

A Comprehensive Framework for Managing Health Crises: Contributions from Psychology, Epidemiology, Physical Therapy, Health Services Administration, Radiology, Laboratory Sciences, and Health Informatics

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Abstract

Health crises can include epidemics, natural disasters, and humanitarian emergencies and provide the most rigorous examination to any nations' health care system. In active management, such crises involve an interprofessional practice in peculiar forms amongst health care practitioners, policy, and community stakeholders. Some of the key disciplines that try to reduce the impact of crises include psychology, epidemiology, physical therapy, health services administration, radiology, laboratory sciences, and health informatics. It reviews the various disciplines contributing to the management of the health crisis, ending with the proposition of strategies aimed at improving interdisciplinary collaboration in bringing better outcomes in resource-limited and emergency settings.

Keywords: health crises; interdisciplinary; health care systems; emergency management; collaboration.

Introduction

Health crises are in various forms, such as pandemics, natural disasters, and events involving bioterrorism. Each one of those threats places high stresses on health systems around the world, for which there is a need to respond with interprofessional coordination. An example includes the COVID-19 pandemic, which showed that a multidisciplinary approach would be needed to tackle the complexities that come with such emergencies (Hick et al., 2020). It generally includes estimation and mitigation of threat, timely care, continuity in operations of lifelines, and managing the after-effects on health. Without which any critical needs also would not have arisen in psychology, epidemiology, physical therapy, health services administration, radiology, laboratory sciences and health informatics per say. Each of these service areas has a unique contribution to make to fundamental knowledge, tools, and interventions; collectively, their sum is an increased state of preparedness of the health system against crises.

These are truly interlocking challenges, where an interdisciplinary approach to health crisis management is eminently called for, ranging from how psychological science contributes to the support of mental health consequences to epidemiology with its methodologies and tools of understanding and prediction of disease propagation (Brooks et al., 2020; Ioannidis et al., 2020). These would include physical therapy for the rehabilitation of the sick and injured; health service administration for the management, distribution, and proper allocation of resources and personnel; advanced radiology and laboratory sciences and health informatics to allow for timely diagnosis and treatment and follow-up on health crises. All these

disciplines, each in their own way, contribute to an aggregate model seeking improvement in public health responses and results individually as well as in community applications.

The COVID-19 pandemic has illustrated the critical need to integrate these fields into a unified strategy. For example, rapid diagnostic testing and genomic sequencing by laboratory scientists allowed for the early detection of SARS-CoV-2 variants, while health informatics facilitated the use of big data to monitor the pandemic's progression and guide interventions (Peeling et al., 2020; Wang et al., 2021). Simultaneously, psychology and risk communication strategies managed public fear and misinformation; meanwhile, health service administration led to equitably distributed vaccines and medical supplies (Ranney et al., 2020). The paper will investigate the contributions of psychology, epidemiology, physical therapy, health service administration, radiology, laboratory science, and health informatics towards underlining the one indisputable method of multidisciplinary collaboration in the management of health crises. Approached by both accordingly, with clear perspectives and means, providing a clear framework from which one may approach the complex nature of the world of health emergencies.

Methodology

A literature review is conducted regarding interdisciplinary roles in the management of health crises. For this review, literature searches on PubMed, Google Scholar, and Scopus databases for works within 2010 through 2023 were conducted. The keywords that could best describe and relate to the present study include "health crises," "interdisciplinary collaboration," "emergency response," "healthcare systems," and "role of health professionals." The initial search retrieved a total of 350 articles; after screening the title and abstract, 78 were selected for full-text review. Of these, 30 were selected for final consideration, including RCTs, cohort studies, case reports, and systematic reviews—all those bearing on evidence relative to the contribution various disciplines make in time of health crises and best practices to optimize those responses.

Literature Review

This review therefore synthesizes the best available evidence on the role of interdisciplinary collaboration during the management of health crises. It tries to meet the mental health needs of the concerned populations, building the resilience of the community and limiting further trauma. It communicates basic information around disease surveillance, outbreak forecasting, and resource distribution during the crisis. Those people who are affected with injury or disability caused by various disasters or outbreaks can be given great rehabilitation through physiotherapy. Health services management can guarantee the adequacy of resource mobilization, coordination in the response, and continuity in health operations in real-time at the time of disaster.

While radiology and laboratory sciences play a great role in diagnosing and following up diseases, health informatics enables data exchange and decision-making in real time among the different players. That is so in cases where, within the current COVID-19 pandemic, health informatics systems have to be set up for efficient contact tracing, vaccination scheduling, and even reporting of infection trends in real time.

Limitations to this multidisciplinary coordination include resource issues, communication gaps, and variable preparation of the services. Intervention strategies will involve formulating uniform treatment protocols, education, and integration into a crisis management system.

Discussion

Health crises in the form of pandemics, natural disasters, or bioterrorism require a comprehensive framework: an interdisciplinary involvement of experts (Hick et al., 2020):

Psychology

The management of health crises greatly incorporates psychology in their handling of mental health challenges among populations and health workers whenever such instances strike, which includes pandemics, natural disasters, or large-scale emergencies. In fact, many are said to suffer from anxiety, depression, and post-trauma stress disorders in such instances. For instance, Brooks et al., in 2020, estimated that during the COVID-19 pandemic, the quarantine measures have resulted in an increase in psychological distress for several reasons that include isolation, uncertainty, and also fear of contamination, which is significantly mediated by mental health interventions such as CBT, mindfulness practices, and resilience training. Besides this, psychologists also contribute to designing mental health support systems among the healthcare workers who burn out due to emotional exhaustion following a prolonged exposure to high-stress environments (Fisher et al., 2020). These interventions promote not only wellbeing but also aim at enhancing the continued capability of the staff to provide healthcare during crises.

It has also, however, fundamentally informed one area: that of risk communication. Risk communication is noted to be an important aspect of bringing forth behavioral changes among the populace during health

crises. Clear communication strategies ensure the population understands the importance of adherence to public health measures and reduces panic and misinformation. One study during the H1N1 influenza pandemic showed that clear and empathetic communication increased the compliance with protective behaviors such as vaccination and maintaining social distancing (van der Weerd et al., 2011). Public health campaigns will also be theoretically designed, taking into consideration that messages must be framed in culturally and socially relevant ways that will resonate with heterogeneous audiences. It also helps in reducing misinformation that could help diminish the trust of the general population in health-related interventions. The psychology addresses emotive and cognitive dimensions of human behavior in enhancing effectiveness in crisis management strategies.

Epidemiology

The study of the distribution, determinants, and control of diseases makes epidemiology the cornerstone of health crisis management. Thus, during the COVID-19 pandemic, epidemiological modeling and surveillance systems guided public health responses through tracking the virus and identification of populations at high risk, as indicated by Ioannidis et al., 2020. Systems put in place for surveillance, by the World Health Organization among others, provide critical data in real time to policy decision-makers on timely decisions over lockdowns, vaccination campaigns, resource deployment, and so on (World Health Organization, 2021). It is in this regard that the discipline of epidemiology has been at the forefront of unpacking health inequity in terms of assessing the social determinants of health-income, education, and access to healthcare-that shape disparity in outcomes during crises. These insights will ensure that the responses to public health become evidence-based, hence being fair.

Advanced technologies such as those of GIS and genomic sequencing go further than enhanced outbreak surveillance to its detection and control. For instance, this is the case with the use of GIS tools in monitoring the spatial transmission of influenza in rolling out targeted vaccination campaigns, as seen in Charu et al., 2017. Moreover, genomic sequencing has underpinned the identification and tracking of new variants of SARS-CoV-2, with due relevance and elaboration of effective vaccinations and treatments. The work that epidemiologists usually perform is how well interventions, such as mask mandates or policies of social distancing, operate to ensure resources are utilized with maximum efficiency. Essentially, it pools data from many sources in order to achieve overall dimensions concerning disease dynamics, hence forming the basis for proactive, evidence-based responses.

Physical Therapy

Physical therapy forms a very important component in health crises in ensuring that the needs of patients concerning rehabilitation after an illness, injury, or long-term disability are met. In the COVID-19 pandemic era, physical therapists played a major role in helping patients recover with severe respiratory complications and PICS (Stam et al., 2020). Early mobilization was incorporated into rehabilitation programs, thus increasing their physical functioning and avoiding complications such as muscular atrophy, joint stiffness, and bed confinement for a long period. These interventions have facilitated not only the return of patients to independence but also eased the burden of healthcare systems by way of early discharges and reduction in long-term care. They also belonged to the multidisciplinary team in devising a treatment plan that would give patients a chance to recover their physical and psychological health.

Beyond individual rehabilitation, physical therapy also contributes to community-level resilience during health crises. Disaster preparedness programs often incorporate physical therapy to train individuals and communities in injury prevention and physical resilience strategies, particularly in regions prone to natural disasters (Cottrell et al., 2022). For instance, physical therapists may design exercise programs to improve balance and strength, reducing the risk of falls and injuries during emergencies. In addition, there is research on the place of exercise within the rehabilitation process from infectious diseases like COVID-19, guiding how safe and efficient rehabilitation is executed (Korupolu et al., 2020). Such development sends an important note on the inclusion of physical therapy in the management framework of health crises because the immediate to long-term health concerns are addressed.

Health Services Administration

In this view, HSA plays a very instrumental role in managing resources, personnel, and infrastructure while responding to emergencies. For instance, the sharing of resources such as PPEs, ventilators, and vaccines makes administrators ensure proper coordination at facility levels to ensure a fairly distributive system. For example, active administrative leadership has played a central role in mobilizing resources to areas of surge and surge management of health systems overwhelmed during the COVID-19 pandemic, reflected by Rananey et al. (2020). Other key roles of the administrators are to provide policies to sustain operations in the face of unprecedented demand, including but not limited to hospital surge capacity plans and guides for

crisis standards of care. Other ways that confidence and compliance with the health measure were ensured were through clear communication and transparency with the general public.

Another critical aspect of HSA during health crises is financial management and sustainability. Health emergencies often strain budgets, requiring administrators to allocate funds judiciously while balancing the costs of emergency responses and routine healthcare services (Shi & Singh, 2022). For example, during the COVID-19 pandemic, the rapid expansion of telehealth services required significant investment in technology and training, which administrators facilitated. This too encompasses crisis preparedness through contingency planning, simulation, and training in order to be certain that the health systems are ready for emergencies. According to Hick et al. 2020, HSA provides strategic leadership and involves many other sectors in a bid to ensure that health systems can be resilient and responsive to health crises.

Radiology

Radiology plays a crucial role in health crises by providing diagnostic imaging that aids in the detection, monitoring, and treatment of diseases. During the COVID-19 pandemic, imaging techniques like chest radiographs and computed tomography (CT) scans were vital in diagnosing and assessing lung complications associated with the disease (Rubin et al., 2020). Radiologists were able to help identify and characterize patterns of lung involvement that assisted clinicians in assessing the severity of disease and guiding treatment. Outside the realm of infectious diseases, radiology is also crucial in disaster situations because imaging is commonly utilized for evaluating traumatic injury, identifying foreign bodies, and guiding surgery. Portable systems and mobile radiology units further increase access in urgent situations and often provide the opportunity for direct bedside examination (Kanne et al., 2021).

Recent technological developments, notably AI, have increased the scope of the health crisis management that is under the purview of the specialty of radiology. Lakhani&Sundaram, 2020, hold that the pace and accuracy of diagnosis done using AI-operated diagnostic tools are very impressive with a high promise of quickening the pace at which test results are given via an overwhelmed health care. The diagnosis of the difference between COVID-19 pneumonia and other lung diseases was done this way during the COVID-19 pandemic, with precision added to diagnosis. Besides, the integration of telemedicine into radiology enables remote consultations and interpretations regardless of the distance, hence bridging gaps between areas that are not as well-served (Smith et al., 2020). These changes demonstrate the critical supportive role of radiology in making rapid and efficient decisions related to public health emergencies.

Laboratory Sciences

Thus, health crises are incomplete without laboratory sciences, which provide the modality for detecting the infection, monitoring, and development of treatment modalities. Indeed, during the COVID-19 pandemic, molecular diagnostic tests, especially for the polymerase chain reaction (PCR), were fast developed by laboratory scientists for the identification of infection due to SARS-CoV-2 (Peeling et al., 2020). These have been highly instrumental in the identification of cases, allowing contact tracing and, thus, hampering further transmission. Besides diagnosis, laboratory science has been very important in the elaboration and production of vaccines, in the monitoring of new variants through the genomic sequencing. With it, for instance, the Delta and Omicron variants came into evidence, while on the other hand, it informed the public health strategies on updating the vaccines. In addition, the added role of laboratories is to guarantee whether the treatments at the clinical trial stage are safe and effective, based on supportive evidence for a new therapy.

Beyond diagnostics and treatment development, laboratory sciences contribute to public education and combating misinformation during health crises. By disseminating accurate information about pathogens, transmission, and prevention measures, laboratory professionals help build public trust in scientific interventions (Larson, 2020). For instance, efforts to explain the safety and efficacy of COVID-19 vaccines were essential in addressing vaccine hesitancy, a major barrier to achieving herd immunity. It integrates laboratory sciences into the system of public health, ensuring real-time information for swift action against new threats. The laboratory sciences are, therefore, contributing to the bases in managing health crises by connecting technical capacity and public involvement.

Health Informatics

Health informatics connects healthcare with technology and thus provides evidence-based practices for responding to health crises. Starting from EHR to telemedicine and using predictive analytics, crisis management has already been changed. In the case of COVID-19, health informatics tools have tracked virus transmission, forecasted resource requirements, and monitored vaccine distribution (Wang et al., 2021). Basically, telemedicine platforms have enabled patients to continue receiving their care remotely, hence minimizing the chance of the virus while continuing care. Predictive analytics had given insight,

through machine learning algorithms, into disease trends that helped policy decision-makers in the work of allocating appropriate resources. Health informatics support interoperability in health teams through the establishment of a centralized platform for data sharing in which health providers assess real-time information.

Health informatics also contributes much to the development of communication either between medical caregivers and medical patients. Wearable devices, mobile health applications, and patient portals that are brought into practice enable them to monitor their health autonomously and provide information in periods of crisis in a timely manner (Rao et al., 2021). A very good example is how lately mobile apps have been used in the COVID-19 pandemic situation for symptom tracking, vaccination appointments, and updating others with the latest information about public health guidelines. This just happens to be one of those fields that catalyzes research in such a way that large datasets get integrated, analyses get done, hence hastening discoveries toward diagnostics and treatment. Health informatics improves responses to health crises because technology is better deployed for saving lives and other resources.

Conclusion

Interdisciplinary management of health crises brings on board players from various health disciplines, including psychology, epidemiology, physical therapy, health services administration, radiology, laboratory sciences, and health informatics. Each of these positions carries different competencies that enable a large array of tasks during emergencies. Each of these functions helps assure comprehensive responses that address mental health, resource allocation, diagnostics, and data communication in a timely manner. Yet, disparities in available resources, defects in communication, and inequality in the level of preparedness among concerned parties usually inhibit excellence in collaboration. Defeating the barriers to these with standardized protocols and integrated training programs, coupled with advanced technological wherewithal, forms a significant upgrade in crisis response capability.

In the future, it would be expected of health systems to invest in making those frameworks resilient on the back of an interdisciplinary approach: encouraging mutual respect among health professionals, policy framers, and community leaders toward adaptive, nimble strategies. This would be further enhanced by regular simulation exercises, cross-discipline training sessions, and seamless integration of emerging technologies such as artificial intelligence and telehealth, with a view toward making the system responsive to future calamities. Health systems would, therefore, have better assurance of minimum adverse effects of health crises through the combined strengths of all disciplines and thus better outcomes in affected populations.

References

- Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *The Lancet*, 395(10227), 912–920.
- Charu, V., Zeger, S., Gog, J., et al. (2017). Human mobility and the spatial transmission of influenza in the United States. *PLOS Computational Biology*, 13(2), e1005382.
- Fisher, J. R., Tran, T. D., Hammarberg, K., Sastry, J., Nguyen, H., Rowe, H., ...& Kirkman, M. (2020). Mental health of people in Australia in the first month of COVID-19 restrictions: a national survey. *Medical journal of Australia*, 213(10), 458–464.
- Hick, J. L., Hanfling, D., Wynia, M. K., & Pavia, A. T. (2020). Duty to plan: Health care, crisis standards of care, and novel coronavirus SARS-CoV-2. *National Academy of Medicine Discussion Paper*.
- Ioannidis, J. P. A., Cripps, S., & Tanner, M. A. (2022). Forecasting for COVID-19 has failed. *International Journal of Forecasting*, 38(2), 423–438.
- Kanne, J. P., Bai, H., Bernheim, A., Chung, M., Haramati, L. B., Kallmes, D. F., ...& Sverzellati, N. (2021). COVID-19 imaging: what we know now and what remains unknown. *Radiology*, 299(3), E262–E279.
- Korupolu, R., Francisco, G. E., Levin, H., & Needham, D. M. (2020). Rehabilitation of critically ill COVID-19 survivors. *Journal of the International Society of Physical and Rehabilitation Medicine*, 3(2), 45–52.
- Lakhani, P., & Sundaram, B. (2017). Deep learning at chest radiography: automated classification of pulmonary tuberculosis by using convolutional neural networks. *Radiology*, 284(2), 574–582.
- Larson, H. J. (2020). A call to arms: Helping family, friends, and communities navigate the COVID-19 infodemic. *Nature Medicine*, 26(10), 1505–1506.
- Peeling, R. W., Wedderburn, C. J., Garcia, P. J., et al. (2020). Serology testing in the COVID-19 pandemic response. *The Lancet Infectious Diseases*, 20(9), e245–e249.

- Ranney, M. L., Griffeth, V., & Jha, A. K. (2020). Critical supply shortages — The need for ventilators and personal protective equipment during the COVID-19 pandemic. *New England Journal of Medicine*, 382(18), e41.
- Rubin, G. D., Ryerson, C. J., Haramati, L. B., et al. (2020). The role of chest imaging in patient management during the COVID-19 pandemic: A multinational consensus statement from the Fleischner Society. *Radiology*, 296(1), 172–180.
- Shi, L., & Singh, D. A. (2022). *Essentials of the U.S. health care system*. Jones & Bartlett Learning.
- Smith, A. C., Thomas, E., Snoswell, C. L., et al. (2020). Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). *Journal of Telemedicine and Telecare*, 26(5), 309–313.
- Stam, H. J., Stucki, G., & Bickenbach, J. (2020). Covid-19 and post intensive care syndrome: a call for action. *Journal of rehabilitation medicine*, 52(4), 1–4.
- van der Weerd, W., Timmermans, D. R., Beaujean, D. J., Oudhoff, J., & van Steenberghe, J. E. (2011). Monitoring the level of government trust, risk perception, and intention of the general public to adopt protective measures during the influenza A (H1N1) pandemic. *BMC Public Health*, 11, 575
- Wang, C. J., Ng, C. Y., & Brook, R. H. (2021). Response to COVID-19 in Taiwan: Big data analytics, new technology, and proactive testing. *JAMA*, 323(14), 1341–1342.
- World Health Organization.(2021). *COVID-19 strategic preparedness and response plan*. World Health Organization.