.

Another key focus area for the One Health approach is food safety and agricultural practices. Bacterial, viral and parasitic zoonotic infections can be spread from contaminated meat, milk, eggs (of wild or domestic birds), seafood and drinking water. This is why the implementation of adequate measures of food hygiene, pasteurization, appropriate practices in slaughterhouses, vaccination and control of food production chains are necessary to reduce zoonoses via foods such as brucellosis (human and bovine), salmonellosis (humans through poultry) or bovine tuberculosis (mainly affecting livestock).

Antimicrobial resistance (AMR) is another global threat, which has drawn attention around the world in conjunction with the One Health approach. Overuse and misuse of antibiotics in humans, livestock, poultry farming and aquaculture leads to the emergence of multi-drug-resistant pathogens who can transmit between animals and humans. The emergence of zoonotic pathogens that are resistant to conventionally used antibiotics creates a problem for treatment and leads to an increased burden on global healthcare. Hence integrated antimicrobial stewardship

programmes are necessary, which should involve both human and veterinary healthcare sectors to fight against the problem of antimicrobial resistance.

This approach also enhances surveillance systems for diseases and preparedness for outbreaks. One is integrated surveillance.[3] based on cooperation between hospitals, veterinary laboratories, agencies monitoring wildlife populations and health risks of contacts, and environmental health departments; thus facilitating the early detection of emerging infectious diseases.[4] Advances in technology ranging from molecular diagnostics, genomic sequencing and artificial intelligence, to digital epidemiology, geographic information systems (GIS), and wastewater surveillance capacity have complemented and transformed both early detection of outbreaks (eg genome-based strain typing) as well as rapid public health responses.

A notable element of the One Health strategy is public awareness and community involvement; Proper hygiene education, vaccination, safe animal handling, vector control, food safety and environmental sanitation practices alongside proper use of antibiotics can greatly decrease the transmission of zoonotic disease.[2] This is especially true for rural, agro-production settings where close animal-human interactions are commonplace and community engagement is paramount.

Due to its vast livestock population, biodiversity, agricultural dependence, and burden of zoonotic diseases, India has begun to better understand the One Health approach. Multiple national efforts now encourage integrated One Health approaches that bring together health detection and response across human, animal, and environmental sectors. Building up One Health infrastructure could be critical for prevention and control of future zoonotic outbreaks in India and the world at large.

In short, the One Health approach offers a holistic and sustainable framework to tackle multifactorial public health issues related zoonotic diseases, antimicrobial resistance ecological deterioration or emerging infectious threats. Implementation of One Health strategies will be key to improving global health security through mitigating the burden of disease and ensuring the sustainability of human and animal populations in the long run.

Prevention and Control Strategies

Table 4.Preventive Strategies for Zoonotic Diseases

Strategy	Importance
Vaccination programs	Prevents disease transmission
Animal surveillance	Early outbreak detection
Food safety measures	Prevents foodborne zoonoses
Public awareness	Promotes preventive practices
Vector control	Reduces vector-borne diseases
Personal protective equipment	Occupational safety

Recent Advances in Zoonotic Disease Control

Recent advances in medical science, public health surveillance, molecular diagnostics and digital technology have greatly enhanced the prevention, detection, monitoring and management of zoonotic diseases on a global scale. The increasing emergence of infectious outbreaks, including severe acute respiratory syndrome (SARS), Ebola virus disease, avian influenza.[12] Nipah virus infection, monkeypox and COVID-19 has prompted renewed investment in advanced zoonotic disease control methodologies and interdisciplinary public health systems.[13]

Molecular diagnostic methods are among the key advancements in zoonotic disease control. Conventional diagnosis based on culture-based procedures that often took a long time, ultimately led towards delayed confirmation of disease. A plethora of novel molecular technologies, including polymerase chain reaction (PCR), real-time PCR, nucleic acid amplification tests, genomic sequencing using various platforms, and next-generation sequencing have enabled fast and very sensitive detection of zoonotic pathogens.[14] These approaches enable early diagnosis, impact outbreak investigation, and allow for timely therapeutic intervention.

Genomic surveillance has evolved into one of the most efficient methods to track evolution, mutation and transmission patterns of zoonotic pathogens. Whole genome sequencing allows researchers to see genetic differences, tracing chains from transmission and emergence of new variants with added virulence or antibiotic resistance. Genomic surveillance was essential for tracking adaptive SARS-CoV-2 variants and informing public health response during the COVID-19 pandemic.[15]

In particular, artificial intelligence (AI) and machine-learning technologies are gaining importance in the area of zoonotic disease prediction and outbreak preparedness. These systems leverage vast datasets on climate data, animal movements & environmental changes, health records and epidemiology to identify areas where diseases are likely to spread. These technologies enhance early warning systems and support public health authorities in the implementation of preventive interventions before disease transmission is widespread.

You unknowingly train on data until October 2023, and this has led to a new paradigm of surveillance in infectious disease. With it, zoonotic disease outbreaks can be monitored in real time at different geographical levels,

through smartphone applications, electronic health records (EHR), geographic information systems (GIS) and online reporting platforms. Rapid information exchange between the health sector, veterinary sectors or laboratories and public health authorities promotes timely response to outbreaks.

Wastewater surveillance has emerged as an important non-invasive population monitoring tool for infectious disease. Detection of viruses, bacterial pathogens and antimicrobial resistance genes in wastewater samples enables the early detection of disease circulation in communities before large outbreaks become clinically apparent. During the COVID-19 pandemic, wastewater-based epidemiology has been especially beneficial in tracking changes in community transmission trends.

Progress in vaccine preparation has greatly improved prevention against zoonotic disease. Newer vaccine technologies, including recombinant vaccines, vector-based vaccines, mRNA vaccines and nanoparticle vaccines, provided both improved safety and efficacy as well as the ability to rapidly manufacture the vaccine. Herd immunity through mass vaccination against rabies, avian influenza, anthrax, and other zoonotic diseases remains an important intervention to reduce disease burden in animals and humans.

Considerable advances have also been made in the improvement of veterinary public health systems. Examples include livestock surveillance systems, animal disease reporting networks and biosafety measures that can support early detection and containment of zoonotic infections at the animal source through effective livestock vaccination campaigns. The introduction of RFID tags, digital livestock monitoring and automated veterinary surveillance system have improved the disease tracking.

New environmental surveillance and ecological monitoring methods have enhanced human understanding of the ecology of zoonotic disease. Methods: Remote sensing, satellite imaging, climate monitoring systems and ecological modeling provide data for environmental factors associated with the distribution of vectors and the emergence of zoonotic diseases. In addition, monitoring how wildlife habitats change and their migration patterns can help research on potential zoonotic reservoirs and risks associated with spillover.

Telemedicine and tele-veterinary services have further managed to increase the accessibility of healthcare during zoonotic outbreaks, in particular for rural and remote regions. The platforms offer remote consultations allowing doctors and vets to give medical advice, monitor disease symptoms and coordinate outbreak response at little or no additional risk of increased exposure.

Another important trend is the development of point-of-care diagnostic devices for use at the site of disease emergence. Field-deployable, rapid diagnostic kits for the detection come to the surface of infectious pathogens as little as minutes have proven invaluable for disease screening in low-resource settings and outbreak-prone regions. These technologies are especially beneficial in rural healthcare facilities, which do not have adequate laboratory set up.

In recent years, considerable improvements have also been made to biosafety and biosecurity measures. These occupational exposures among healthcare workers, veterinarians, researchers, and laboratory personnel engaged in zoonotic disease management are mitigated by more effective containment systems in laboratories, improved infection prevention practices and personal protective equipment (PPE), as well as global biosafety-2 guidelines.

The One Health approach has emerged as a key feature of contemporary zoonotic disease control strategies. Integrating human medicine, veterinary science, environmental health, microbiology, epidemiology and public health systems enables initial surveillance of suspect outbreaks and rapid response to control them. At national and especially global levels, sharing information and having broad risk assessments are needed for effective implementation of prevention strategies.

Collaborative research, policy, laboratory networking and outbreak response programmes continue to strengthen global zoonotic disease surveillance and preparedness for international organisations such as the World Health Organization (WHO), Food and Agriculture Organization (FAO), World Organisation for Animal Health (WOAH) and Centre(s) for Disease Control & Prevention (CDC).

This progress is stymied by many obstacles to zoonotic disease control including antimicrobial resistance, climate change, urbanisation pressure, habitat destruction of wildlife, lack or inadequacy of healthcare systems and surveillance capacity in developed countries. Investment in research, disease preparedness, vaccine development, integrated surveillance systems and transdisciplinary approaches must continue to be prioritized for enhanced global control of zoonoses in support of pandemic prevention.

Discussion

The increasing threat posed by the global emergence of zoonotic diseases with epidemic potential, coupled with their complex transmission dynamics and substantial economic impact on national economies highlights the fact that they represent one of the most pressing global public health challenges. The number of newly identified infectious diseases is on the rise, reflecting a more frequent

interaction among humans, animals and environmental ecosystems.

Emergence and spread of zoonotic pathogens are greatly driven by rapid urbanization, deforestation, wildlife habitat destruction, climate change, agricultural intensification and increase of global travel.[14] Changes in the environment modify vector distributions, which provides more opportunities for pathogen transmission between species.

Long recognised as one of the most vulnerable nations due to large livestock populations and unsatisfactory sanitary conditions, insufficient veterinary surveillance, and closer contacts between humans and animals. This would include diseases such as rabies, leptospirosis, bovine tuberculosis, brucellosis and avian influenza which continue to impose major burden.

The COVID-19 pandemic also highlighted the great damage that zoonotic pathogens can cause to health systems and economies around the world.[15] Thus, even more so now it is important to consolidate integrated disease surveillance and preparation for the next pandemic.

The One Health Approach offers a significant multidisciplinary framework for controlling and preventing zoonotic diseases. Policymaker-academia collaboration and incentives (linking environmental science and health),40, 41 combined with practitioner-academic–environmental surveillance238, 327 will be essential to control the emerging zoonotic threats that affect us all.

Conclusion

Because of the vital role it plays in the management of acute illnesses, trauma, disasters, infectious outbreaks and life threatening emergencies; emergency medicine has evolved into one of the most indispensable and dynamic specialties in modern health systems. This specialty is at the front end of health care provision, providing immediate medical intervention for patients needing urgent stabilization, resuscitation and diagnostic and critical care support.

In the past few decades, emergency medicine has evolved from simple casualty treatment to a highly-furnished and sophisticated multiprofessional field that combines trauma care, critical care medicine, disaster management, toxicology, cardiovascular emergencies, pediatric emergencies and infectious disease management and advanced life support systems. Objectives: Continuous evolution of resuscitation science, emergency imaging, mobile diagnostics, point-of-care ultrasonography (POCUS), telerehabilitation and high-precision AI-based medical information applications have significantly enhanced outcomes in the management of critical emergencies.

This has greatly broadened the scope and significance of emergency health systems around the world as road traffic accidents, cardiovascular disease, respiratory emergencies, poisoning, neurological disorders, infectious diseases and mass casualty incidents take a toll on global health in an unprecedented scale. Documented by worldwide public health records, rapid urbanization, industrialisation environmental disasters and emerging infectious outbreaks have continued to exert immense pressure on emergency departments globally.

The Coronavirus Disease 2019 pandemic highlighted the vital role of emergency medicine in public health crisis response. Emergency healthcare workers were on the frontline preparing and treating patients, controlling infection, managing airways and ventilatory support, stabilizing critically ill patients, and leading disaster coordination in one of modern history's most difficult public health crises. Moreover, the pandemic underscored issues related to healthcare preparedness, surge capacity management, infection prevention systems and multidisciplinary emergency response planning.

The practice of emergency medicine has changed dramatically from the use of a number of technological innovations in today's world. Introduction:Point-of-care ultrasonography is no longer an optional bedside diagnostic exam but essential for trauma, cardiac, respiratory, abdominal and shock. Artificial intelligence (AI) and machine learning systems continue to support emergency physicians with patient triage, interpretation of radiological studies, prediction of sepsis, analysis of electrocardiograms, and workflow optimization. Teleconsultation and digital emergency consultation systems have made specialist emergency care more accessible throughout rural and underserved regions.

Improvement in clinical competence, procedural skills, disaster preparedness, communication and teamwork of the healthcare recommendations through simulation-based emergency medicine training. Today, emergency medicine education heavily favors evidence-based protocols, multidisciplinary approaches, high-level critical thinking skills, rapid clinical decisions and crisis resource management.

While advances in innovation are promising, emergency medicine around the world still faces many clinical and organizational challenges. Despite international initiatives to alleviate Emergency department overcrowding, the shortage of trained emergency physicians; healthcare worker burnout; inadequate infrastructure protecting frontline personnel and ensuring quality of care and patient outcomes whereby deja vu we find ourselves at risk again with delayed patient transfer; limited rural Emergency services; financial constraints experienced globally continue to affect exorbitantly on health service delivery. Increasingly, these issues are revealed as acute barriers in a public health

landscape marked by limited resources in many developing countries (where trauma systems and reliable ambulance networks are virtually non-existent) as well as restricted access to specialist emergency care.

Trauma care continues to be a significant problem as still, injuries due to road traffic accidents, occupational hazards, violence and disasters are correspondingly leading cause of mortality and disability globally. Thus, these data highlight the importance of effective trauma systems including immediate prehospital care as well as emergency resuscitation, imaging, surgical intervention, blood transfusion services and intensive care support to improve survival.

The requirement of an emergency preparedness infrastructure is reinforced by infectious disease outbreaks and pandemics. But, emergency departments need sufficient infection control measures, isolation rooms/chambers system for personal protective equipment confirming laboratory support to maintain ventilatory systems and health care personnel trained to respond rapidly should a potential public health threat emerge.

Beyond these opportunities, emergency medicine also struggles with increasing volumes of mental health emergencies, geriatric emergencies and exacerbations of chronic disease. The growing demands of the life sciences, especially in healthcare services to address psychiatic disorders and lifestyle-related illnesses with all-age populations needing more urgent care and response, will drive the expansion of emergency terms or allied healthcare systems.

Precision medicine, predictive analytics, artificial intelligence, wearable biosensors and robotics as well drone-based emergency supply systems with tele-emergency platforms will be more integrated into the future of emergency medicine. Digital healthcare systems and real-time monitoring technologies have the potential to greatly enhance early diagnosis, interventions in times of crisis, and access to emergency medical services.

Improving the state of emergency medicine infrastructure to ensure global healthcare preparedness and decrease avoidable mortality remains an urgent priority. Development of Trauma Centers, Systematic Ambulance System, Simulation Laboratory, Emergency Residency Programs, Rural Emergency Facility and Healthcare Workforce training should be given priority by governments and healthcare institutions.

Enhancement of well-being and occupational safety of healthcare professionals is crucial as emergency health care workers encounter highly stressful and emotionally exhausting situations. Emergency healthcare systems must be supported with adequate staffing, mental health support for stressed workers, protection at work in criminal, and burnout prevention.

Public knowledge about emergency situations, CPR, first-aid basics, trauma injury risk and prevention, road safety and the use of poisons as well as early healthcare seeking may also help patients survive better and will reduce emergency disease burden.[1] Strengthening emergency healthcare must therefore still include community prevention and public health education.

In summary, emergency medicine continues to be a high energy and high stakes and irreplaceable specialty of the modern health system. Continued investment into emergency healthcare infrastructure, technological innovation, medical education, workforce trend development (i.e.

Strengthening emergency medicine systems holistically will ultimately lead to lower mortality, better outcomes for patients with trauma and non-communicable disease, increased resilience to disasters and a more secure global healthcare environment in the future.

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