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ORIGINAL ARTICLE

Prevalence, Clinical Characteristics and Outcome of COVID-19 Infection among Healthcare Workers: A Retrospective Analysis in a Single Northwest Malaysia Specialist Centre

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ABSTRAK

Petugas kesihatan paling mudah dijangkiti COVID-19 kerana mereka sentiasa terdedah kepada sumber jangkitan. Kajian ini bertujuan untuk menentukan kelaziman, ciri-ciri klinikal dan kesan jangkitan kepada petugas kesihatan yang telah positif COVID-19 di sebuah institusi di Semenanjung Malaysia. Data petugas kesihatan yang telah disahkan positif COVID-19 dengan menggunakan 'real-time reverse transcription-polymerase chain reaction' (RT-PCR) antara 1 Januari 2021 sehingga 31 Disember 2021 di Hospital Tuanku Fauziah, Perlis, Malaysia telah dianalisa secara retrospektif. Seramai 198 petugas kesihatan terlibat dalam kajian ini. Majoriti adalah wanita (72.2%), dengan purata umur 39.9 ± 6.55 tahun, Melayu (96%), jururawat (46%), tanpa komorbid (92.4%) dan telah menerima dua dos vaksin COVID-19 (97%). Seramai 115 petugas kesihatan mendapat jangkitan daripada komuniti, manakala 65 petugas kesihatan mungkin dijangkiti daripada tempat kerja. Kebanyakan petugas bergejala (84.3%). Gejala demam (49%), sakit tekak (40.4%), batuk (33.8%) dan hingus/hidung tersumbat (22.2%) adalah merupakan gejala yang paling ketara. Sejumlah 82.8% daripada petugas kesihatan telah disahkan dengan jangkitan COVID-19 klinikal kategori dua. Tempoh median jangkitan berlaku adalah kira-kira 5 bulan selepas dua dos vaksinasi. Semasa diagnosis dibuat, majoritinya dibenarkan melakukan pemantauan di rumah (76.2%) dan tiada kematian direkodkan. Petugas yang bergejala mempunyai durasi vaksinasi COVID-19 – jangkitan jauh lebih lama ($p<0.001$). Petugas yang disahkan dengan COVID-19 klinikal kategori dua mempunyai tempoh vaksinasi COVID-19 – jangkitan yang jauh lebih lama berbanding dengan klinikal kategori satu

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(p=0.012). Penilaian berkala jangkitan COVID-19 di kalangan petugas kesihatan adalah penting untuk mengatur strategi mitigasi yang berkesan untuk mengawal pandemik secara optimum serta untuk melindungi petugas kesihatan semasa fasa endemik.

Kata kunci: COVID-19, kelaziman, Malaysia, petugas kesihatan, tempat kerja

ABSTRACT

Healthcare workers (HCWs) are most susceptible to COVID-19 because they are constantly exposed to the source. This study aimed to determine the prevalence, clinical characteristics, and outcome of healthcare workers (HCWs) with positive COVID-19 in a single institution in northwest Malaysia. Data log of HCWs diagnosed with positive COVID-19 with real-time reverse transcription-polymerase chain reaction (RT-PCR) between 1st January 2021 and 31st December 2021 in Hospital Tuanku Fauziah, Perlis, Malaysia was retrospectively analysed. A total of 198 HCWs were included. Majority were female (72.2%), mean age of 39.9 ± 6.55 years, Malay (96%), nurses (46%), without co-morbidities (92.4%) and had completed two doses of COVID-19 vaccination (97%). A total of 115 HCWs contracted the infection from the community, whereas 65 HCWs may be infected from the workplace. Most of the staff were symptomatic (84.3%). Fever (49%), sore throat (40.4%), cough (33.8%) and runny nose/nasal congestion (22.2%) are the most prominent symptoms. A total of 82.8% of HCWs were diagnosed with stage 2 COVID-19. The median length of infection to occur was approximately 5 months after two doses of vaccination. Majority were manageable at home during diagnosis (76.2%), with no deaths were recorded. Symptomatic HCWs had significantly longer interval of COVID-19 vaccination-to-infection period ($p<0.001$). The HCWs diagnosed with stage two COVID-19 had significantly longer interval of COVID-19 vaccination-to-infection as compared to stage one COVID-19 ($p=0.012$). Periodic evaluation of COVID-19 infection among HCWs is essential for the development of effective mitigation strategies for optimal pandemic control as well as for HCWs protection during the endemic phase.

Keywords: COVID-19, Malaysia, health personnel, prevalence, workplace

INTRODUCTION

Coronavirus disease-2019 (COVID-19) raises international concern and was declared as a pandemic by the World Health Organisation (WHO) on March 11, 2020 (WHO 2020). The virus implicated was the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), known to cause acute respiratory illness (Chu et al. 2020). Despite its relatively low mortality rate among otherwise healthy individuals, the disease burden was found to

debilitate the elderly and those with poorly controlled chronic illnesses.

The virus spreads via respiratory droplets and aerosols (Mittal et al. 2020), hence the standard precautions including wearing a facemask, maintaining social distancing, practising good hand hygiene, normalising cough etiquette, and avoiding unnecessary physical contact. Once infected, the virus replicates in the cells lining of respiratory system before finding its way to the lung parenchyma, causing further damage and irreversible scarring with prolonged respiratory sequelae and multiorgan involvement (Abd El-Aziz & Stockand 2020). Preventing local transmission remains the central tenet of public health in containing a pandemic. Communities play an indefinite role in curbing the spread of the virus, hence the implementation of movement control order, and limitation to certain economic sectors, social activities, and public gatherings.

The pandemic did not only impact our economy and socio-cultural settings, but also overburdened public health and hospital capacities globally. Frontline health-care workers (HCWs) have been saving lives and fighting COVID-19 with great dedication and commitment. There were limited local literatures on the prevalence of COVID-19 among HCWs, hence our study aimed to remedy this. This paper sought to determine the prevalence, clinical characteristics, and outcome of HCWs infected with COVID-19 in a single state hospital in Perlis, Malaysia, during the early phase of COVID-19 infiltration.

MATERIALS AND METHODS

Setting and Design

This is a retrospective cross-sectional study conducted in Hospital Tuanku Fauziah, Perlis, Malaysia. Data log of HCWs diagnosed with positive COVID-19 via real-time reverse transcription-polymerase chain reaction (RT-PCR) from January 1st, 2021 until December 31st, 2021 were retrieved from the Occupational Safety and Health (OSH) Unit.

Data Collection

Individual investigation form, Notification of Occupational Lung Disease form and Risk Assessment form from each HCWs infected with COVID-19 during the study period was analysed and transcribed into a separate datasheet. Detailed information was collected including the reason for initial screening, clinical characteristics at presentation, possible sources of infection, clinical staging with clinical parameters upon diagnosis, management and the clinical outcome.

Statistical Analysis Plan

Descriptive data were described using distribution and percentages. Normally distributed numerical data such as age and cycle threshold (CT) value were described in mean and standard deviation while non-normally distributed data like duration of exposure, duration of symptoms, and interval of vaccination before

diagnosis were described in median and interquartile range. Statistical association between interval of COVID-19 vaccination and COVID-19 infection *vs.* COVID-19 symptomatology was determined using Mann-Whitney U test, while association between interval of COVID-19 vaccination and COVID-19 infection vs. clinical category of COVID-19 infection were analysed using Kruskal-Wallis test. Pairwise comparison was further tested using Mann-Whitney U test.

Ethical Approval

Ethical approval for this study was obtained from the Medical Research and Ethics Committee (MREC) (Ref : 22-00078-RUV (2)), Ministry of Health Malaysia.

RESULTS

Prevalence

A total of 198 HCWs out of a total of 2,307 hospital staffs (accounting for 8.6%) were positive for COVID-19 between January 1st, 2021 and December 31st, 2021. Majority were female (72.2 %), Malay (96%), had the mean age of 39.9 ± 6.55 years old, were without co-morbidities (92.4%), and had completed two doses of COVID-19 vaccination (97%). Nurses (46%), clinical support personnel (27.8%), and doctors (17.2%) were most frequently affected (Table 1).

Reason for Screening

Healthcare workers presenting with acute respiratory symptoms were twice the number (73.3%) of those who had been screened due to having close contact with a positive individual (37.9%). Among these, close contact with family members (40%) was frequently reported (Table 1).

Probable Sources of Infection

Majority of HCWs may contracted infection from community, including from family member (32.0%), social activities (8.6%), and infection cluster (0.9%). On the other hand, 65 HCWs reported to be likely infected from workplace (Figure 1).

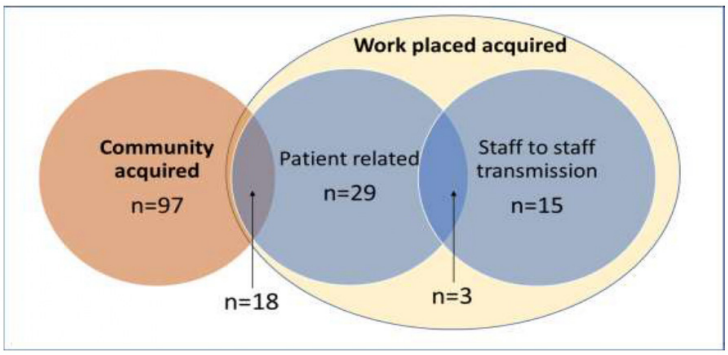

Figure 1: Distribution of probable sources of infection among all HCWs (n=180)

Table 1: Socio-demographic distribution, clinical characteristic, clinical parameter, and reason for screening of HCWs with positive COVID-19 in the year 2021 (n=198)

Variable	Mean (SD)	Median (IQR)	n (%)
Socio-demographic and clinical characteristics			
Age	39.9 (6.55)		
Gender:			
Female			143 (72.2)
Male			55 (27.8)
Ethnicity:			
Malay			190 (96.0)
Chinese			4 (2.0)
Indian			4 (2.0)
Co-morbidity:			
No			182 (92.4)
Yes			15 (7.6)
HPT			6 (40.0)
DM			5 (33.3)
Pregnant			3 (20)
Other			6 (40)
Vaccination status:			
Complete two doses			192 (97.0)
Incomplete			1 (0.5)
Not vaccinated			5 (2.5)
Job Designation:			91 (46.0)
Nurse			55 (27.8)
Clinical support staff			34 (17.2)
Doctor			13 (6.6)
Administrator			5 (2.5)
Pharmacy officer			
Symptomatology:			
Symptomatic			167 (84.3)
Asymptomatic			18 (14.1)
Symptom:			
Fever			97 (49.0)
Sore throat			80 (40.4)
Cough			67 (33.8)
Runny nose/nasal congestion			44 (22.2)
Headache			33 (16.7)
Anosmia			27 (13.6)
Ageusia			23 (11.6)
Other			3 (1.5)
Clinical parameter upon diagnosis			
Duration exposure before date of diagnosis:		3 days (3)	
0 – 7 days			123 (62.1)
8 – 14 days			9 (4.5)
> 14 days			1 (0.5)
Duration of symptoms before date of diagnosis:		2 days (2)	
0 – 7 days:			154 (77.8)
8 – 14 days			3 (1.5)
> 14 days			1 (0.5)
Interval of COVID-19 vaccination - COVID-19 infection		167.5 days (49)	

CT value upon diagnosis	26.27 (6.2)	
Reason for screening		
Reason for screening:		
Acute symptom		145 (73.3)
Close contact with positive individual		75 (37.9)
Self-initiative		28 (14.1)
Travelled from the identified red zone		19 (9.6)
Attended event related to a cluster		1 (0.5)
Screening for pre-procedure		1 (0.5)
Close contact with positive individual sub-categories:		
Family member		30 (40)
Other staff		25 (33.3)
Patient		14 (18.6)
Friend		1 (1.3)
Undetermined		5 (6.7)

Clinical Characteristics

Majority were symptomatic (84.3%) with minor upper respiratory tract infection symptoms. A vast majority of HCWs were diagnosed within 7 days of exposure (62.1%) at the median of 3 days (IQR=3.0), whereas those who showed symptoms had earlier diagnoses made. Upon diagnosis, 164 (82.8%) HCWs were diagnosed with stage 2 COVID-19 infection (Figure 2) with the mean cycle threshold (CT) value of 26.27 ± 6.2. The median length of time for infection to occur was approximately 5 months (Median=167.5 days, IQR=49 days) after the completion of the second dose of COVID-19 vaccination. Symptomatic HCWs had significantly longer interval of COVID-19 vaccination-to-infection period ($p<0.001$) and HCWs diagnosed with COVID-19 clinical Stage 2 had significantly longer interval of COVID-19 vaccination-to-infection as compared to clinical Stage 1 ($p=0.012$).

Outcome

Upon diagnosis, majority (n=151,

Table 2: Association between variables and interval of COVID-19 vaccination until COVID-19 infection

Variable	Interval of COVID-19 vaccination and COVID-19 infection	Median	IQR	Pairwise comparison	p-value
COVID-19 symptomatology					<0.001[a]
	Symptomatic	174	(46)		
	Asymptomatic	149	(82)		
Clinical category of COVID-19 infection					0.046[b]
	Stage 1	153	(58)	Stage 1 vs Stage 2	0.012[a]
	Stage 2	170	(46)	Stage 1 vs Stage 3&4	0.627[a]
	Stage 3&4	174	(0)	Stage 2 vs Stage 3&4	0.899[a]

Note: [a]Mann-Whitney test; [b]Kruskal-Wallis test

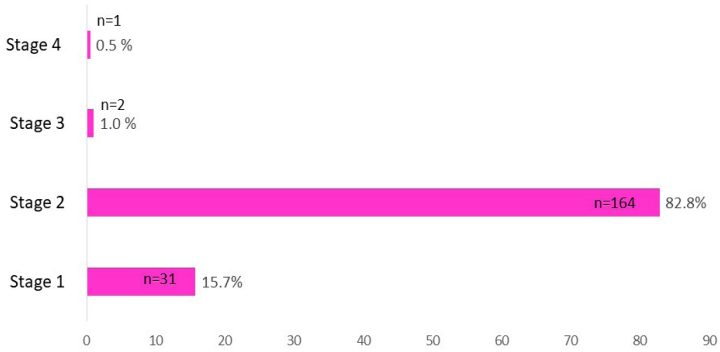

Figure 2: Clinical categories of COVID-19 infection at diagnosis (n=198)

76.2%) were manageable at home, 32 (16.2%) were admitted to COVID-19 Low-Risk Quarantine and Treatment Centres (PKRC) and 15 (7.6%) were hospitalised. Overall, no mortality was recorded.

Infected HCWs were immediately quarantined and excluded from work. Multiple strategies were employed to contain the spread of infection in the workplace, including close contact tracing (94.4%), workplace disinfection (49.0%), and enforcement of standard operating procedures (37.4%).

DISCUSSION

Our study determined that 8.6% (198/2,307) of HCWs in our centre were infected with COVID-19 infection in the year of 2021. The majority were female, with a mean age of 39.9 years old, and worked as nurses. The prevalence of infected HCWs in our centre was slightly lower than that reported by Sahu et al. (2020) at 10.1% from a systematic review of 11 articles on the prevalence of HCWs infected with COVID-19. This could be due to the difference in the timing of evaluation as the review included all articles published from December 2019 till April 2020, and the different countries being studied (i.e. China, United States of America and Italy) which had different response mechanism to the pandemic. The relatively low prevalence of COVID-19 infection among HCWs could also be contributed by a high rate of responsibility, discipline and compliance at work (Abed Alah et al. 2021). There were also additional public health measures instilled among hospital community that were essential in halting the spread of highly contagious diseases (Wilder-Smith & Freedman 2020).

The same demographic preponderance was also reflected in other studies which found a higher occurrence among females, primarily among nurses, and with similar age group (Alajmi et al. 2020; Gholami et al. 2021; Ramli et al. 2022; Sabetian et al. 2021; Zheng et al. 2020). This observed gender disparity may be due to several factors, including a higher proportion of female nursing staff, differences in exposure levels, adequacy of training and equipment, and adherence to preventative measures.

The majority of our HCWs diagnosed with COVID-19 were symptomatic with prominent upper respiratory tract infection, namely fever, cough, sore throat, and runny nose/nasal congestion, similar to other studies (Gómez-Ochoa et al. 2021; Sahu et al. 2020). However, the pathophysiology of COVID-19 symptomatology is complex and still poorly understood. Furthermore, the ability of virus mutation as a result of evolution and adaptation processes may lead to the emergence of a new variant that could alter its transmissibility, characteristics, virulence, and antigenicity (Harvey et al. 2021). Rapidly changing SARS-CoV-2 variance imposed a challenging experience as individuals infected with SARS-CoV-2 can have a wide range of clinical manifestations, ranging from asymptomatic to severe acute respiratory illnesses. Clinical judgment is frequently complicated if based on clinical characteristics alone, primarily because of their initial signs and symptoms are nearly identical. These common symptoms of influenza-like illness (ILI) such as fever, cough, sore throat, and runny nose could be due to other pathogens as well. According to Agrupis et al. (2021), rhinovirus is the most common underlying virus (6.5%) infection among HCWs presented with upper respiratory tract infections (URTI)/lower respiratory tract-like symptoms, followed by influenza A (0.7%), influenza B (0.7%), human bocavirus (0.4%), parainfluenza 1 (0.4%), and adenovirus (0.7%). The high transmissibility of SARS-CoV-2 before the appearance of symptoms, as well as the efficiency of human-to-human transmission, indicate that the virus is more difficult to contain than other respiratory viruses. Therefore, maintaining a low infection suspicion threshold and early detection for symptomatic employees can aid in identifying the sources to prevent an outbreak of infection in the workplace.

Majority of our HCWs were middle-aged adults with no premorbid and had completed two doses of vaccination before contracting COVID-19 infection. Therefore, the severity of the disease was lesser with stage 1 and stage 2 COVID-19 infection corresponding to asymptomatic and mild symptoms, respectively. Several studies have found that COVID-19 vaccinations successfully lowered infection, severity, hospitalisation, and mortality rates in various populations (Mohammed et al. 2022). A longer COVID-19 vaccination-to-infection interval was observed among those with symptoms. Similarly, those in stage 1 (asymptomatic) had a significantly shorter time interval between vaccination and disease onset as compared to those in stage 2 (mild symptoms). There was evidence that vaccine efficacy or effectiveness against SARS-CoV-2 infection and symptomatic COVID-19 disease decreased by approximately 20-30% by 6 months after fully vaccinated (Feikin et al. 2022). On the contrary, most studies found that vaccine efficacy or effectiveness against severe disease remained above 70% after full vaccination, with a minimal decrease of approximately 9-10% to 6 months (Feikin et al. 2022). The decline in vaccine efficacy or effectiveness is most likely due to waning immunity

(Menni et al. 2022). Hence, to break the transmission cycle, robust vaccination strategies among HCWs, including promoting booster doses and providing frequent valid knowledge to combat vaccine hesitancy among HCWs and the community, are crucial. The official social media platform of the Ministry of Health (MOH) should routinely and actively combat misconceptions and fake news related to COVID-19, which would otherwise amplify.

In 2021, there was no mortality reported among infected HCWs in our facility. In parallel with other study findings, the majority of HCWs were eligible to be managed at home upon diagnosis (Gholami et al. 2021). Comorbidities, especially cardiovascular disease, secondary infection, and elevated inflammatory markers could all play a role in influencing the clinical outcome and mortality (Ruan et al. 2020).

Majority of our HCWs likely contracted the infection from the local community. This was also consistent with the findings of other studies (Al Maskari et al. 2021; Alajmi et al. 2020). To curb the spread of infection from community to healthcare facility, multimodal measurements were used including regular education programmes to provide HCWs with the most recent information on COVID-19 disease transmission, enforcement of preventive measures, frequent infection control surveillance, efficient contact tracing method through a designated liaison officer in each department and/or unit and mass screening.

Furthermore, workplace safety plays a significant role in reducing disease transmission not only from community but also within the facility. Effective COVID-19 infection control strategies in a health care facility necessitated collaboration from multiple hospital and other relevant parties. Hospital-based COVID-19 psychoeducation team may be led by officers from the Occupational Safety and Health unit, which is tasked to disseminate information related to COVID-19 and instill awareness on the preventive strategies of the infection among staff working in hospital grounds (Ahmad Musadad et al. 2022). This is a key step in reducing HCWs' anxiety and providing accurate information. The establishment of local Mental Health Psychosocial Team (MHPSS) is also important to monitor and assess the psychosocial well-being and provide emotional support and psychological first aid (PFA) to staff working during the pandemic. Apart from that, the Infection Control Unit may also hold regular and small-scaled workshops for personal protective equipment (PPE) donning and doffing, including a refresher course on hand hygiene techniques for staff who deals directly with COVID-19 patients and biospecimens. Hospital management plays a big role in mobilising human resources, providing prompt update on the indoor policies for HCWs, visitors, and patients, as well as establishing reliable collaboration with external parties in ensuring efficient management of the pandemic at the hospital level.

As we enter the endemic phase of COVID-19, coronavirus continues to evolve. The infection control measures

must be strengthened in healthcare facilities to prevent nosocomial outbreak that could affect both patients and healthcare personnel. Hence, continuous monitoring of infection prevention and control practices in healthcare facilities needs to be audited by the occupational health personnel together with the provision of employee support to safeguard the health and wellbeing of HCWs. In addition, the key role in mitigating the spread of COVID-19 in healthcare facilities is the implementation of a rigorous screening programmes among suspected cases. Ensuring the cleanliness of facilities, having good ventilation in the workplace, and keeping up of COVID-19 updates are strongly encouraged. COVID-19 precautions of wearing face masks at healthcare facilities, maintaining social distancing and hand hygiene should always be cautioned among HCWs.

Growing evidence suggests multiorgan involvement in infected individuals with COVID-19 (Gavriatopoulou et al. 2020). According to research conducted in London, among 384 patients who were followed for a median of 54 days after discharge, 53% experienced chronic breastlessness, 34% had persistent cough, 69% had fatigue, and 14.6% were depressed (Mandal et al. 2021). Most of the infected COVID-19 individuals recovered completely, but a considerable number may still experience symptoms and consequences. Long COVID-19 is the term used to describe patients with persistent symptoms for more than three months, which include fatigue, breathlessness (Aiyegbusi et al. 2021) and 'brain fog', which refers to difficulties with concentration and memory (Hugon et al. 2022). Therefore, depending on the severity of clinical symptoms among HCWs, we propose that infected HCWs should have adequate clinical and psychological support including long term monitoring, mental health support, rehabilitation services and social support services, even after returning to work.

Our findings were limited to a single centre study, hence restricting generalisability. Hence, we suggest for future research to evaluate the risk factors of COVID-19 among HCWs with detailed follow-up clinical data including long term sequelae of long COVID to allow proper risk and clinical characterisation.

CONCLUSION

Despite the relatively low prevalence of COVID-19-related sickness among HCWs, this issue still need to be seriously addressed as COVID-19 transmission in healthcare institutions could worsen even in the endemic phase, potentially resulting in nosocomial COVID-19 outbreak that could compromise the quality of healthcare services. Our clinical data provided guidance for local risk stratification and multiagency involvement through integration of clinical, occupational health, infection control and public health measures to curb the infection. The capacity and efficiency of the healthcare system must be maintained by effective administration and management, early

adoption of infection control measures and efficient diagnostic testing, response and support service.

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