

Vulnerability of nurse and physicians with COVID-19: Monitoring and surveillance needed

1 | INTRODUCTION

SARS-CoV-2, the virus that causes COVID-19, is wreaking havoc around the world. This unprecedented pandemic has led to illness, death and economic destruction. The pandemic has challenged healthcare systems globally for a range of reasons. In developed economies, the focus on noncommunicable diseases rather than infectious diseases has caught us short. A period of complacency and a lack of focus on potential pandemics have meant that documented shortages of personnel, workforce and equipment have limited healthcare delivery. The lack of access to personal protective commitment (PPE), lack of training and workforce shortages have exposed the vulnerability of healthcare workers (Daly, Jackson, Anders, & Davidson, 2020). The COVID-19 pandemic is a highly fluid and dynamic with new information emerging daily.

Nurses are the only profession that spends a considerable amount of time in providing one-on-one care to COVID-19 patients. COVID-19 is highly contagious, and anyone providing direct health care to an affected patient is a high risk of being infected. Though there is a lot we do not yet fully understand, such as correlations between viral load and risk and severity of infection, we do know that nurses are at considerable risk of becoming infected.

The actual number of healthcare workers infected with the COVID-19 virus across the world is unknown. In this editorial, we aim to firstly provide an overview of some of the known demographic characteristics of physicians and nurses who are known to have died from COVID-19, and secondly, to explore factors that may have contributed to mortality and most importantly cast a spotlight of an area of important emphasis. To date, reports have focused on recognition and mourning, not on the investigation of workplace deaths and identification of root causes. In fact, in the United States, the Guardian and Kaiser Health News (2020) note that many cases have been "shrouded in secrecy" and they have launched a site, *Lost on the Frontline* to bring visibility to this critical issue. This approach limits our capacity to develop resilient systems to protect healthcare workers nor recognise robust systems who have treated many patients with COVID-19 and had no staff deaths.

2 | WHERE IS THE DATA?

There is no aggregated database at a global level accurately tracking deaths from healthcare workers, and this is problematic for many

reasons but importantly it prevents us from implementing strategic models for worker protection. The methods used in this report rely upon published data from various sources including governmental health websites. Governmental websites are inconsistent in the data that they have been able to collect, so for this editorial, we also used data from data compiled by health-related publications. The validity and reliability of this information are unknown, and reports suggest that around the world there has been an under-reporting of all cases of COVID-19. Self-reported data in the public domain are assumed to be relatively accurate, and many cases identified are linked to obituaries. In examining the existing data, we have attempted to compile information from these sources, and such serves as the foundation for our analysis. The analysis only uses information regarding physicians' and nurses' deaths due to the virus although we acknowledge that other health workers have also died because of the COVID-19 pandemic.

To understand the magnitude of mortality effect by profession caused by COVID-19, we performed regression analysis on the population of fatalities to determine whether some professions were safer off than others, stratified by seven countries (United States of America (USA), Italy, Spain, France, Brazil, United Kingdom (UK) and Australia). The professions examined were medical doctors (MD), registered nurses (RN) and licensed practical nurses (LPN). Logistic regression was used to study the differences in mortality rates between professions. We analysed results at the 95% confidence level, stratified by country where the deaths of profession occurred, as well as adjusting for *age* and *sex* of the individual who passed while providing professional services to COVID-19 patients.

3 | MORTALITY

The number of healthcare workers from around the world who have died because of COVID-19 is not known. Often, the information received is fragmented, incomplete and in extreme cases concealed. In the USA, the Centers for Disease Control (CDC) released a report on April 2020. Between 12 February–9 April 2020, there were 315,531 COVID-19 cases. Of those, 9,282 (19%) were healthcare workers. The average age was 42. Seventy-three per cent were women, with 38% reported having at least one underlying health condition. Of the number reported, 90% were not hospitalised. However, there were 27 deaths across all age groups. The deaths occurred most frequently in those 65 years or older (CDC, 2020). Within the CDC

report, there were no data on the number of deaths by profession. Thus, it is unknown how many physicians and nurses who were working primarily with COVID-19-infected patients are among those who died. These data are quite limited in that it is only a snapshot of self-reported information. The extent of the death rate of healthcare workers may well be much higher than that reported in the CDC report. All employers are required to notify Occupational Safety and Health Administration when an employee is killed on the job or suffers a work-related hospitalisation. COVID-19 is included in this framework but it is likely interpretation of attribution is broad, and it may be difficult to be sure whether the virus is community acquired or infection is directly workplace related.

Medscape medical news has a website for the self-report of healthcare workers who have died of COVID-19. The in-memoriam page has self-reported tests of healthcare workers from around the world. As of 28 April, the number of deaths in the USA from this database was reported at 71. Of those, 44 were registered nurses and 25 were physicians. The reporting of deaths on the memorial page is ongoing, and the deaths continue to rise (In Memoriam, 2020). Using the Medscape self-report information for some of the hardest-hit countries with COVID-19, the self-report information provides some insight into the deaths in the USA, Italy, the UK, Brazil, Spain and France. The death of the Australian nurse was reported in the Australian media (Sakkal, 2020). Table 1 illustrates the death of nurses and physicians. While Table 1 provides a snapshot of the deaths, these data are limited and do not allow a conclusive statement. In further reviewing the data, Table 2 reveals a higher percentage of nurses in the USA have died from COVID-19 than physicians. The USA has the highest overall number. While more healthcare worker deaths have occurred, finding a reliable database to assess such was not possible. CNN, in a news story, report the deaths of 94 doctors and 26 nurses in Italy. The source of this information is unknown (CNN Coronavirus, 2020). Of note, almost 70% of the deaths were men ($n = 159$; 68%) which is unusual in the context of what we know about the health professions. This may be the result of the fact that more men tend to work in critical care units and emergency departments.

Table 3 reports the age distribution of self-reported death. Missing age information was present in 44 cases. The age data tend

TABLE 1 Death of nurses and physicians (accessed at 28 April 2020)

Country	Frequency	Per cent
USA	71	30.2
Italy	65	27.7
UK	33	14.0
Brazil	30	12.8
Spain	18	7.7
France	12	5.1
Australia	1	0.4
Total		230

to follow the general infection rate of the public. Most of the deaths were in those aged 50 years and older. The finding is congruent with the CDC report on age and deaths. They report that 97% of deaths in the general population are older than 45 years (National Center, 2020).

The regression analysis of mortality rates by profession and by country has provided useful insights into the higher-risk professions. Overall, nurses were associated with a significantly ($p < .05$) higher rate of death than physicians in Italy, Brazil, Spain and France (Table 4). The increased risk of nurse death relative to physician death in Spain exceeded an odds ratio of 50.0, and in France, nurse risk of death exceeds an odds ratio of 120.0. There were not significant differences in mortality between physicians and nurses in USA, UK or Australia. Licensed practical nurses did not have enough observed deaths in order to provide conclusive results in this analysis, which limited our analysis to a simple logistic regression (MD vs. RN mortality) as opposed to multinomial logistic regression (MD vs. RN vs. LPN).

4 | MODELS OF INFECTION CONTROL AND HEALTH WORKER VULNERABILITY

MacIntyre and colleagues argue that many infection control procedures, which health workers follow, are driven primarily by concerns about patient safety (MacIntyre, Chughtai, Seale, Richards, & Davidson, 2015). Protecting patients from nosocomial infection and the protection, occupational health and safety of the healthcare worker, as well as preventing transmission of infections and patient safety, should be equally weighted. Beurhaus and colleagues report that many hospital-based registered nurses, non-hospital-based registered nurses and physicians are 55 years of age or older (Buerhaus, Auerbach, & Staiger, 2020). The higher risk of COVID-19 in older individuals and in particular those with chronic conditions has led to recommendations for those older than 60 years, to stay at home and practice social distancing to slow the spread of infection and help avoid overwhelming hospitals. However, we know that many nurses and physicians in this age group and with cardiovascular and other conditions are still going to work, increasing their vulnerability. Many stories of heroism and sacrifice have been presented in the media.

5 | OCCUPATIONAL HEALTH, MONITORING AND SURVEILLANCE

Occupational health services for all workers, irrespective of age, sex, nationality, type of employment, and size or location of workplace, has been a recommendation of the World Health Organization (WHO) (Burton & WHO, 2010). Models of occupational health services vary from country to country and are influenced by regulatory and policy frameworks (Salguero-Caparrós, Pardo-Ferreira, Martínez-Rojas, & Rubio-Romero, 2020). Models of occupational

	Country	USA	IT	UK	BRZ	SPN	FR	AU	Total
Profession	RN	44	1	25	8	3	1	1	83
	MD	25	64	8	21	15	11	0	144
	LPN	1	0	0	1	0	0	0	2
Total		70	65	33	30	18	12	1	229

TABLE 2 Death by profession

TABLE 3 Age distribution

Age	N (%)
28–49	30 (12.7%)
50–59	47 (20%)
60–69	76 (32%)
70–78	31 (13.2%)
82–84	4 (0.2%)
Missing	47

health are now also expanding beyond physical health to consider psychological and social issues. Occupational health and safety is commonly embedded in the human resource function, and a review of the literature demonstrates limited data in the context of crisis management, particularly in the context of what we are seeing in the context of COVID-19 (Fan et al., 2020). In the Emergency Response Framework, the WHO define an emergency as a situation that has an impact on the lives and well-being of a large number of people or a significant percentage of a population and requires substantial multisectoral assistance (WHO, 2018). There appears to be a disconnect in some organisations between the approaches of usual work and a crisis. Although some organisations increased preparedness following recent infectious disease outbreaks, this has not been consistent across healthcare systems and countries. Moreover, COVID-19 challenges many models of mandatory reporting where causation and attribution of the infectious source may not be clear. There are

also hot spots of infection and death such as nursing homes where detailed forensic analysis is warranted (Davidson, Padula, Daly, & Jackson, 2020).

6 | WHAT THESE DATA TELL US?

We recognise the many gaps in these data and methodological limitations but it is important to present this information, provide a voice to the voiceless and place this important issue front and centre. The highly dynamic nature of the COVID-19 pandemic means that the pictures provided by these data may change over time. But we hope this information will make countries take a deeper look at the well-being of their workforce. The percentage of deaths from healthcare workers compared to the general population is lower given they are using PPE to decrease the risk of exposure and have the skills to protect themselves. The general population risk without social distancing could mean that 81% of the world population could be infected (Ferguson, 2020). The modelling for projecting the actual number has varied widely. The bottom line is the number of healthcare workers who potentially can be infected remains high—nurses are particularly vulnerable to COVID-19 mortality given the number of contact hours that they have with infected patients compared to physicians, and specific groups, such as anaesthetists, are at a higher risk in activities such as intubation. Given the urgent need for health care services in time of pandemic, the need to keep health workers well and uninfected is critical and efficient and effective models of prevention are vital.

MD versus RN	Odds ratio	Coefficient	SD	p-value	95% Confidence interval
USA	1.101	0.096	0.707	.891	–1.289 to 1.482
Italy	82.471	4.412	1.406	.002	1.657 to 7.168
Brazil	14.615	2.682	1.031	.009	0.660 to 4.704
Spain	50.629	3.925	1.302	.003	1.372 to 6.477
France	124.255	4.822	1.579	.002	1.727 to 7.918
Sex	1.063	0.061	0.027	.021	0.009 to 0.113
Age	0.013	–4.367	0.822	<.001	–5.979 to –2.755
Intercept	3.488	1.249	1.851	.500	–2.379 to 4.878

TABLE 4 Logistic regression analysis of MD (physician) versus RN (registered nurse) mortality by country, controlling for age and sex of the deceased

Note: RNs have significantly higher odds of mortality while responding to the COVID-19 crisis than MDs, particularly in Italy, Brazil, Spain and France.

Pseudo R-Squared: 0.597.

Log-Likelihood: –48.428.

7 | CONCLUSION

The COVID-19 pandemic has caused unprecedented deaths among nurses and physicians signalling a need to examine and improve occupational health and safety for nurses and physicians and indeed, all health workers. In countries where there is a dire shortage of health professionals, the death or disability of physicians and nurses can have a cumulative and calamitous effect on populations. Exploring strategies to improve personal protection, policies for monitoring and surveillance of workplace characteristics are critical in ensuring the health and well-being of patients, staff and visitors. As the world pivots to a new era where the risk of new infectious diseases is increasing and another wave of COVID-19 looks us in the eye, this is a crucial issue requiring global focus and attention.

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REFERENCES

- Borghese, L., & Braithwaite, S. (2020). *94 doctors and 26 nurses in Italy have died of coronavirus*. CNN Coronavirus News, April 7. Retrieved from https://edition.cnn.com/world/live-news/coronavirus-pandemic-04-07-20/h_b7583ec9fa05d053f6faca9b164817eb
- Buerhaus, P. I., Auerbach, D. I., & Staiger, D. O. (2020). Older clinicians and the surge in novel coronavirus disease 2019 (COVID-19). *JAMA*, *https://doi.org/10.1001/jama.2020.4978*
- Burton, J. & World Health Organization (2010). *WHO healthy workplace framework and model: Background and supporting literature and practices*. World Health Organization. Retrieved from https://www.who.int/occupational_health/healthy_workplace_framework.pdf
- CDC COVID-19 Response Team (2020). *Characteristics of health care personnel with COVID-19, United States, February 12-April 9, 2020*, April 17.
- Daly, J., Jackson, D., Anders, R., & Davidson, P. M. (2020). Who speaks for nursing? COVID-19 highlighting gaps in leadership. *Journal of Clinical Nursing*, *https://doi.org/10.1111/jocn.15305*
- Davidson, P. M., Padula, W. V., Daly, J., & Jackson, D. (2020). Moral outrage in COVID19-understandable but not a strategy. *Journal of Clinical Nursing*. *https://doi.org/10.1111/jocn.15318*
- Fan, D., Zhu, C. J., Timming, A. R., Su, Y., Huang, X., & Lu, Y. (2020). Using the past to map out the future of occupational health and safety research: Where do we go from here? *The International Journal of Human Resource Management*, *31*, 90-127. *https://doi.org/10.1080/09585192.2019.1657167*
- Ferguson, N. (2020). *Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand*. Imperial College COVID-19 Response Team, March 16. Retrieved from https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf?campaign_id=30&emc=edit_int_20200327&instance_id=17136&nl=the-interpreter®i_id=66215121&segment_id=23120&te=1&user_id=45c65b829ab8cb8218b3a6e1f434e77e
- In Memoriam: Healthcare workers who have died of COVID-19 (2020). *Medscape Medical News*, April 28. Retrieved from <https://www.medscape.com/viewarticle/927976>
- Kaiser Health Care News and the Guardian (2020). *Lost on the Frontline*. Retrieved from <https://khn.org/news/lost-on-the-frontline-health-care-worker-death-toll-covid19-coronavirus/>
- MacIntyre, C. R., Chughtai, A. A., Seale, H., Richards, G. A., & Davidson, P. M. (2015). Uncertainty, risk analysis and change for Ebola personal protective equipment guidelines. *International Journal of Nursing Studies*, *52*, 899. *https://doi.org/10.1016/j.ijnurstu.2014.12.001*
- National Center for Health Statistics (2020). *Provisional death counts for coronavirus disease (COVID-19): Weekly updates by select demographic and geographic characteristics*, May 1. Center for Disease Control. Retrieved from https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm#AgeAndSex
- Sakkal, P. (2020). *Our lives will never be the same: COVID-19 victim identified as loving healthcare worker*. The Age (accessed, 16/5/10). Retrieved from <https://www.theage.com.au/national/victoria/our-lives-will-never-be-the-same-covid-19-victim-identified-as-loving-healthcare-worker-20200406-p54hmw.html>
- Salguero-Caparrós, F., Pardo-Ferreira, M., Martínez-Rojas, M., & Rubio-Romero, J. (2020). Management of legal compliance in occupational health and safety. A literature review. *Safety Science*, *121*, 111-118. *https://doi.org/10.1016/j.ssci.2019.08.033*
- World Health Organization (2018). *Occupational safety and health in public health emergencies: A manual for protecting health workers and responders*. ISBN: 978-92-4-151434-7 Retrieved from https://www.who.int/occupational_health/publications/safety-health-public-health-emergencies/en/