Medical Research Archives

European Society of Medicine

OPEN ACCESS

Published: April 30, 2024

Citation: Michaels-Strasser S, 2024. Protecting Frontline Nurses: What will it take? A review of policy, practice and lessons learned from High Consequence Infectious Diseases like Ebola and COVID-19, Medical Research Archives, [online] 12(4). https://doi.org/10.18103/mra.v12i4.4993

DOI
https://doi.org/10.18103/mra.v12i4.4993

ISSN: 2375-1924

REVIEW ARTICLE

Protecting Frontline Nurses: What will it take? A review of policy, practice and lessons learned from High Consequence Infectious Diseases like Ebola and COVID-19

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ABSTRACT

The significance of failing to protect frontline health workers, especially nurses cannot be overstated. Inadequate personal protection, psychosocial support and emergency training put our frontline of defense in jeopardy. When comparing death by occupation early evidence showed that nurses constituted the largest percentage of health workforce deaths. Other severe consequences like high levels of resignation, burnout and other signs of mental distress are a warning that health systems require fundamental change to protect and retain our frontline of health security. This is equally true in settings with both high and lower resources. Those at the frontlines pay a heavy price responding to infectious disease outbreaks, but it does not have to be.

This paper outlines key issues and potential strategies to ensure our health workers have the right environment, competence, tools, and support to protect themselves and society when needed most. Using an umbrella review, this paper sought to review the extant literature and identify the best way forward. Failure to learn from recent events such as the 2014-2016 West Africa Ebola outbreak and the COVID-19 pandemic could further exacerbate health worker shortages and our collective ability to prevent, detect and respond effectively. Protecting frontline health workers requires a multi-faceted approach including well-defined policies, adoption of best practices and continuous learning. The focus should move from broad policies and benchmarks to specific, tangible actions, including standard guidelines and protocols that use an All-Hazards Approach. Taking concrete steps to improve protection with national and local accountability that ensures adequate safety standards will be key.

Moreover, continuous learning and investment in health system strengthening are needed. The return on investment in preparedness and protection are clear. COVID-19 has shown the devastating economic and social impact of failing to be prepared. Investment is needed in innovation, including new personal protective equipment (PPE) technology, resilient supply chains that move beyond "just-in time" procurements, and competency-based experiential learning that simulates complex emergencies, in "real world" settings as much as is possible. Learning from history, including nursing pioneers, is essential.

Outbreaks begin in communities. Close community engagement and understanding of the social determinants of health for which those on the margins pay the heaviest price is central to nursing. Since this paper focuses on protection of frontline health workers, it would be remiss not to revisit nursing's role in caregiving. This paper presents examples from 19th and 20th century nursing leaders who developed community- and person-centered models of care, led the development of hygiene and sanitation standards and examples which highlight the critical role of nurses at the frontlines. Nursing has historically been community- and person-centered. Serving as the communities' first line of healthcare, nursing pioneers like Florence Nightengale and Lillian Wald offer guidance which is still valuable in our modern, highly connected world.

Applying lessons from both our recent and past experiences to develop robust systems for health workforce protection and preparedness is a health security priority. Now, as COVID-19 becomes an endemic disease for which an effective vaccine is available, is the time to harness these lessons learned, develop more robust standards and accountability for emergency protection and health workforce protection, without which history will repeat itself.

Introduction

In any complex humanitarian emergency, health workers rush in to respond. As our first line of defense, their safety should be prioritized. Yet, recent experience has shown that our ability to protect this frontline of health security is woefully lacking. Experience from the 2014-2016 West Africa Ebola Outbreak and COVID-19, show that the risk to health workers is especially severe.[1] The magnitude of health worker loss amidst crisis is not systematically documented and serious underreporting is likely.

No matter the epidemic or where it occurs, we lack a systematic way to track and verify health workforce deaths. The World Health Organization (WHO), drawing on statistics from the International Labor Organization (ILO) and WHO COVID-19 surveillance data put forward a central point estimate of over 115,000 health workers deaths between January 2020 and May 2021.[2] In an effort to track the number of health care workers who died from COVID-19 in the United States, the Kaiser Health News and The Guardian identified over 3,600 hundred deaths over a one year period beginning in April 2020.[3] Nurses accounted for 32% of these deaths, more than any other occupation.[4] Health worker deaths were largely preventable, but depended on training, preparation, and guaranteed access to personal protective equipment (PPE). Experience shows that these conditions are severely lacking, ironically, in both resource-rich and resource-lacking settings.

Context

The significance of failing to protect frontline health workers cannot be overstated. Prior to the COVID-19 pandemic, WHO estimated the global health worker shortage at 18 million.[5] In addition to deaths attributed to COVID-19, the adverse conditions in which health workers provide care have led to mass resignation and emigration, further compounding an already serious human resource deficit. Emigration is especially problematic in the global South. It is difficult for Ministries of Health to control this emigration, despite the desperate domestic need, as health system gaps and challenges such as low or inconsistent remuneration remain. Furthermore, although the production of nurses has increased in many countries, the government's ability to absorb these health workers into the public health system is constrained by international finance obligations and restrictions.

In early 2022, the US government proposed a global health workforce plan to address this crisis.[6] This plan included four pillars: 1. Protect health workers, 2. Expand the global health workforce and in turn, economic development, 3. Advance equity and inclusion and, 4. Invest in new technology and innovation. While valuable, this initiative is beholden to election cycles and politics and needs to be coupled with global minimum standards and benchmarks for health workforce protection to be able to sustain measurable progress, translated into the day-to-day experience of working at the frontlines. Finally, the paradigm needs to shift from only considering the cost of a national health workforce to examining the return on investment made in health workers and pandemic preparedness.

Assessment of emergency preparedness today resides in documents such as the Joint External Evaluation (JEE) and State Parties Self-Assessment Annual Reporting Tool (SPAR).[7,8] These tools, which are used to measure a country's preparedness, can assess progress from the national down to the community level. For example, to score a 5, a country needs to have mechanisms for coordination of RCCE functions and resources implemented at the national, intermediate, and local levels and which are fully integrated into emergency response systems. Indicators for relevant topics such as biosafety and emergency preparedness exist but adding specific assessments down to the site level would strengthen accountability. Plans need to be coupled with routine assessment of existing supplies and relevant support structures at the site level to truly ensure working conditions are safe.

Ensuring these minimum standards protect all health workers, irrespective of setting, should be a priority. The 2014-2016 West Africa Ebola outbreak highlighted the vulnerability of health workers in countries with historic underinvestment in health system strengthening and the early outbreak impact on the health workforce. The Lancet, in early 2015, reported on the disproportionate risk to health workers.[9] This is especially true early in an epidemic, when health systems grapple to identify the threat and put systems in place to protect health workers. When comparing general population deaths to deaths of health workers, the authors found a striking disparity. For example, in Guinea, deaths among the general population were 0.02% compared to 1.45% of the country's doctors, nurses, and midwives. In Liberia, the difference was 0.11% to 8.07%, and in Sierra Leone 0.06% to 6.85%.[10,11,12,13]

Outbreaks begin in communities. Close community engagement and understanding of the social determinants of health for which those on the

margins pay the heaviest price is central to nursing. While this paper focuses on the protection of frontline health workers, it would be remiss not to include lessons from the history of nursing. This paper presents examples from 19th and 20th century nurses who developed community- and person-centered models of care, led the development of hygiene and sanitation standards, and modeled the trusted role of nurses in communities and at the frontlines.

Nursing, by definition, is community- and person-centered. Pioneer nurses like Florence Nightengale and Lillian Wald offer health security and health system approaches that are still relevant in our modern, highly connected world. For example, Nightengale's Notes on Nursing, published in 1860, highlights the importance of public health and the social determinants of health and illness.[14] These foundations of health and wellness are not new. She promoted the importance of basic public health including access to potable water, nutrition, hygiene, and sanitation, yet communities today still struggle to protect themselves with these basic measures amidst outbreaks like cholera. To emphasize the point that understanding communities begs more discerning analysis, Nightengale writes "But minute enquiries into conditions enable us to know that in such a district, nay, in such a street,--or even on one side of that street, in such a particular house, or even on one floor of that particular house, will be the excess of mortality, that is, the person will die who ought not to have died before old age."[15(p.65)]

Public trust has been identified as a key factor in how well a country managed COVID-19.[16] Year on year, nursing is identified as the most trusted profession.[17] At the turn of the 20th century, Lillian Wald, considered the pioneer of public health nursing, identified the importance of nurses being in and among the communities they serve. Wald's approach to healthcare being community-based garnered tremendous trust. While buzz words such as social determinants and patient-centered care are now commonly discussed, nursing has always prioritized these. Wald's work in the tenements homes of New York City led to the formation of the Visiting Nurse Service (VNS) and numerous social programs which continue today.[18]

The Problem

Statistics showing excess mortality when comparing the general population to health workers is but the tip of an iceberg of vulnerabilities health workers face when providing care amidst crisis. These gaps urgently need to be closed. In addition to inadequate access to PPE, psychosocial support and training need to be improved to ensure health workers are available, competent, and able to respond effectively in crisis. High levels of mental distress and resignation are symptoms that demonstrate that existing health policies, practices and system preparedness need urgent and systematic review. From this review, we can begin to develop protection models that are holistic, measurable, and practical.

Methods

This paper presents an umbrella review of published works discussing health workforce protection. An umbrella review was chosen because the protection of health workers is multidimensional including physical and psychosocial safety considerations. Given the complexity and multifaceted characteristics of keeping health workers safe in dynamic, unpredictable and fluid environments, a wide lens of consideration was warranted. In addition, this method was chosen since there were multiple systematic reviews and metanalyses available relevant to the topic as is needed to complete an umbrella review. The purpose of this review was to synthesize the state of the current study of health workforce protection, which can serve to stimulate further conversation on what measurable global minimum standards and benchmarks are needed to ensure health worker protection.

Using the search engine PubMed® (which includes over 36 million citations), we conducted two searches. The first search included all papers published with the key terms "health workforce", "protection", "infectious disease" and "systematic review." A total of five articles were identified, of which four were reviewed. One paper focusing on adolescent HIV risk behavior was removed. Since no training-related reviews were identified, a second search using the terms "systematic review" "training" "infectious disease" and "health worker protection" yielded 37 results, of which 29 papers were kept for review. Nonrelevant articles covered non-healthcare worker topics, such as school-based services and drug susceptibility testing.

Results

Following removal of any duplicate papers identified across the two searches, a total of 41 papers were identified of which 31 were relevant to the purpose of this paper and selected for further review. Articles that focused on non-clinical settings, individual case studies or non-health worker populations were removed. The papers covered a wide range of topics, including training and education, psychosocial support and mental health,

infection prevention and control (IPC) and occupational exposure, personal protective equipment (PPE), vaccination, resource management, perceptions of risk and coping strategies, resilience, and health information systems. A summary of key findings is presented here.

TRAINING AND EDUCATION

A 2016 Cochrane review examining the best methods to train health workers in PPE use found that adding computer simulation led to fewer errors in doffing (MD -1.2, 95% CI -1.6 to -0.7) and the use of spoken instruction led to less errors (MD -0.9, 95% CI -1.4 to -0.4). The results from active versus passive training were mixed. Yet, this systematic review noted a very low quality of evidence, limited by issues such as risk of bias and small sample size.[19] In another Cochrane review of education and training to prevent splash exposures and sharps injuries, the quality of evidence demonstrating positive change was very low. The authors highlighted the need for developing valid measures of sharps injuries to improve monitoring and the priority of developing educational interventions. [20] Preparedness activities varied considerably and were rarely described in detail. Important training topics such as use of laboratory diagnostics and management of hazardous materials were rarely discussed. Although several articles discussed training of nurses and/or physicians, few mentioned the engagement of multidisciplinary teams including key staff, such as respiratory therapists and nonclinical staff.

PSYCHOSOCIAL SUPPORT AND MENTAL HEALTH

A systematic review of mental health interventions for health workers during epidemics found that while many seemingly helpful interventions were noted, the quality of evidence was low or very low in most studies. While multimodal prevention efforts such as staffing changes, enhanced IPC, staff recognition and psychological support were noted, there was low confidence in the methodologies used to evaluate these efforts. Several concerns were noted, including high loss to follow-up of participants, lack of a control group, and inadequate measures of workplace exposure. The duration of interventions also varied widely.[21]

In another systematic review that extended from 2003 to 2020 and included patients, health workers, and the general public, the researchers found that the prevalence of probable depressive disorder and PTSD in healthcare workers after the 2002-2003 SARS outbreak was 12 and 11%, respectively.[22] In another rapid systematic review researchers explored what health workforce factors were associated with psychological distress in the context of working during an infectious disease outbreak.[23] They included factors such as demographic characteristics, occupational, social, psychological, and infection-related factors. Factors associated with reports of psychological distress were many, including experiencing stigma, being female, being a nurse, the use of maladaptive coping, experiencing quarantine and having contact or risk of contact with infected patients. Additionally, they identified protective factors, including a sense of control, access to social support in the community and at work, a positive work environment, access to adequate information about the infectious disease and information about measures to protect oneself. In addition, training and access to resources were associated with less distress.

In another review that spanned outbreaks from SARS, COVID-19, Ebola, and H1N1, the authors identified common mental health symptoms, including depression and anxiety, insomnia, acute stress disorder, PTSD, and burnout.[24] This study also sought to identify associated risk factors. In addition to working in frontline, high-risk environments, they also found that being female, being a nurse, experiencing quarantine, and a lack of social support, were associated with increased risk. Lack of adequate PPE and knowledge of the virus were also identified, as were inadequate training and few years of work experience. In yet another review, specific to COVID-19, the authors reinforced what has been identified elsewhere.[25] They found that working in areas with higher infection rates, being female, and working on the frontlines were associated with more severe mental health symptoms.

A 2020 systematic review describing mental health interventions identified four categories of support. These include 1. informational support (e.g., training and guidelines), 2. instrumental support (e.g., PPE) 3. organizational support (e.g., workforce allocation, hours, access to rest areas) and 4. emotional/psychological support (e.g. mental health and peer-support, counseling).[26]

PERCEPTIONS OF RISK AND COPING STRATEGIES

In one systematic review of health workers' perceptions of risk and coping strategies, a total of 14 quantitative and 2 qualitative studies were included.[27] All quantitative studies were descriptive-correlational and lacked heterogeneity. Although the review showed that while health care workers recognized both health and social risks, most also recognized a professional obligation to care. Unhelpful coping strategies included

avoidance to caring for those infected, and resignation. Several positive coping measures were also noted. Risk mitigation measures used by health workers included use of PPE, IPC training, self-monitoring for signs and symptoms, vaccination, screening of staff and visitors, restricting visitation, and cancellation of outpatient services. Using Joann Briggs Institute (JBI) criteria, the authors put forward three practice recommendations. First, employers should provide support and training to increase a sense of control and ability to manage uncertainties experienced during an outbreak. Secondly, institution-wide control measures need to be communicated and PPE needs to be available. Thirdly, incentives such as additional compensation were considered worthwhile.

An integrative systematic review, completed in 2012, already showed the lack of preparedness and coping among general practitioners. They identified only ten studies which reported several challenges, such as lack of PPE, limited information access and training, limited understanding on how to interact with authorities, and finally, the psychosocial effects of responding to an outbreak with unknown characteristics.[28] Another systematic literature review specific to severe acute respiratory system (SARS) explored social and workplace factors associated with HCW wellbeing. Upon review of 22 papers, they report that well-being appeared to be associated with factors such as occupational role and related stressors, training, environmental risk and risk perception, quarantine, social support, and isolation/rejection as well as the impact of an outbreak like SARS on either personal or professional life.[29]

INFECTION PREVENTION AND CONTROL, OCCUPATIONAL EXPOSURE AND PERSONAL PROTECTIVE EQUIPMENT

In early 2020, a rapid Cochrane review was conducted to explore barriers and facilitators to PPE use and adherence to IPC guidelines.[30] A wide range of issues were identified, including access to succinct guidelines, the work environment, including physical space, support, and training for all staff. The level of trust in PPE and the desire to ensure quality patient care were also noted. In another systematic review focusing on surgical patient outcomes and provider safety, noted no adverse outcomes to surgical workers when proper protection efforts were used.[31] Comparatively, another systematic review focusing specifically on endoscopy procedures revealed less favorable outcomes.[32] While there was an expected reduction in endoscopy procedures, the burden of staff reallocation and risks of COVID-19 transmission were reported.

Early exploration (up to November 2020) of over 7,000 publications on aerosolization risks during nasopharyngeal or oropharyngeal swabbing, identified only one study specific to SARS-CoV-2.[33] Although only one study, it is worthy of note, considering that there were no health workers (n=8 nurses) infected from carrying out over 11,000 nasopharyngeal swabs. These procedures were all completed in the context of optimal IPC. At this tertiary hospital, IPC measures included strict sterilization protocols in a negative pressure isolation room. Nurses were protected with PPE, including N95 or higher masks. Clear standards for collection as well as structured training were also noted.

Another systematic review of lessons learned from hospital preparation in developed countries amidst the 2014-2016 Ebola Virus Disease (EVD) Outbreak, identified that while training improved IPC practices and PPE use, the level of sustained improvement was not clear. The authors recommend standardizing protocols, types of PPE and training.[34]

Another Cochrane review focused specifically on assessing the benefits of mouth rinse on the prevention of infection during dental aerosol-generating procedures (AGPs) found a severe lack of evidence and concerns about high or unclear risks of bias. Although 17 trials were reviewed, none measured infection in dental providers. While studies measured bacterial contamination in aerosols, they did not investigate viral or fungal contamination. Therefore, no conclusions can be drawn regarding whether rinses reduce the risk of infection.[35]

Following the West Africa Ebola EVD outbreak, which led to a large number of health care worker deaths, the National Health Service (NHS) England and Public Health England (PHE) established the High Consequence Infectious Disease (HCID) program to address PPE preparedness. Although a systematic review reported in 2018 identified PPE protocol standardization as a priority, the authors noted the lack of safety data which limited the ability to mandate specific protocols.[36] Following this review, a simulation exercise was developed to assess health workforce safety. In this simulation, ultraviolet (UV) light was used to detect any health worker contamination when interacting with a simulation mannequin. Upon review of the exercise, a significant amount of HCW contamination was identified. From this, an expert stakeholder group examined the simulation results and developed recommendations for improved PPE set up. Upon further testing using this improved PPE ensemble,

there was no evidence of HCV contamination. These promising findings led to the development of a unified 'HCID assessment PPE' ensemble.

Another review of 23 studies on glove use found that glove contamination was common.[37] Both overuse and misuse of gloves were identified, including a failure to change gloves between procedures on the same patient and inadequate hand hygiene.

A comparative analysis of disposable and respirator reuse standards, performance, and impact yielded four findings. 1. International respirator standards are comparable, 2. Safe use is dependent on fitting and fit testing, 3. All respirators interfere with vocal communication and have some level of discomfort, which may limit safe use over extended periods, and 4. Some tasks, such as performing chest compressions, can reduce filtering performance. The authors conclude that while there are many models and types of respirators, careful consideration is needed around respirator performance to ensure health workforce protection.[38]

A series of Cochrane reviews beginning in 2016 aimed to evaluate PPE protection based on PPE type, methods of donning and doffing, risk of self-contamination and the influence of the type of training on PPE compliance.[39,40,41] The 2016 review included nine studies (n=1200) and assessed ten interventions. Of the nine trials, eight used simulations with either fluorescent markers or testing for viral or bacterial contamination. Only five of the nine studies compared different types of PPE, but two did not report enough data to be included. Two studies examined different donning and doffing methods and three studies explored types of training. Standardized classification of PPE was lacking. Wide variation in contamination rates (25% to 100%) was seen with different types of PPE. While some studies compared PPE characteristics such as breathability, gowns vs aprons, and use of air-purifying respirators, several PPE gaps were identified. Specifically, there were no studies on goggles versus face shield, varying glove lengths, taping PPE, or use of disinfectant use during doffing procedures.

PHYSICAL SPACE AND ENVIRONMENTAL CONTROLS

In a Cochrane review updated to include COVID-19, the authors assessed studies of the effectiveness of changes to the physical environment to interrupt the spread of respiratory viruses. Eleven new RCTs were added for a total review of 78 RCTs, but low adherence to interventions and bias concerns were noted.[42] While the authors reported that the effects of facemasks are uncertain, it is important to note that this report included a variety of influenza-like illnesses (ILI) and not only COVID-19. When comparing evidence on the use of medical/surgical masks versus N95/P2 respirators amongst healthcare workers, no clear difference in reducing respiratory viral infections was noted. Hand hygiene was deemed likely to have a modest reducing effect on the spread of respiratory illness. Although the review included searches related to other physical interventions, such as screening at entry ports, isolation, quarantine, physical distancing, and other personal protection such as glasses, and gargling, no RCTs on gowns and gloves, face shields, or screening at entry port were identified.

HEALTH INFORMATION SYSTEMS

We have included one scoping review completed in December 2023, which explored existing approaches and challenges of the epidemic intelligence workforce. While field epidemiology training programs (FETP) are the common capacity building approach, there is need to increase the range of disciplines included in FETP, including the adoption of a One Health approach and increased engagement of communities.[43]

VACCINATION

In a systematic review of Hepatitis B coverage (HBV), which included persons working in Germany with occupational exposure risk, vaccination coverage varied considerably. Across eight studies devoted to HBV, vaccine coverage among hospital staff including doctors, nurses and other medical staff found that complete vaccine coverage was suboptimal at 63.6%.[44] Another systematic review from 2011 on influenza vaccination of staff found that only three RCTs were available for review. At that time, the authors concluded that further study was needed to evaluate whether annual vaccination could be considered a key measure to protect healthcare workers.[45] In a second study of Hepatitis B vaccine amongst healthcare workers in Ethiopia, 15 articles involving nearly 6,000 participants were systematically reviewed and included in a meta-analysis.[46] The pooled prevalence of full (3-dose) vaccination was 20%. Factors associated with being fully vaccinated included being male, less than 5 years work experience, education at diploma or below level, having received IPC training and a history of exposure to blood or body fluids. In a third systematic review with meta-analyses, acceptance rate and predictors of vaccination were assessed. A total of 38 articles, including over 80,000 people, were reviewed. Interestingly, the pooled acceptance rate among the general

population was higher than among health workers (81.65% to 65.65%). Gender, education level, influenza vaccine history and trust in government were identified as strong predictors of willingness to receive COVID-19 vaccination.[47]

Conclusion

While preliminary and not exhaustive, this umbrella review points to the urgent need for greater structure and benchmarks for protecting frontline health workers. Gaps exist in all areas of health workforce protection, namely the physical environment, workplace policies, training and both psychosocial and physical support. There remains a lack of comprehensive guidance on health workforce protection that is evidence-based. Recent reports provide examples of promising multimodal protection programs.

Developing new paradigms of disease spread and models of infection control need to be encouraged, as has been done by Brown and Mitchell (2020)[48] in their rejection of the traditional size and distance limitations of particle movement, forgoing conventional mechanisms of transmission to instead examine both contact and aerosol exposures. Much time was wasted early in the COVID-19 pandemic debating whether SARS-CoV-2 is airborne. Lives were lost and the disease spread unabated while debate carried on. Brown and Mitchell's fresh thinking allows for the elimination of the category of airborne transmission by broadening the description of aerosols.

Health workforce deaths due to occupational exposure are largely avoidable, if adequate access to timely actionable information, training and PPE are provided. Preparation through simulation, full scale field exercises and after-action reviews, as used in other high-risk professions, such as the military and the aviation industry, need to be adopted. Ample technology exists to identify new and emerging pathogens quickly and effectively. What does not exist is the assurance that information, training, and PPE are available when they are most needed. This is not a failure of science but of preparation, priority setting and allocation of resources.

Even though studies that focus on physical space and environmental controls are lacking, where preparation is prioritized, occupational exposure can be drastically reduced or even eliminated. In Italy, passion for health workforce safety led to years of investment in all aspects of infection control, which showed that protection of health workers can be done effectively, even in the early chaotic phase of an infectious disease outbreak. While numerous health workers were infected elsewhere in Italy, Cotugno Hospital in Naples had no COVID deaths due to occupational exposure as of March 31, 2020.[49]

There is also an urgent need to better understand why vaccination amongst health workers is suboptimal, even for highly transmittable diseases for which a safe and effective vaccine is available, such as Hepatitis B. We need to better understand methods to promote workforce uptake of available safe and effective vaccines. Increasing health workforce understanding of vaccine technology and the difference between sterilizing vaccines and those that strengthen the immune response to reduce risk of severe disease is urgently needed to dispel misunderstanding and increase trust.

It is important to be continuously learning and improving health system preparedness and response to ensure a protected health workforce. Using simple tools such as checklists, which are commonly used in other high intensity settings, such as the airline industry, could serve to anchor support for the health workforce during times of crisis. Meyer et al. (2021) recently published two checklists for hospitals and health workers engaged in the management of high-consequence infectious diseases (HCID).[50]

We can and must do better. Overwhelming evidence exists regarding infectious disease risks to health personnel.[51] Colleagues from South Africa stress the importance of a 'zero harm' target and put forward clear expectations for respiratory standards, use, fit testing and integration as part of a 'package of care' for the health worker.[52] Atul Gawande provides an apt summary when discussing the importance of frontline health workers, "When people have a weird rash, a nasty cough or a bad fever, it's a local doctor or nurse who they most depend on to recognize that it could be mpox, a new coronavirus variant or a deadly strain of avian flu breaking out. And then it's those same primary care professionals who deliver the needed testing, vaccinations, and treatments to the community at large. Yet around the world, they are routinely among the most neglected and underfinanced part of the health care work force."[53]

Finally, COVID-19 has shown, once again, the politics of pandemic response and public health more generally. Discouraging mask use early in a global pandemic that rapidly emerged defied common sense and the voice of experts.[54] Developing more robust, transparent, and integrated health information systems that

transcend borders need to be prioritized. This needs to be complemented with accountability and swift action in line with recent recommendations such as the Resolve to Save Lives' 7-1-7 benchmark.

The earliest days of an outbreak are the riskiest for health workers, and especially frontline nurses who provide high-touch care. To be sure, this umbrella review showed that there is a paucity of evidence in several areas of health workforce protection, raising the need for more rigorous study. Yet, we cannot forget that there is much we know and can do immediately to better protect health workers. The pioneering work of nursing innovators like Nightengale and Wald should not be lost. Their focus on basic hygiene and sanitation and community/patient-centered approaches remains as relevant today as it was over one hundred years ago. Yet, basic gaps remain. Identification and further study of frontline nursing innovations, as was done by Johnson and Johnson[55] during COVID-19 should be encouraged. We have a moment, while the COVID-19 pandemic is still fresh in people's minds, to advocate for greater investment in research and practice standards that truly protect our frontline.

This umbrella review points to the urgent need for greater structure and benchmarks for health workforce protection and further study. Significant gaps exist in all areas of protection from the physical environment to workplace policies, training, and psychosocial and physical support. Several limitations were identified through this review. Across many reviews, the quality of evidence was low, with concerns regarding bias commonly mentioned. Activities were not described in enough detail and when discussed, the duration of interventions varied widely. Despite these limitations, several findings are worthy of note. In the area of training and education, increasing the use of computer simulation and spoken instruction for PPE are promising means to enhance performance. There is a need to prepare and assess multidisciplinary team training, including non-clinical staff. Laboratory diagnostics and management of hazardous materials also need to be strengthened.

Critical to staff retention and well-being is mental health support amidst chaos and crisis, but again, we lack substantive evidence of models of psychosocial support that are robust and well-tested. Protective factors were identified and are encouraging, but again consistent evidence is limited on what, when, or how best to do this. Coupling specific, onsite mental health support for trauma and anxiety with measures to enhance staff coping strategies is promising, but limited data exists. Koh et al. (2011) moved this discourse forward through the identification of three practice recommendations, including support and training to increase a sense of control among health workers, clear communication on existing control measures, the type of PPE needed, and lastly, added compensation.

A wide range of barriers and facilitators to PPE adherence were noted, including access to succinct guidelines, and a conducive work environment including physical space, support, and training for all staff. The literature shows that minimizing infection is doable even in high-risk settings, such as surgery and when performing procedures that generate aerosols. Clear standards for procedures, as well as structured training, need to increase, but there is currently a lack of safety data which limits the ability to mandate specific protocols. At the same time, studies do show that focused efforts can reduce or eliminate contamination. Further study of the use of the unified 'HCID assessment PPE' ensemble is needed.

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