

Prevalence of COVID-19 among healthcare workers in the paediatric department: Estimates from a multicenter cross-sectional survey in Negeri Sembilan

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ABSTRACT

Introduction: The COVID-19 pandemic has reached a phase where many have been infected at least once. Healthcare workers were not spared from being infected. This study aimed to determine the period prevalence of COVID-19 among the paediatric healthcare workers in Negeri Sembilan as the country transitioned into an endemic phase of the pandemic. Additionally, we investigate potential sociodemographic and occupational characteristics associated with SARS-CoV-2 infection among healthcare workers.

Materials and Methods: A cross-sectional study was conducted among the healthcare workers in the paediatric department at three public specialist hospitals in Negeri Sembilan between 15 and 21 April 2022. Data were collected through a self-administered questionnaire.

Results: Out of the 504 eligible healthcare workers, 493 participated in this study (response rate 97.8%). The overall prevalence of COVID-19 (11 March 2020–15 April 2022) among healthcare workers was 50.9%. The majority (80.1%) were infected during the Omicron wave two months before the survey. Household contacts accounted for 35.9% of infection sources. The proportion of non-doctors in the COVID-19-infected group was significantly higher compared to the non-infected group (74.1% vs 64.0%, $p=0.016$). The COVID-19-infected group had a higher proportion of school-going children (44.6% vs 30.6%, $p=0.001$) and children who attended pre-school/sent to the babysitter (49.0% vs 24.4%, $p<0.001$). There were no significant differences between infection rates among the healthcare workers working in the tertiary hospital and the district hospitals. There were also no significant differences in the proportion of COVID-19-infected doctors and nurses when analysed by seniority.

Conclusion: Our study provided an estimate on the prevalence of COVID-19 among paediatric healthcare workers in Negeri Sembilan and the factors associated with infection, which captures the extent and magnitude of this pandemic on the state's paediatric department. Most infections resulted from household contact, with a higher

proportion of infected healthcare workers having young children.

KEYWORDS:

COVID-19; SARS-CoV-2; healthcare workers; prevalence

INTRODUCTION

Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has been an unprecedented global crisis since being officially declared a pandemic by the World Health Organization (WHO) on 11 March 2020.¹ The pandemic has placed immense pressure on the healthcare systems in many countries worldwide.

Healthcare workers are at high risk of contracting the disease in the course of their duties as front-line responders in the pandemic. Risk factors for nosocomial transmission of COVID-19 include frequent exposure to infected patients, work overload, poor infection control practices and pre-existing medical conditions.^{2,3} Furthermore, healthcare workers could be exposed to infected colleagues, family members or contacts during social events such as weddings or religious gatherings.

The Ministry of Health Malaysia reported almost 9,000 infected healthcare workers in just the first 6 weeks of 2022.⁴ The numbers more than doubled during the peak of the Omicron wave in the country.⁵ The pandemic has exerted significant physical and psychological impact on healthcare workers, highlighting the need for appropriate psychological and emotional support.^{6,7}

The epidemiology of COVID-19 has been studied locally among the general population and healthcare workers before the emergence of the Omicron variant.⁸⁻¹⁰ There are no studies on the prevalence of COVID-19 among healthcare workers following Omicron, which drove a massive surge of cases in the country.¹¹ Malaysia transitioned into an endemic phase on 1 April 2022, more than 2 years after the outbreak of COVID-19.¹² As we recover from the pandemic, it would be

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informative to know the proportion of healthcare workers who have been infected with COVID-19. In this study, we report the period prevalence, symptoms and clinical outcomes of COVID-19 among healthcare workers in the paediatric department in Negeri Sembilan. Additionally, we investigate potential socio-demographic characteristics associated with SARS-CoV-2 infection.

MATERIALS AND METHODS

Study Design and Setting

We conducted a cross-sectional study among the paediatric department staff at the three public specialist hospitals in Negeri Sembilan from 15 to 21 April 2022, in the third week following the country's transition to the endemic phase of COVID-19. Hospital Tuanku Ja'afar (HTJ) Seremban served as the sole tertiary referral centre for both COVID-19 and non-COVID-19 cases, whereas Hospital Tuanku Ampuan Najihah (HTAN) Kuala Pilah and Hospital Port Dickson (HPD) served as non-COVID-19 district hospitals with specialists. During this period, the total cumulative cases of COVID-19 had exceeded 200,000 in the state of Negeri Sembilan.¹³ The study was conducted when booster COVID-19 vaccination was already widely available to the general population.¹⁴

The study population comprised doctors, nurses, healthcare assistants, medical assistants and office clerks. All healthcare workers in the paediatric department were included in the study, even those on quarantine or leave. We excluded those who had left the department at the time of the survey, as well as those who declined to participate. Healthcare workers working in the paediatric department of other district hospitals in the state were excluded as these district hospitals were fully converted to COVID-19 hospitals during the study period. A liaison officer at each study site was appointed. The liaison officer recruited participants from the department based on a list of healthcare workers obtained from the paediatric office.

Participants were invited to participate in the survey using a self-administered online questionnaire. The link to the online questionnaire was disclosed through WhatsApp by the appointed liaison officer at each study site. Upon clicking the link to the questionnaire, the participants would be directed to a webpage containing the participant information sheet. Permission to participate in the study was obtained by the "I agree" checkbox, signifying implied consent from the participants. Participants who selected "I disagree" would be allowed to withdraw from the study. The participants were given a week to respond to the survey. The questionnaire took approximately 10 minutes to complete.

The questionnaire comprised three main sections and was conducted in Bahasa Malaysia. Section A contained socio-demographic information such as age, gender, job position, comorbidities and vaccination status. Section B contained information about the household members, such as the number of people in the household, and children in school or kindergarten. Section C included details of COVID-19 infection such as the number of times infected, symptoms and outcomes.

The primary outcome measures were the period prevalence of COVID-19 among healthcare workers in the paediatric department (11 March 2020–15 April 2022). Secondly, we described the symptoms of COVID-19 among healthcare workers and compared the socio-demographic differences between healthcare workers who had COVID-19 with those who have not.

Study Definitions

Healthcare workers who were COVID-19-infected were defined as those who had a laboratory-proven diagnosis of COVID-19 at any point since the start of the pandemic (either by reverse transcriptase polymerase chain reaction or antigen detection tests using nasopharyngeal swabs or saliva samples). Prevalence in this study refers to the period prevalence of COVID-19 between 11 March 2020 (the start of the pandemic) and 15 April 2022 (the start of the study period), calculated by the proportion of healthcare workers who were COVID-19 infected at any point during the period mentioned above. Healthcare workers were considered to have completed COVID-19 booster vaccination if they had received the COVID-19 booster dose for more than 14 days following the vaccination. The period of 1 February 2022 onwards was considered the Omicron wave, with more than 95% of samples tested in the country being Omicron, which corresponded to Omicron dominance elsewhere around the world.¹⁵ The source of infection was identifiable only when there was significant face-to-face contact within 1 meter for more than 15 minutes with a confirmed COVID-19 case in the preceding two weeks prior to the onset of the healthcare worker's diagnosis. The household attack rate was defined as the number of infected household members (excluding the healthcare worker) divided by the total number of household members.

Statistical Analysis

Categorical variables were expressed as frequencies (%). Continuous variables were expressed as means and standard deviation of the mean (SD) or as medians and interquartile ranges (IQR) when appropriate. Data were assessed for conformance to the normal distribution using the Shapiro–Wilk test. Independent t-test was used to compare means if the data distribution was normal, and Mann–Whitney U test was used if the data were not distributed normally. Categorical variables were compared using Chi-squared or Fisher's exact tests. Logistic regression was used to calculate odds ratio (OR) and its 95% confidence interval (95% CI). A p-value <0.05 was considered statistically significant. Data analysis was performed using SPSS Version 26.0 (IBM Corp., Armonk, NY, USA).

Ethical Consideration

The study was reviewed and approved by the Medical Research and Ethics Committee, Ministry of Health Malaysia [NMRR-22-01170-VKK(2)]. The survey was anonymous, and confidentiality of the respondent's information was ensured. No personal or identifiable data were collected during the conduct of the study. There was no patient or public involvement in the study design.

Table I: Baseline characteristics of the study population (n=?)

Baseline Characteristics of patients	Total n (%)
Age in years, mean \pm SD	35.4 (7.2)
Sex	
• Male	59 (12.0)
• Female	434 (88.0)
Post	
• Specialist	23 (4.7)
• Medical officer	64 (13.0)
• House officer	65 (13.2)
• Matron/ nursing sister	23 (4.7)
• Staff nurse	222 (45.0)
• Community nurse	44 (8.9)
• Health care assistant	46 (9.3)
• Others	6 (1.2)
Hospital	
• Hospital Tuanku Ja'afar Seremban	342 (69.4)
• Hospital Tuanku Ampuan Najihah Kuala Pilah	103 (20.9)
• Hospital Port Dickson	48 (9.7)
Completed booster COVID-19 vaccination	455 (92.3)
Comorbidities ^a	
• None	419 (85.0)
• Obesity	29 (5.9)
• Hypertension	28 (5.7)
• Respiratory	20 (4.1)
• Diabetes mellitus	16 (3.2)
• Others	23 (4.7)
COVID-infected healthcare workers	
• Yes	251 (50.9%)
• No	242 (49.1%)

SD Standard deviation

^aA patient may have more than one comorbidity

RESULTS

A total of 493 out of the 504 eligible healthcare workers participated in this study, which corresponded to a participation rate of 97.8%. The characteristics of the study participants are described in Table I. The mean age of the participants was 35.4 years (SD 7.2) with a male: female ratio of 1:7. The doctors made up less than a third of the respondents, while more than two-thirds were nursing staff members. Most participants (69.4%) were from HTJ Seremban, the state's sole hospital with specialists managing COVID-19 cases. These baseline data reflected the demographics of the paediatric department workforce in Negeri Sembilan. At least one comorbidity was identified in 74 participants (15%), with obesity being the most commonly reported comorbidity (5.9%). The prevalence of COVID-19-infected healthcare workers was 50.9% (251/493).

The mean age of those infected was 35.0 years (SD 6.5) and 25 (10%) were males. The characteristics of the COVID-19-infected healthcare workers are further described in Table II. The proportion of COVID-19-infected healthcare workers in the paediatric department of HTJ Seremban was 50.3% (172/342), while the proportion of COVID-19 infected healthcare workers in the non-COVID-19 hospitals was 52.3% (79/151). The vast majority (80.1%) were infected during the Omicron wave, which occurred two months before the survey. Only 8 (3.2%) were infected more than once. The source of the COVID-19 infection was unknown to most of the respondents (41.8%). Household contacts accounted for 35.9% of infection sources, while contacts from the work circle accounted for 17.1% of cases. Most healthcare workers

had completed their COVID-19 vaccination or had been boosted at the time of infection. Only 11 (4.4%) required hospitalisation. The overall proportion of household attack rate (excluding the healthcare workers) was 54.7% (488/892).

The clinical characteristics and outcomes during the Omicron wave and previous waves were compared in Table III. Healthcare workers infected during the Omicron wave were significantly older than the previous waves, with a mean age difference of 2.3 years ($p=0.03$). During the Omicron wave, asymptomatic infection was less common (OR 0.39, 95% CI 0.17–0.92). Symptoms such as fever (OR 2.73, 95% CI 1.33–5.61), cough (OR 4.94, 95% CI 2.34 – 10.44), sore throat (OR 5.18, 95% CI 2.33–11.49), lethargy (OR 2.29, 95% CI 1.14–4.58) and headache (OR 2.11, 95% CI 1.05–4.20) were significantly more common during the Omicron wave. On the other hand, anosmia and ageusia were significantly less common during the Omicron wave (OR 0.18, 95% CI 0.09–0.39 and OR 0.16, 95% CI 0.08–0.33, respectively). The proportion of healthcare workers requiring hospitalisation was significantly higher during previous waves than during the Omicron wave (15.0% vs 2.7%, $p=0.004$).

We compared the socio-demographic characteristics of the COVID-19-infected and non-infected healthcare workers to identify parameters associated with infection (Table IV). The mean age, sex, comorbidities and the proportion of healthcare workers who received booster vaccination did not significantly differ between both groups ($p>0.05$). There were no significant differences between the proportion of infected healthcare workers working in the tertiary and district

Table II: Characteristics of healthcare workers who had been COVID-infected Include (n=?)

Characteristics of healthcare workers	Total n (%)
COVID-infected, by hospital ^a	
• Hospital Tuanku Ja'afar Seremban (n=342)	172 (50.3)
• Hospital Tuanku Ampuan Najihah Kuala Pilah (n=103)	50 (48.5)
• Hospital Port Dickson (n=48)	29 (60.4)
COVID-infected, by profession ^a	
• Specialist (n=23)	9 (39.1)
• Medical officer (n=64)	33 (51.6)
• House officer (n=65)	23 (35.4)
• Matron/ nursing sister (n=23)	11 (47.8)
• Staff nurse (n=222)	122 (55.0)
• Community nurse (n=44)	24 (54.5)
• Health care assistant (n=46)	25 (54.3)
• Others (n=6)	4 (66.7)
COVID-infected, by date	
• Pre-Feb 2022	50 (19.9)
• Post-Feb 2022	201 (80.1)
Number of times COVID-infected	
• Once	243 (96.8)
• More than once	8 (3.2)
Source of COVID-19 infection	
• Household	90 (35.9)
• Workplace	43 (17.1)
• Social activities	13 (5.2)
• Unknown	105 (41.8)
COVID-19 vaccination status while infected	
• Not vaccinated	8 (3.2)
• Completed 1 dose COVID-19 vaccine	4 (1.6)
• Completed 2 doses COVID-19 vaccine	53 (21.1)
• Completed booster dose of COVID-19 vaccine	186 (74.1)
Outcome	
• Not hospitalised	240 (95.6)
• Hospitalised	11 (4.4)
Symptoms lasting for more than 2 weeks	85 (33.9)
Household attack rate	54.7 (95% CI 51.4 – 57.9)

CI confidence interval.

^aPercentages reflected the proportion by row instead of column

Table III: Comparison of clinical characteristics and outcomes during the Omicron wave and previous waves (n=?)

	Total (n=I) (%)	Previous waves (n=I) (%)	Omicron wave (n=I) (%)	p value	Odds ratio (95% CI) ^a
Age in years, mean ± SD	35.0 (6.5)	33.2 (6.1)	35.5 (6.5)	0.030	1.06 (1.01 – 1.12)
Sex, male	25 (10.0)	6 (12.0)	19 (9.5)	0.591	0.77 (0.29 – 2.03)
Asymptomatic	28 (11.2)	10 (20.0)	18 (9.0)	0.031	0.39 (0.17 – 0.92)
Fever	167 (66.5)	23 (46.0)	144 (71.6)	0.006	2.73 (1.33 – 5.61)
Cough	179 (71.3)	22 (44.0)	157 (78.1)	<0.001	4.94 (2.34 – 10.44)
Rhinorrhea	164 (65.3)	29 (58.0)	135 (67.2)	0.869	1.07 (0.50 – 2.30)
Sore throat	189 (75.3)	25 (50.0)	164 (81.6)	<0.001	5.18 (2.33 – 11.49)
Shortness of breath	21 (8.4)	3 (6.0)	18 (8.9)	0.648	1.35 (0.38 – 4.81)
Anosmia	83 (33.1)	28 (56.0)	55 (27.4)	<0.001	0.18 (0.09 – 0.39)
Ageusia	72 (28.7)	27 (54.0)	45 (22.4)	<0.001	0.16 (0.08 – 0.33)
Lethargy	132 (52.6)	17 (34.0)	115 (57.2)	0.020	2.29 (1.14 – 4.59)
Headache	139 (55.4)	19 (38.0)	120 (60.0)	0.035	2.11 (1.05 – 4.20)
Myalgia	145 (57.8)	24 (48.0)	121 (60.1)	0.463	1.30 (0.64 – 2.63)
Loss of appetite	69 (27.5)	10 (20.0)	59 (29.3)	0.371	1.43 (0.65 – 3.11)
Vomiting/diarrhoea	172 (68.5)	34 (68.0)	138 (68.7)	0.196	0.54 (0.21 – 1.37)
Hospitalised	11 (4.4)	6 (12.0)	5 (2.5)	0.004	0.16 (0.05 – 0.55)

CI confidence interval

^aUsing the previous waves as the reference group

Table IV: Comparison of characteristics of COVID-19-infected and non-infected group of healthcare workers

	COVID-19 infected (n=) (%)	Non-infected (n=) (%)	p value
Age in years, mean ± SD	35.0 (6.5)	35.7 (8.0)	0.317
Sex			
• Male	25 (10.0)	34 (14.0)	0.162
• Female	226 (90.0)	208 (86.0)	
Presence of comorbidity	45 (17.9)	29 (12.0)	0.065
Completed booster vaccination	227 (90.4)	228 (94.2)	0.116
Hospital			
• HTJS (tertiary)	172 (68.5)	170 (70.2)	0.678
• HTAN/HPD (non-tertiary)	79 (31.5)	72 (29.8)	
Profession			
• Doctors	65 (25.9)	87 (36.0)	0.016
• Non-doctors	186 (74.1)	155 (64.0)	
Doctors, by seniority ^a			
• Specialist	9 (13.8)	14 (16.1)	0.702
• MO/ HO	56 (86.2)	73 (83.9)	
Nurses, by seniority ^b			
• Sister/Matron	11 (7.0)	12 (9.1)	0.514
• SN/ JM	146 (93.0)	120 (90.9)	
Number of household, median (IQR)	4 (2-5)	3 (2-4)	0.135
Partner/spouse working as healthcare worker	63 (25.1)	44 (18.2)	0.063
Child in primary school/secondary school	112 (44.6)	74 (30.6)	0.001
Child in kindergarten/baby sitter	123 (49.0)	59 (24.4)	<0.001

^aThe calculated percentages were based on a total of 65 doctors in the COVID-19-infected group and 87 doctors in the non-infected group, respectively.

^bThe calculated percentages were based on a total of 157 nurses in the COVID-19-infected group and 132 nurses in the non-infected group, respectively.

HO: House officer, MO: Medical officer, SN: staff nurse and JM: jururawat masyarakat (community nurse).

Table V: Subgroup analysis of healthcare workers who had children attending primary/secondary school or kindergarten/babysitter

	Doctors (n=) (%)	Non-doctors (n=) (%)	p value
Child in primary school/ secondary school	22 (14.5)	164 (48.1)	<0.001
Child in kindergarten/ baby sitter	31 (20.4)	151 (44.3)	<0.001
Number of household, median ± IQR	3 (2 -5)	3 (2 -5)	0.228

hospitals ($p=0.678$). However, the proportion of non-doctors in the COVID-19-infected group was significantly higher compared to the non-infected group (74.1% vs 64.0%, $p=0.016$). We observed no significant differences between both groups when the doctors and nurses were analysed separately by seniority.

The household characteristics of both groups were examined, and no significant differences were found between the median number of household members and the proportion of participants who had a partner/spouse who worked in healthcare ($p>0.05$). However, the COVID-19-infected group had a higher proportion of school-going children (44.6% vs 30.6%, $p=0.001$) and children who attended pre-school/sent to the babysitter (49.0% vs 24.4%, $p<0.001$). A subgroup analysis between the doctors and non-doctors in Table V revealed a higher proportion of non-doctors who had school-going children (48.1% vs 14.5%, $p<0.001$) and children who attended pre-school/sent to babysitter (44.3% vs 20.4%, $p<0.001$).

DISCUSSION

A high prevalence of COVID-19 was found in this multicentre cross-sectional study of healthcare workers working in the paediatric department in Negeri Sembilan. More than half of

the 493 healthcare workers surveyed have been infected with COVID-19 at least once since the pandemic began. Seroprevalence studies among healthcare workers generally reported lower prevalence.¹⁶⁻²⁰ However, these studies were conducted much earlier in the pandemic, before COVID-19 was widely prevalent in the community. On the contrary, seroprevalence studies from community-based studies carried out in a comparable period in the pandemic ranged from 57.7% to 66.0%.²¹⁻²³ The significant increase in seropositivity rates was driven by the large number of infections during the Omicron wave. These findings were reflected in our study, whereby a vast majority (80.1%) of our healthcare workers were infected during the Omicron wave.

There were observable differences in the clinical manifestations of COVID-19 during the Omicron wave compared to the previous waves. Our findings of lower rates of anosmia/ageusia during the Omicron wave were consistent with existing literature.²⁴⁻²⁶ On the other hand, sore throat was more common during the Omicron wave, which was similarly observed elsewhere.^{24,26} Fever and cough were found to be more common during Omicron predominance in our study, in contrast to the previous reports.^{25,27} Hospitalisation rates were significantly lower during the Omicron wave. This could be attributed to various factors, including Omicron's milder clinical course²⁸ and

comprehensive COVID-19 vaccine coverage was already achieved during the Omicron wave. Additionally, mandatory hospitalisation as part of containment measures was no longer necessary during the Omicron wave.

Most healthcare workers had no identifiable source of infection, which was not unusual at this stage of the pandemic when contact tracing activities were no longer carried out routinely. Household exposure was the most common among those with a known source of infection. Workplace exposure accounted for less than half that of household exposure. There were no significant differences between the infection rates among healthcare workers working in the tertiary hospital caring for COVID-19 patients and the district hospitals that do not manage COVID-19 cases. Our findings suggest that nosocomial transmission was not the primary source of infection, which concurred with existing literature that healthcare workers were not at an increased risk of infection.^{17,29,30} This was likely due to the widespread use of personal protective equipment and stringent enforcement of infection control practices within the workplace.

We observed variations in infection rates by profession. The proportion of doctors who had been infected with COVID-19 was lower than the non-doctors. However, there were no significant differences in the proportion of COVID-19-infected doctors and nurses when analysed by seniority. This suggested that most infections originated from out-of-the-hospital sources since the junior staffs tend to have more patient contact than the senior ones.

We observed a significantly higher proportion of COVID-19-infected healthcare workers with school-aged children or children who attended kindergarten/sent to the babysitter, which further implied that household contacts were the primary source of infection. A subgroup analysis revealed a higher proportion of non-doctors who had school-aged children and children who attended pre-school/sent to the babysitter, thereby explaining the differences in the infection rates by profession earlier. Although children were less likely to be the vector for SARS-CoV-2 transmission within household settings, their transmissibility appeared to have increased with the Omicron variant.³¹ Additionally, the reopening of schools and communities during the Omicron wave likely altered transmission dynamics. Young children tend to be less compliant with masking and social distancing and are more likely to be exposed and become a foci for viral transmission within the household. The overall household attack rate in our study was 54.7%, which was comparable to a previously published study locally.³²

Despite a high prevalence of COVID-19 infection among healthcare workers, the outcomes were largely favourable, with only a small proportion requiring hospitalisation. The good prognosis can be attributed to our healthcare workers' high uptake of COVID-19 vaccination. Almost all (95.2%) healthcare workers had completed two doses of COVID-19 vaccination or their booster vaccination at the time of infection. However, a substantial proportion of healthcare workers reported symptoms that persisted for more than 2 weeks, raising the possibility that some might progress to develop long COVID.

Our study has certain limitations. First, this study on the prevalence of COVID-19 infection used a self-reported questionnaire rather than serological prevalence using SARS-CoV-2 immunoglobulin G (IgG) detection. The prevalence of COVID-19 infection could have been higher as some healthcare workers could have had a subclinical or asymptomatic infection and were not tested. The data obtained from the self-administered questionnaire could also be predisposed to underreporting bias, although participation in this study was voluntary with a declaration of non-disclosure of identity and confidentiality. Nevertheless, our findings on the prevalence of COVID-19 infection matched the gross figures of quarantine leaves obtained from official office records. Second, we acknowledge the possibility of recall bias when the healthcare workers report their symptoms, which could overestimate or underestimate their symptoms of COVID-19. Lastly, our study was not designed to test transmission dynamics within the household. Therefore, some participants may have misidentified their exposure source. However, this bias was minimised by defining a definite source only when the chronological and epidemiological link matched the natural history of COVID-19. Healthcare workers were given an option for an unidentified source if they could not identify their COVID-19 source of infection. A larger-scale study conducted nationwide addressing those limitations would provide more wholesome data.

CONCLUSION

In conclusion, our study provided an estimate on the prevalence of COVID-19 among healthcare workers in the paediatric department of hospitals in Negeri Sembilan and the factors associated with infection. This study would serve as a formal record for future generations of medical professionals on the magnitude of this once-in-a-lifetime pandemic on the state's paediatric department, where more than half of the healthcare workers had contracted the illness by the time the pandemic reached an endemic phase. The high prevalence of infection resulted in periods of shortages in staff due to the significant cumulative absent days from work. Additionally, a substantial proportion of healthcare workers reported symptoms that persisted for more than 2 weeks. Our study highlights the need for further research on the prevalence of long-COVID among healthcare workers, which may impact their work performances and psychological well-being.

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