

Factors That Play Roles in COVID-19 Transmission Among Healthworkers

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Abstract

Introduction: The impact of COVID-19 has spread around the globe since first announced in March 2020 by WHO and was first acknowledged in an occupational setting, and up to now, becoming the major percentage of the cases. ¹. Regardless of the prompt response made, COVID-19 infection cases among healthcare workers have risen quickly and high. It is essential to understand the features that play roles in COVID-19 transmission among healthcare workers in occupational settings to build a better understanding in minimizing the occupational hazards and prevent such cases.

Methods: This literature review was conducted in April 2022. Research related to the COVID-19 infection among healthcare workers in an occupational setting by using specific keywords including COVID-19, healthcare workers, occupational on two database Pubmed and Google Scholar.

Results: 12 articles were analysed for the literature review. Recognizing hazardous work characteristics and demographic characteristics as the risk of transmission among healthcare workers can help optimizing the protection and reduce transmission cases among healthcare workers in an occupational setting.

Conclusions: Having a better understanding of factors that play a role in COVID-19 transmission among healthcare workers in the occupational setting is essential to create a better policy implemented to safeguard healthcare workers' health and safety. The provision of health services to patients relies on professional staff who feel safe and well protected. Therefore, ensuring workers' safety and health is critical to keep transmission rates low. COVID-19 is a trigger for the world of health, especially occupational health in socialization and commitment to the implementation of the control hierarchy and also certainty in making policies.

Keywords: COVID-19, occupational, healthcare workers, aerosol

Abstrak

Pendahuluan : Pandemi COVID-19 yang berkembang di seluruh dunia telah menyebabkan dampak signifikan pada petugas kesehatan sejak pertama kali diumumkan pada Maret 2020 oleh WHO dan kasus pertama diidentifikasi pada lingkup kerja. ¹ Terlepas dari usaha yang telah dibuat, kasus infeksi COVID-19 di kalangan petugas kesehatan telah meningkat dengan cepat dan tinggi. Penting untuk memahami faktor yang berperan dalam penularan COVID-19 di antara petugas kesehatan untuk membangun pemahaman yang lebih baik untuk meminimalkan bahaya pekerjaan yang ada dan mencegah kasus-kasus seperti itu.

Metode : Tinjauan literatur ini dilakukan pada bulan April 2022. Penelitian tentang infeksi COVID-19 terkait pekerjaan di kalangan tenaga kesehatan dengan menggunakan kata kunci tertentu termasuk COVID-19, petugas kesehatan, pekerjaan melalui Pubmed dan Google Scholar.

Hasil : 12 artikel dianalisis untuk tinjauan literatur. Mengenali bahaya dari karakteristik pekerjaan dan demografis sebagai risiko penularan di antara petugas kesehatan dapat membantu mengoptimalkan perlindungan dan mengurangi kasus penularan di antara petugas Kesehatan.

Kesimpulan : Memiliki pemahaman yang lebih baik tentang factor-Faktor yang berperan dalam penularan COVID-19 di antara petugas kesehatan sangat penting untuk membuat kebijakan yang lebih baik yang dapat diimplementasikan untuk melindungi kesehatan dan keamanan petugas kesehatan. Penyediaan layanan kesehatan kepada pasien bergantung pada staf profesional yang merasa aman dan terlindungi dengan baik. Oleh karena itu, memberikan jaminan pekerjaan yang memadai kepada petugas kesehatan sangat penting untuk menjaga tingkat penularan tetap rendah. COVID-19 adalah trigger bagi dunia kesehatan terutama occupational health dalam sosialisasi dan komitmen implementasi hirarki control dan juga kepastian dalam mengambil kebijakan.

Kata kunci: COVID-19, lingkup kerja, petugas kesehatan, aerosol

Introduction

The impact of COVID-19 has spread around the globe since first announced in March 2020 by WHO and was first acknowledged in an occupational setting, and up to now, becoming the major percentage of the cases.¹ Healthcare workers face the highest risk of infection during treating hospitalized COVID-19 patients. There have been cases reported of healthcare workers infected in a single case series of 29% (40/38) during January 2020 in Wuhan, China.² The following month on February 11, 2020, China's Infectious Disease Information System has reported 1716 healthcare workers were COVID-19 infected.² Most healthcare workers with COVID-19 tested positive from the patients they were taking care of.³

Not only infected but health workers also face the threat of death. Globally, WHO records the death of health workers due to COVID-19 around 80,000 – 180,000 in the period from January 2020 to May 2021.⁴ Meanwhile, in Indonesia, the death of health workers or health workers due to COVID-19 until December 3, 2021 is 2,066.⁵

The international community as well as our country regulates laws regarding the rights and guarantees of protection for health workers. Where health workers who are reported to be infected with COVID-19 due to work will be registered as occupational diseases are entitled to rights, namely guaranteed protection and compensation by the state.²

Apart from this, there needs to be preparedness or mitigation to do. Although it is not the first time that the world or Indonesia faced a pandemic or outbreak, COVID-19 is a trigger for the world of health, especially occupational health, in socializing and committing to the implementation of the control hierarchy.

Methods

We searched PubMed for articles published from March 31 to April 3, 2022, for articles on COVID-19 as an occupational disease in healthcare workers. No language restrictions were applied. Search terms were (“COVID-19” “SARS-CoV-2” OR “PANDEMIC”) AND (“healthcare personnel” OR “health*care workers” OR “healthcare workers” OR “doctors” OR “nurses”) AND (“Occupational” OR “work-related”). The eligibility criteria for inclusion were related to the COVID-19 infection as an occupational disease among healthcare

workers. Criteria of exclusion are any study that does not match the above criteria.

Results & Discussion

Covid-19 transmission among healthcare workers has been a concerning issue. Not only healthcare workers are expected to be infected from exposure to COVID-19 patients in dedicated COVID-19 facilities but also from patients who are admitted for other reasons in other healthcare settings.⁶ However, healthcare workers in a hospital setting, especially in COVID-19 wards, have a higher risk of COVID-19 exposure, therefore, most likely to get infected than in other wards or healthcare facilities or settings.^{7,8} Further discussed in a hospital setting, healthcare workers in the emergency department were at bigger risk compared to other critical care areas including ICU and inpatient settings. This finding might be associated with acute care environmental factors, such as crowd and physical spacing.^{2,6} The study also found that male healthcare workers had a significantly higher case of transmission compared to female health workers.^{8,6} Yet, of all those exposure risks among healthcare workers, a physician was said to be at greater risk as they conduct aerosol-related-procedure on their patients such as bronchoscopies or intubation.⁹

Among 68% of healthcare workers who were infected from the COVID-19 patients they were taking care of, 86% of those used proper or recommended PPE while the rest either did not have it or did not comprehend the proper or recommended PPE.³ At the beginning of the emerging pandemic, healthcare workers were vulnerable due to inadequate personal protective equipment (PPE) and defective handwashing, yet the improvement of PPE plays an enormous role in reducing the transmission risk.^{7,9,10} Further evidence mentioned of all healthcare workers sent to Wuhan rolling shift in Intensive Care Unit at least performing aerosol-generating procedure equipped with appropriate PPE tested negative for COVID-19 even before vaccine available.^{10,13}

Occupational health and safety guidelines divide occupational risks into four categories: 1) Group one: is a very high risk group. Where work with close/close contact with patients infected with COVID-19. Namely, occupational groups related to aerosols, including dentists, anesthesiologists, emergency department health workers, taking specimens from laboratory personnel, and also officers performing autopsies. 2) Group two: high risk

category. This group has a lower risk than group one but is still high. They are service providers or support staff in a health facility including inpatient doctors, nurses, and other officers. 3) Group of three: medium risk category. A group of workers who are close and in contact (i.e. people who are 2 meters apart) with COVID-19 infection. This group of workers includes people who work in other public facilities. 4) Group of four: low risk workers. Workers who are not in contact with infected with COVID-19 or contact with a distance (more than 2 meters).²

When viewed from the risk of work, most of the workers or health workers are in the first category or group and the second group. In the United States at the start of the COVID-19 pandemic, COVID-19 officers accounted for nearly 11%. While in Australia the group of nurse workers represented the most at 36.3%. Where the nature and symptoms of COVID-19 often change or vary but the severity faced is around 27.5% treated in the intensive care unit (ICU), 15.8% required an invasive mechanical ventilator, and 4.2% of them died.¹¹

Factors that play roles in transmission among healthcare based on hazardous work characteristics are pointed out as (1) aerosol exposure, (2) lack of proper personal protective equipment (PPE) or occupational safety training, (3) densely populated, enclosed, or poorly ventilated workplace, and (4) prolonged face-to-face or physical contact or where social distancing cannot be practiced.¹⁶ While factors based on demographic characteristics as mentioned: (1) elderly, (2) male sex, (3) comorbidities (obesity, hypertension, diabetes mellitus, cardiovascular disease, COPD, and immunosuppression), (4) co-exposures toward smoking/environmental tobacco smoke exposure, residence or work in high particulate air pollutant environments, and limited access to healthy foods and physical activity.^{2,8}

Aerosol

Aerosol exposure is the most suspected cause of transmission of COVID-19 in health workers. Definitions used herein are provided in the margins. The phrases “small-particle aerosols” and “droplet nuclei” refer to particles of a size similar to that of respirable particles.^{2,12}

Any virus can cause disease that can be transmitted by aerosol but the virus must become aerosolized after emission from the source. Natural biological processes—breathing, speaking, coughing, etc.—produce aerosols of respiratory secretions, and aerosols can form during some medical procedures. But to transmit disease, the resulting

aerosol must contain an infectious pathogen.¹²

Aerosol SARS-COV-2 Procedure

Mostly transmitted by droplets (5-10 mm); however, it can become aerosolized under certain conditions, called “aerosol generating procedures”.³ When aerosolized, virus particles become airborne in droplet nuclei that are 15 mm in size, can travel 0.1 m apart, and can remain in the air for up to 3 hours.⁴ During the event, the core of the virus droplets can pass through the pores of the surgical mask.¹³

Medical procedures that generate high-risk aerosols can lead to aerosolization of high viral loads which represent an increased risk to healthcare workers. This is especially true for healthcare workers exposed to high-risk aerosol-generating procedures, including otolaryngologists, ophthalmologists, neurosurgeons, maxillofacial surgeons, and laparoscopic surgeons.¹²

Availability and Appropriate Use of PPE

The crisis and scarcity of PPE have become an inseparable issue from the transmission of COVID-19 to health workers. In March 2019, the World Health Organization (WHO) recommended that particulate respirators (e.g., NIOSH certified N95, EU FFP2 or equivalent masks) be used by healthcare workers only when performing aerosol generating procedures (AGP). In contrast, the US Occupational Safety and Health Administration (OSHA) recommends implementing airborne precautions against respiratory illness, when a known pathogen causes severe illness.¹¹

Factors that can increase the risk for health workers during the procedure are by using or choosing the right PPE.^{11,14} The PPE recommended by the Centers for Disease Control and Prevention (CDC) in health care facilities includes surgical masks, disposable masks/respirators (including N95 respirators), elastomeric respirators, powered air-purifying respirators (PAPR) and controlled air-purifying respirators (CAPR).¹⁴ Although not all can be available in health facilities.

The COVID-19 pandemic has provided a reality of the need for knowledge related to PPE, especially respiratory protective equipment. N95 masks/respirators are recommended for the prevention of airborne transmission. However, the high risk and prolonged AGP procedures and proximity to the airway may require even higher levels of respiratory PPE.¹⁴

Ventilation

Ventilation is one of the factors that trigger the transmission of COVID-19. Evidence of airborne transmission of COVID-19 indicates a greater need for ventilation procedures. The Centers for Disease Control and Prevention issued the latest guidance on improving ventilation and building design. UV light can be effective in infection control but has limitations with large air volumes and is associated with other occupational hazards. A high efficiency particulate air filter (HEPA) is a cost-effective control tool to complement ventilation when a negative pressure room is not available. However, it requires increased maintenance and replacement.¹¹

Other cross-cutting factors that may confer or compound both vulnerability and susceptibility as predispose to poorer health outcomes were the presence of low socioeconomic status/underprivilege, language and/or communication barriers, and limited access to paid sick

leave and healthcare. These issues require mitigation to reduce the risk of poor health outcomes which include: (1) enhanced administrative and engineering preventive controls, (2) warranting access to workers’ compensation benefits, (3) increasing sick leave benefits, (4) delivering occupational and general health insurance coverage.^{2,3}

To prevent occupational exposure to COVID-19 among healthcare workers, several national and international associations have presented guidance ; (1) exposure elimination, (2) exposure elimination, (3) engineering controls, (4) administrative controls, and (5) Proper PPE.²

A good understanding is needed in assessing the interaction between risk factors and control potential to produce policies, especially the very effective prevention of infectious diseases and especially in terms of protection for health workers. Of course the workplace risk assessment determines the suitability of the controls because the danger of SARS-CoV2 is not measurable.²

Table 1. The selected articles overview

Title Of Article	Study Design	Population	Major Outcomes
COVID-19 As an Occupational Disease	Systematic review	The published documentation on COVID-19 as occupational disease	Health workers want and deserve a safe working environment by optimizing their protection as they are put at high risk of facing COVID-19.
Diagnosing Occupational COVID-19 In Croatian Healthcare Workers	Case study	Croatian healthcare workers	COVID-19 infected healthcare workers should be covered by insurance accordingly and receive particular attention as they return to work.
COVID-19 Among Health Workers in Germany and Malaysia	Descriptive study	Health workers in German and Malaysia	Systematic supply and use of proper PPE can effectively protect health workers from infection.
COVID-19 Among Health Workers in Germany – An Update	Descriptive study	Health workers in Germany	Long-term effect of COVID-19 should be monitored closely and the importance of preparedness for the next pandemic.
Risk of COVID-19 in Health-care Workers in Denmark – an Observational Cohort Study	Observational Cohort Study	Healthcare workers in Capital Region of Denmark	Frontline health-care workers working in hospitals and health-care workers working on a dedicated COVID-19 ward had significantly higher seroprevalence rates than other health-care workers did. More than half of seropositive health-care workers had symptoms attributable to SARS-CoV-2.

Use of Personal Protective Equipment Against Coronavirus Disease 2019 by Healthcare Professionals in Wuhan, China: Cross-Sectional Study	Cross sectional study	Healthcare professionals who were deployed to Wuhan by two affiliated hospitals of Southern Medical University	Healthcare professionals who were given appropriate PPE while working in ICU that at least once performed aerosol-generating procedure reported testing negative for SARS-CoV 2
Protecting the Front Line: a Cross-sectional Survey Analysis of the Occupational Factors Contributing to Healthcare Workers' Infection and Psychological Distress During the COVID-19 Pandemic in the USA	Cross-sectional study	Healthcare workers in Northeast and Southern USA	Healthcare workers working in the emergency department were more likely to contract COVID-19 compared to those in ICU and inpatient settings. Healthcare workers who contracted COVID-19 reported a higher level of depressive symptoms.
Role and Task of the Occupational Physician during the COVID-19 Pandemic	Systematic review	The published documentation role and task of occupational physician in COVID-19	The new instrument proposed can be new method to contrast spread of the infection as part of a all-inclusive system response.
COVID-19 infection and the broader impacts of the pandemic on healthcare workers	Review Series	The epidemiology of COVID-19 infection and illness in HCWs	The specific epidemiology of COVID-19 as an occupational disease affecting HCWs has been increasingly understood as the pandemic has contin- ued.
Risks of COVID-19 by occupation in NHS workers in England	Original Research	Pseudonymised data on 902 813 individuals employed by 191 National Health Service trusts to explore demographic and occupational risk factors for sickness absence ascribed to COVID-19 in England.	Analysis suggests that during the first wave of the COVID-19 pandemic in England, occupationally attributable relative risks for COVID-19 among most patient-facing occupations in healthcare workers were in the order of 1.5–2.5. For medical and dental personnel, relative risks were a little lower, but still elevated.
Transmission of Respiratory Viral Diseases to Health Care Workers: COVID-19 as an Example	Annual Review	The published documentation on COVID-19 as occupational disease; Transmission of Respiratory disease	Strong evidence indicates that COVID-19, like other viral respiratory infectious diseases, is an aerosol-transmissible disease
High-Risk Aerosol-Generating Procedures in COVID-19: Respiratory Protective Equipment Considerations	Commentary	The Published High-Risk Aerosol Generating Prosedur	N95 masks/respirators are appropriate for most airborne precaution situations. However, high-risk AGPs—including those with extended duration of exposure, proximity to the airway, manipulation of high-viral load tissue (nasopharynx/oropharynx), and aerosolization through the use of energy devices (drills, saws, and ultrasonic devices) —may require heightened levels of respiratory PPE

Regular testing on prioritized healthcare workers using evidence-based screening algorithms is needed to minimize the risk of transmission.^{2,9} COVID-19-targeting testing aims to create a safe environment for healthcare workers establishing practices. The workplace should provide a return-to-work policy as following plans: (1) evaluate the hazard unique to specific workplaces and jobs; (2) implement infection protection strategies; and (3) develop evidence-based policies to identify and isolate healthcare workers with suspected or confirmed infection, while allowing previously infected healthcare workers to return to work after self-isolation.²

One of the efforts that can also be done in providing protection to health workers is the provision of vaccines to health workers.

COVID-19 pandemic requires great effort in measuring the risk of infection in the workplace suitable to different settings and jobs. That being said, the role of the Occupational Physician, though crucial in this pandemic situation, is rarely mentioned.¹ Occupational Physician can provide an assessment on the identification, management and prevention of infectious disease and conduct diagnostic, along with referral for specialist assessment and treatment in case of respiratory disease.

Conclusions

Having a better understanding of factors that plays a role in COVID-19 transmission among healthcare workers in the occupational setting is essential to making a better policy implemented to safeguard healthcare workers' health and safety. The provision of health services to patients relies on professional staff who feel safe and well protected. Therefore, ensuring workers' safety and health is critical to keeping transmission rates low.

The guidance on susceptibility for transmission has been highlighted by WHO and other national and international organizations. Multidisciplinary expertise from an occupational physician that provides a comprehensive system response in countering the spread of the infection is important to avoid the onset of new epidemic outbreaks.

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