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A Multidisciplinary Approach to Public HealthCrises: Insights from Epidemiology, Nursing, Family Medicine, Psychology, and Health Informatics

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ABSTRACT
Multidisciplinary approaches produce more effective public health solutions. Integrating knowledge from several disciplines, including epidemiology, psychology, and health policy, enhances understanding of health concerns and fosters public health initiatives. Improved responses to health crises, like the COVID-19 pandemic, demonstrate the effectiveness of a multidisciplinary strategy in understanding and reducing disease spread. Interdisciplinary collaboration has enhanced innovation in public health research methods and practices. Studies demonstrate that interdisciplinary collaboration can produce new and adaptable strategies for addressing intricate health challenges. Monodisciplinary methods can uncover innovative, effective, and pragmatic solutions that are frequently inaccessible. Although multidisciplinary techniques provide considerable benefits, they also present problems with team collaboration and inter-disciplinary communication. Enhancing governmental support for interdisciplinary collaboration, encompassing flexible funding and policies that integrate science.

Keywords: Public Health; Crises; Epidemiology; Nursing, Family Medicine; Psychology; Health Informatics

INTRODUCTION

As global interconnection via travel, migration, and economic dynamics expands, numerous health issues are increasingly seen as challenges not solely for individual countries but for all nations collectively. Infectious diseases, including pulmonary infections, tuberculosis, and HIV, along with chronic ailments such as diabetes, cancer, and ischemic heart disease, are the primary causes of mortality globally (1). Sudden outbreaks, like severe acute respiratory syndrome (SARS), H5N1 influenza, and the emerging Ebola virus, have attracted global attention. Tropical illnesses that were previously overlooked are now garnering increased attention and, in certain instances, escalating in severity (3, 4). Severe dengue fever, a viral infection carried by mosquitoes and lacking a cure, has escalated significantly over the past four decades, expanding from nine countries in 1970 to over 100 by 2010 (1). These health concerns are not exclusive to particular continents, nations, social strata, ethnicities, or genders. These health risks pertain to all individuals. Informatics has been used to infectious diseases (5), chronic disorders (6), and neglected tropical diseases (7,8). Public health professionals utilize surveillance systems, laboratory information systems (LIS), data warehouses, electronic health records (EHR), and various electronic health information systems (HIS) to detect and manage infectious disease outbreaks and

maintain continuity of chronic illness care. worldwide action is essential for attaining optimal health and well-being for the worldwide population; therefore, global health informatics is vital for tackling these international health issues. The global health landscape has significantly transformed during the past thirty years. Life expectancy and quality of life have enhanced in nearly every nation. The expansion can be attributed to enhanced health awareness, widespread adoption of novel medical technologies, and public health initiatives. The enhancement of public health has significantly depended on synchronized global health initiatives. The modifications were supported by two pivotal policy declarations: the United Nations (UN) Millennium Declaration of 2000, which elaborated on the principles of the Alma-Ata Declaration by delineating eight objectives, each accompanied by quantifiable targets to be achieved by 2015, and the WHO Declaration of Alma-Ata of 1978, which called upon governments and the global community to undertake prompt measures to enhance the health of all individuals globally.

The significance of a multidisciplinary approach in global health. The COVID-19 pandemic has underscored the increasing need of a multidisciplinary approach in addressing global health catastrophes. This method leverages the knowledge of various fields, such as virology, epidemiology, sociology, and public health policy, to deliver a thorough and unified response to health crises (10). This collaborative framework expedites the development of innovative and effective solutions by amalgamating diverse viewpoints and areas of expertise, hence enhancing the overall effectiveness of crisis management (11). The multidisciplinary approach employed in public health research has demonstrated efficacy in formulating comprehensive health solutions to tackle the increasingly intricate global health concerns. Integrating knowledge from multiple domains enhances our comprehension of disease dynamics and health-related human behaviors, as noted in (12). The COVID-19 pandemic underscored the necessity for ongoing innovation and enhancement in public health research and healthcare provision. The collaboration of numerous specialized experts expedited vaccine development and enhanced disease prevention and treatment measures, which were tailored to meet the diverse demands of worldwide populations (13). This collaborative initiative enhances scientific and medical capabilities while facilitating the swift implementation of practical solutions in real-world situations, thereby mitigating the crisis's effect on public health (14). A comprehensive strategy is necessary to effectively enhance fairness and accessibility in healthcare services. Health crises can intensify existing gaps, disproportionately affecting the most vulnerable populations. Integrating experts from several fields facilitates the identification and effective resolution of significant social, economic, and cultural obstacles to healthcare access. A comprehensive understanding of these challenges promotes the formulation of more inclusive health policy (16). This paper recommends future research on the effectiveness of multidisciplinary approaches in public health across many geographical and cultural contexts.

Informatics for Global Health

Clinical databases and clinical decision support systems are used in the specialized field of health informatics to manage patient data. Numerous subfields fall under this specialized area, including public health informatics, consumer health informatics, clinical informatics, and nursing informatics. Information technology that facilitates the organization and analysis of health data to enhance patient outcomes is referred to as "health informatics" in the healthcare industry. The most significant health informatics technologies include robotics, augmented reality (AR), virtual reality (VR), wearable technology, cloud computing, big data, nanomedicine, mHealth, Internet of Medical Things (IoMT), 3D bioprinting, telemedicine, wearable technology, and artificial intelligence (AI). The resources, instruments, and practices utilized in medical practice are all included in healthcare informatics solutions. A variety of equipment is available, such as medical technologies, communication networks, and computers. Electronic access to medical records is available to patients, nurses, hospital administrators, insurance providers, and health information technologists (17,18). Because borders and areas of focus are always changing, it can be challenging to define a health informatics workforce. Technology and communication are combined in health informatics to enhance patient safety and care quality. In addition to empowering patients, health informatics aims to promote cooperation among medical professionals (19). An overview of the health informatics workforce is given in this brief, covering occupations, roles, educational paths, and the impact on health equity. This brief discusses knowledge gaps and obstacles to a unified health informatics workforce. Using concepts like multicausality, multifactorial disease, and web of causation, epidemiologists have long sought to enhance the "magic bullet" paradigm in order to better represent the complexity of the issues they encounter (20–26).Consequently, epidemiology has developed into a method of gathering information on risk factors with the ultimate objective of determining suitable public health measures (27).

Risk-factor epidemiology has been attacked, meanwhile, for producing erroneous, vague, or unworkable causal assertions. Extensive mathematical models for causal inference built by recent methodological developments have led to more strict criteria for proving causality (28). Formal causal inference systems draw attention to the intervention and assert that all causal effects—including hypothetical ones—must be expressed as intervention outcomes (29). Therefore, even if that framework is improved and more extensively applied, the inherent difficulty, if not impossibility, of addressing complicated health events within the formal causal inference

framework will persist and will affect public health interventions (30). Critics claim that the paradigm is probably going to overlook the most challenging and urgent public health issues including health inequalities (31,32).The framework for causal inference seeks to duplicate the randomized controlled experiment, therefore separating the effects of different components. Basically, it is a tactic that tries to match the complexity of the public health phenomena. Therefore, it is not unexpected that attempts to bring subjects like studies on health inequalities into the causal inference paradigm have had little success(33-36).

Epidemiology in global health

Effective preparedness, identification, investigation, and response to intricate epidemic scenarios necessitate a proficient and capable applied epidemiology staff (37). In response to the increasing need for proficiency in applied epidemiology, prompted by rising public health issues, the Field Epidemiology Training Program (FETP) has broadened its international scope, developing into an extensive three-tiered structure. The divisions comprise basic/frontline, intermediate, and advanced levels, specifically intended to bolster public health systems at the district, subnational, national, and regional tiers (38,39). This versatile model addresses the specific requirements of different countries and locations, emphasizing essential applied skills such epidemiology, data analysis, epidemic investigation, scientific communication (both oral and written), surveillance assessment, and public health leadership (40,41). Since its inception, proficient epidemiologists have been instrumental in examining outbreaks and developing surveillance systems (42). The Field Epidemiology Training Program (FETP) was initiated in Sudan in 2017 to enhance the skills of epidemiologists in their assistance to various levels of the health system, including federal, state, and local tiers. It seeks to enhance the supervision and public health responses to epidemics and emergencies. The training primarily consists of field-based instruction, which includes 75% of the curriculum, whilst didactic in-class training comprises just 25%. Two advanced cohorts and one intermediate cohort of the Field Epidemiology Training Program (FETP) have successfully concluded their training. Additionally, two intermediate cohorts are presently under progress, with 30 epidemiologists in training (43).

Family medicine in global health

Family medicine requires physicians to serve as resources for both their practice communities and individual patients. Understanding the biophysical medical model of disease and illness, as well as its effects on individuals, is critical for accurately diagnosing and treating all patients. Nonetheless, an individual's experience with sickness is frequently influenced by larger external factors. Income, culture, environment, genetics, education, and the overall social structure all have an impact on community members' health. The affected group may differ significantly from or be bigger than the clinic's defined population. Identifying and influencing these qualities, both in practice and in the general community, can benefit the health of all Canadians (44). Public health and family medicine are inherently linked. Collaboration allows both parties to increase their performance and achieve better results. Nonetheless, teamwork often fails to develop. Medicine and public health evolved independently, are often taught at separate institutions, and are practiced in diverse situations and frameworks with opposing motivations and goals. Public health and medicine have different ideals, concepts, and cultures. Family medicine has attempted to address this imbalance by introducing community-oriented primary care (COPC) into undergraduate and residency training programs; nevertheless, the impact on future practice of the majority of community family physicians has been minimal. Numerous COPC processes, such as defining and characterizing the community, identifying community health issues, and implementing programs to address them, are functions that many local health departments are more adept, motivated, and incentivized to perform than physicians, who are typically preoccupied with individual patient needs. The adoption of COPC would benefit from collaboration between public health and community physicians, with each playing a unique and important role. Family physicians can improve their trustworthiness by using a variety of coordinated communication tactics (48).

In-person consultations have been suspended by numerous practitioners as a result of COVID-19 advisories. Therefore, in order to engage an expanding patient population, alternative communication strategies are implemented. Telemedicine, which employs digital and telephonic platforms, will be indispensable in facilitating rapid, interactive communication and healthcare delivery, thereby ensuring the health of both patients and healthcare professionals. The implementation of telemedicine involves the use of phone calls to contact patients prior to their arrival at the healthcare facility, the facilitation of electronic appointments, and the provision of virtual check-ins that allow patients to establish a connection with clinicians. Additionally, the successful implementation of these new technologies is contingent upon the availability of personnel to assist patients in their use. During a period of confusion for a multitude of individuals, each of these procedures demonstrates empathy and contributes to the preservation of trust. Family physicians are also instrumental in raising awareness of prospective public health issues(49). To be effective and informative, communication must be both prominent and intelligible, and it should be customized to the audience. Medical practitioners and clinic personnel must be prepared to address inquiries regarding patient information materials or symptoms, even if the

purpose is to direct patients to the most suitable sources for their inquiries. Health risks must be emphasized to patients during consultations by medical professionals through the use of plain, accessible language. Notifying patients of an imminent health crisis is inadequate. Family physicians must improve their comprehension of the health crisis and the determinants that influence changes in health behavior, particularly in terms of the severity and susceptibility to potential exposure. The volatility of information presents a challenge in the context of a burgeoning crisis, as it is difficult to achieve patient comprehension. Family physicians have the ability to provide patients with a "information prescription," which directs them to reliable and comprehensive online resources, such as the websites of state or county public health departments or the Centers for Disease Control and Prevention (50,51). Patients' outcomes were enhanced by physicians who implemented information prescriptions, as evidenced by prior research, which clarified complex concepts and medications. In the context of a pandemic, physicians can enhance comprehension by providing patients with a clear definition of the term "pandemic illness," providing historical examples of pandemics, elucidating the associated risks in probabilistic terms, and visually presenting numerical data. By proactively identifying erroneous assertions and refuting potential counterarguments, family physicians can effectively protect patients from misinformation.(53,54). Modern nursing emerged in response to crises and emergencies. The profession has been shaped and transformed by conflict and adversity as a result of the necessity for nurses to perpetually adapt to the evolving healthcare environment and their circumstances. The ongoing requirement for healthcare practitioners to demonstrate adaptability and creativity in response to medical emergencies has been present throughout the professionalization and advancement of nursing.The world has become increasingly unstable as a result of pandemics, wars, and conflicts, in addition to the climatic issue. It is undeniable that nurses play a unique role in addressing global health crises. Therefore, it will be essential to enhance their abilities and responsibilities in this area in order to advance the profession and humanity's future response to such events.The global health issues are posing substantial challenges to the fundamental principles of modern nursing, which include quality of care, standardization, regulation, advocacy, and compassion. Due to the tumultuous circumstances of unforeseen catastrophes or the progressive deterioration of these systems, healthcare professionals face difficulties in optimizing care and providing effective medical treatment. The most effective humanitarian response to these circumstances is based on the principles of effective nursing: advocacy, empathy, and compassion, which are bolstered by a successful, evidence-based approach. Despite the fact that nurses should be at the forefront of contemporary humanitarian response, this is frequently overlooked (55). The role of nurses in global health crises has been frequently mischaracterized, disregarded, and minimized.

The role of nursing in humanitarianism should not be interpreted as a unilateral endeavor. Nurses have historically played and will continue to play a critical role in medical settings. However, the influence of innovations implemented by nurses in response to the crisis on the current state of nursing practice is occasionally overlooked (56). The advancement and development of modern nursing practice during the conflicts and pandemics of the 20th and 21st centuries were significantly influenced by Florence Nightingale's inventions, which were driven by nurses operating in emergency situations and crises. Despite the fact that health and urban planning have been successful collaborators, the formation of a respectful relationship founded on mutual understanding and pragmatic interaction across these domains has become increasingly challenging(57,58).

Over the last ten years, researchers have dug deep into the idea of multi-disciplinarity as a means to tackle complex problems that necessitate management at different levels (e.g., research, local governance, policy) through the use of new and creative techniques. It is well acknowledged that the study sector greatly benefits from interdisciplinary approaches. This took place in both more established areas, like physics and applied mathematics, and in more dynamic ones, such nanotechnology applications and new infectious disease research (e.g., HIV, Ebola, SARS-CoV). In the academic sphere in particular, multidisciplinarity goes beyond simple cooperation for progress. (59) looked at 90,000 articles written by 2,500 professors from more than 100 universities in three interdisciplinary fields: information science, public policy, and neuroscience, to determine whether there was a correlation between more interdisciplinary work and genuine internal collaborations. They found that although there was an increase in interdisciplinary interactions, many institutions that claimed to be multidisciplinary were not actually working together. Unsustainable urban expansion and climate change have worsened a number of health problems already plaguing cities around the world, including but not limited to: air, water, and soil pollution; traffic congestion; noise; and inadequate housing. Opportunities for integrated low-carbon solutions in urban areas can be found through a multidisciplinary assessment of these issues, which can yield various benefits for public health (60). Urban planners and health specialists must work together to achieve high walkability, but this is not enough. Regulatory frameworks must prioritize health and health promotion in order to encourage cultural and commercial activities while also ensuring adequate maintenance and safety. To better understand the manner in which urban living characteristics impact health, interdisciplinary techniques that combine quantitative and qualitative methods are highly recommended. Quantitative and qualitative approaches can work together to reduce the impact of earlier decisions; nevertheless, traditional interdisciplinary methods often involve people from different backgrounds, which can lead to different definitions of terms used

in different domains. Consequently, there are significant challenges to collaborate when academics and practitioners come from different academic backgrounds. (63) Professionals in the health and built environment sectors should collaborate to make use of their unique expertise rather than acquiring in-depth knowledge of each other's disciplines. This necessitates comprehension, and professional development programs ought to center on cultivating this comprehension instead of just enhancing technical abilities.

CONCLUSION

It is a multidisciplinary approach to managing public health crises, integrating fields like epidemiology, nursing, family medicine, psychology, and health informatics.

It indicates how interdisciplinary collaboration in these fields enhances the understanding and response to complex health challenges, such as infectious diseases, chronic conditions, and health emergencies like COVID-19. This text also discusses the roles of technology, policy, and teamwork in public health and addresses barriers to interdisciplinary collaboration. Successful applications are witnessed in health informatics, field epidemiology, and other similar programs where expert combinations have

proven benefits regarding increased access to healthcare, improved management of crisis situations, and equity.

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