Obstetric services preparedness among healthcare workers in maternal wards during COVID-19 pandemic

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Abstract

Background The COVID-19 pandemic has been spreading rapidly since 2019, leading to devastating consequences worldwide, as well as putting healthcare providers at high risk. This study intends to assess the awareness and preparedness activities among maternal healthcare (MHC) workers and to determine factors that lead to obstetric services' preparedness in ten Government Hospitals in Selangor, Malaysia.

Methods A cross-sectional survey was conducted among 409 MHC workers which include doctors, nurses, and midwives in the government hospitals in Selangor, Malaysia between May 2022 till June 2022. Respondents were given validated questionnaires which include socio-demographic background, knowledge, awareness, and attitude as well as the obstetric services' preparedness activities in managing the COVID-19 pandemic.

Results Majority of the respondents were nurses/midwives (87.5%), female (98.5%), age 35–45 years old (48.5%), had working experience of more than 5 years (92.7%), had good knowledge and awareness (92.2%) and good obstetric services preparedness (88.3%). However, only about half (54.0%) of them had positive attitude towards COVID-19. When controlling for confounding factors, multivariate analysis showed that working period factor ($p < 0.001$), knowledge and awareness factor ($p < 0.001$) and attitude factor ($p < 0.001$) were significant predictive factors of obstetric services preparedness during the COVID-19 pandemic.

Conclusions Majority of the respondents had good knowledge and awareness, as well as good level of obstetric services preparedness. However, only about half of them had a positive attitude towards COVID-19. The findings in this study revealed that efforts should be made to further increase the knowledge and attitude of MHC workers on COVID-19 and more so to further improve the positivity of their attitude towards this pandemic so that they can provide better obstetric services especially in the current and future pandemics to come.

Keywords Obstetric services, COVID-19, Level of preparedness, Maternal, Healthcare workers

Background

Rapid global spread of the novel Coronavirus disease in 2019 (COVID-19) has catastrophic effects for patients, medical personnel, the healthcare system, and the economy. The pandemic threatens the capacity of the healthcare system to respond to emergencies and places medical professionals, particularly those who provide maternal health care (MHC), at serious risk as it spreads to low- and middle-income nations [1–3].

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To stop the spread of COVID-19, governments from all over the world have put in place several public and social health initiatives. The delivery of health services has changed in many contexts to concentrate on managing COVID-19 cases and decreasing the provision of services for non-COVID-19 health emergencies and critical health services. Thus, despite attempting to control infection, the health system has found it difficult to continue providing basic health services. Like in other infectious disease epidemics, maternal or obstetric health services may have been most impacted of all the health services provided [4].

Moreover, according to recent research from Sweden and the US, women who were pregnant or recently gave birth were more likely than women of the same age who are not pregnant to experience more serious COVID-19-related problems. Pregnant women were encouraged to prioritise COVID-19 prevention, and any barriers to following these recommendations should be addressed [5, 6]. Because maternal patients are more vulnerable to COVID-19 infection, such as having severe pneumonia (due to physiological changes in the immune and cardiopulmonary systems during pregnancy), and died more than other patients or populations, it is imperative that MHC workers have a high level of obstetric service preparedness, particularly during the COVID-19 or during other pandemics [7, 8].

Healthcare professionals worked at the front lines of the COVID-19 pandemic to identify, contain, and halt the disease's spread to deliver well-prepared obstetric services included MHC employees, such as physicians, nurses, and midwives. Therefore, risk mitigation techniques such as infection prevention and control (IPC) should efficiently be implemented to guarantee that MHC workers are protected from contracting future diseases while on the job or infections associated to healthcare. The higher infection incidence, despite the IPC's ongoing efforts, indicates that these mitigation measures fell short on all fronts and may mark a turning point in the quest to deliver well-prepared obstetric services during the COVID-19 pandemic. Weaknesses in the preparedness of obstetric services and global readiness initiatives were shown by the fact that healthcare personnel, particularly MHC workers, remained infected and served as a source of infection throughout this crucial public health period [9].

Numerous scholars have examined matters concerning the healthcare systems' readiness for COVID-19, encompassing the accessibility of obstetric treatments, particularly in underdeveloped nations with restricted resources and infrastructure. Healthcare professionals, including MHC workers, are predicted to be at higher risk of infection since they play a major role in interacting with many maternity patients and are a significant source of exposure to infected patients while in the healthcare setting. The WHO also started several online training sessions and published resources on COVID-19 in a variety of languages in order to increase preventive knowledge and tactics. These materials include training healthcare workers, especially MHC workers, in preparedness actions and increasing awareness [10–12].

Misunderstandings among MHC staff members have occasionally hindered control attempts to administer the required care, which has accelerated the development of infection in hospitals and put patients' lives in peril [13–15]. To lower the danger to MHC workers, it is crucial to evaluate the readiness of the obstetric service and to introduce screening for patients admitted to the obstetric unit. The attitude and abilities of medical professionals as well as the resources allotted to hospitals determine whether obstetric services were prepared or adequate. Concerns were also raised regarding the availability of obstetric services in underdeveloped nations to handle the COVID-19 pandemic [1].

A global cross-sectional study conducted by Semaan (2020) between March 24 and April 10, 2020, during the early stages of the pandemic, documented the experience of frontline MHC workers in 81 countries with 714 respondents, 47 percent of whom were from low- and middle-income countries (LMICs). Research indicates that a mere 33% of participants obtained COVID-19 training from their healthcare facilities, while nearly all of them sought out information about the virus independently. In contrast to 82% of respondents in high-income countries (HIC), only half of respondents in LMICs received the most recent instructions for care procedures. In general, only 47% of participants in LMICs; however, 69% in HICs thought they knew a lot about caring for COVID-19-infected maternity patients. Compared to LMICs, HIC had greater facility-level COVID-19 preparations (signage, inspection, testing, and isolation rooms). Additionally, there was a general awareness of changes in the treatment process and a decline in the regular use of maternity care services. Furthermore, 90% of respondents worldwide stated that the epidemic increased their stress levels [16].

The World Health Organisation (WHO) has released guidelines for managing COVID-19 and preserving critical health services since the Semaan study (2020). Many sub-Saharan African nations have adopted this—or practices akin to it—to improve the responsiveness of their healthcare systems [17]. Key recommendations to maximise health capacity are included in these suggestions, such as hiring more people, reusing training and skill capacity, redistributing jobs among health professionals while maintaining their safety, and offering mental

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and psychosocial support. Other research has evaluated health workers' knowledge, attitudes, and practices in relation to their preparedness to manage COVID-19; however, these studies did not examine the intricate relationships between fear, anxiety, stress, support networks, and health facility preparedness [18, 19].

In general, there are still a lot of unanswered questions regarding the recommendations for managing instances of maternity patients, particularly those who have COVID-19 infection. Therefore, the objectives of this study were to determine the level of obstetric services preparedness and its predictive factors, and to identify any differences between the previous year (the peak of the COVID-19 outbreak) and the present regarding the knowledge, awareness, attitudes of MHC workers in the government hospitals in the state of Selangor, Malaysia, during the COVID-19 pandemic.

Methods

Study design, study setting and sampling
A cross-sectional study was conducted among MHC workers (doctors, nurses, and midwives) in the Department of Obstetrics and Gynecology in all 10 government hospitals in the state of Selangor, Malaysia, between May 2022 till June 2022. Government hospitals in the state of Selangor, Malaysia, were selected in this study as the state of Selangor continued to record the highest number of COVID-19 cases in the country, with the highest number healthcare workers that have been infected with COVID-19, as well as having the highest number of deaths due to COVID-19 [3, 20].

The sample size was calculated using the Raosoft software [21], with a 5% margin of error and a 95% confidence level, based on a population size of 1,340 individuals (total MHC employees in government hospitals in Selangor at the time of this study). This calculation resulted in 299 respondents. Then, considering a 20% adjustment for expected non-responses, the sample size was increased by 60, bringing the total estimated minimum recommended sample size to 359 respondents.

A proportionate stratified random sampling method was used in this study. The proportion (percentage) of the number of respondents required from each hospital is determined by the number of their MHC workers relative to the entire target population, which is the total number of MHC workers in government hospitals in the state of Selangor, Malaysia. It determines the number of respondents representing each hospital to meet the sample size of 359 respondents (minimum recommended sample size) required for this study (Fig. 1). Following this, the selection of specific respondents from each hospital was then selected through computer-assisted random sampling

using SPSS version 28. Finally, a total of 409 respondents participated in this study.

Study tool
This questionnaire was adapted from two studies by Elhadi et al. (2020) [1, 18] which was mostly based on service preparedness checklists by WHO and CDC [22]. Some of those questions were based on a framework similar to the studies conducted earlier on infectious disease outbreaks [22–25]. Reliability for knowledge, awareness & attitude and preparedness questionnaires was determined using Cronbach alpha, which each revealed a score of 0.72 for knowledge and awareness scales, and 0.68 for attitude and the obstetric service preparedness scale respectively. This questionnaire has also been prepared in the Malay language version that was translated from the original language (the English Language).

To assess the respondent's level of obstetric service preparedness, each correct answer was assigned a score of 1, and the wrong answer was given a score of zero. The score for this 4th part was summed up for a total score of 32, which ranges from 0 to 32 (score included for answers to sub-unit questions). Those who scored ≥ 22 was considered to have a good level of obstetric service preparedness, while a score of < 22 was considered to have poor levels of obstetric service preparedness.

Data collection and data analysis
Data collection was done through dissemination of the validated questionnaire using Google form via WhatsApp application. Respondents did not need to sign in to any account to fill out this questionnaire. The questionnaire took about 20 min in average to be completed. The informed consent to participate was obtained from all the participants in the study and was completed first before proceeding to participate in the questionnaire.

The data were then analyzed by using the SPSS version 28 to explore the distribution and association between the knowledge, awareness, attitude, and obstetric services preparedness during this COVID-19 pandemic. Descriptive (frequency, mean, standard deviation), bivariate (paired t-test, linear regression analysis), and multivariate (multiple linear regression)

Results

Background of the respondents
The results showed that out of 409 respondents, majority of the respondents i.e. 403 (98.5%) were female respondents, while only 6 (1.5%) were male respondents. From these statistics, we can make the general impression that the number of female respondents was significantly greater than male respondents. There was a wide age range among respondents, with the youngest aged 23
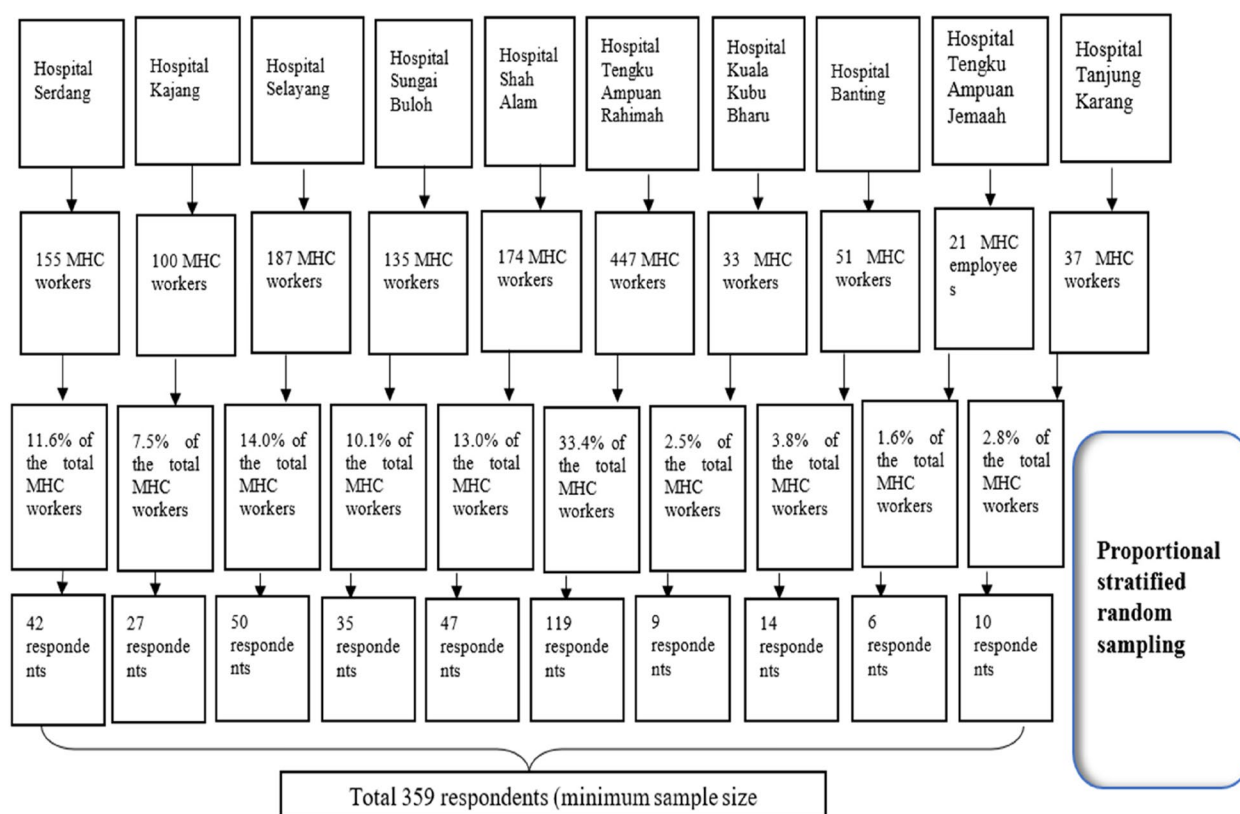
Fig. 1 Study sampling flowchart

and the oldest aged 58. The results showed that respondents aged 35–45 years showed the highest number of 199 (48.7%), followed by respondents aged < 35 years at 140 (34.2%) and respondents aged > 45 years old with 70 (17.1%). The average age of the respondents was 38.38 ± 7.17 years. In terms of profession, most respondents involved were nurses or midwives i.e. 358 people (87.6%), while the medical staffs were 33 (8.0%), followed by specialist doctors, 18 (4.4%).

For the duration aspect of working experience for the respondents, majority 380 (92.9%) respondents had more than five years of working experience while only 7.1% of respondents had less than five years of experience. There was a large range of total hours worked (in a week) among respondents with a minimum of 40 h up to a maximum of 145 h. Most of the respondents (65.0%) worked more than 45 h a week. The average number of hours respondents worked in a week was 50.19 ± 12.38 h.

The results also showed that in the previous year, which only 243 people (59.4%) felt confident and prepared to manage and treat COVID-19 patients, while only 113 people (27.6%) felt slightly confident. In addition, only 5.6% of respondents felt very confident in managing and treating COVID-19 patients, while 7.3% of respondents

felt unconfident. As for the current time, majority of 271 respondents (66.3%) felt more confident and prepared in managing and treating COVID-19 patients, and 73 (17.8%) of them felt very confident. Only 15.4% of respondents felt slightly more confident, and very few (0.5%) of them still felt unconfident in managing and treating COVID-19 patients at the current time (Table 1- in supplement).

Knowledge and awareness of MHC workers during the COVID-19 pandemic

The results showed that the majority 407 (99.5%) respondents knew the symptoms of COVID-19 infection, 381 (93.2%) of them knew the latest information on the definition of cases for COVID-19 infection, 406 (99.3%) of them knew how to use PPE correctly in the event of exposure to COVID-19 infection currently, and 404 (98.8%) of them knew how to properly wash their hands and practised hand hygiene care in line with WHO and CDC guidelines currently. However, only 37.4% of respondents knew the main type of treatment for COVID-19 infection and only 40.3% of respondents knew the most common way of spreading COVID-19

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infection. In addition, only 34.7% of respondents knew how to reduce the risk of COVID-19 infection (Table 2- in supplement).

The mean score for knowledge and awareness factors is 14.20 ± 1.66 (total score = 17). Majority 378 (92.2%) respondents had good level of knowledge and awareness regarding COVID-19 pandemic (Table 5- in supplement).

Attitude of MHC workers towards COVID-19 pandemic

The results showed that during the previous year, majority of the respondents i.e. 305 (74.6%) respondents had increased in stress level, 321 (78.5%) respondents felt very tired from work caused by the COVID-19 pandemic, 254 (62.1%) respondents felt fear of contracting COVID-19 which could hinder their ability to provide quality obstetric health services, and 277 (67.7%) respondents felt stigmatized by the community. However, only half of the respondents (50.1%) felt protected from COVID-19 infection in their workplace, and only 58.2% felt ready to manage the COVID-19 pandemic.

Meanwhile, at the present time, majority 307 (75.1%) respondents felt more protected from COVID-19 infection at their workplace, and 384 (93.9%) felt ready to manage the COVID-19 pandemic. However, currently 32.3% of respondents still felt their stress level increasing, 36.9% of respondents felt their work as healthcare workers were still getting stigmatized from the community, and 31.3% of respondents still felt very tired or burnout from work caused by the COVID-19 pandemic (Table 3- in supplement).

The mean score for the attitude factor is 8.17 ± 2.87 (total score = 15). Only about half (54.0%) of the respondents had a positive attitude towards COVID-19 (Table 5- in supplement).

Obstetric services preparedness during the COVID-19 pandemic

The findings showed that during the previous year, majority 377 (92.2%) respondents said that they had been informed by the hospital/obstetric unit administration regarding the protocol for triage and isolation for suspected COVID-19 cases, 389 (95.1%) respondents said that they have been informed regarding the isolation procedures, and 391 (95.6%) respondents said that their hospital/obstetric unit provided isolation room for suspected or confirmed COVID-19 cases for maternity patients. In addition, 326 (79.7%) respondents said they knew how to report potential cases for COVID-19 and be ready to do so, 85.8% of them said they knew the protocol that need to be done if they have any signs

of contracting COVID-19, and 76.8% of them said they knew how to make an assessment for a patient who is under investigation.

However, 22.5% of respondents said that there were no training courses for COVID-19 management been given, 26.9% of them said that there were no dedicated teams provided by the hospital/obstetric unit in the management and treatment of pregnant/maternity mothers who have COVID-19, 11.0% of them said obstetric emergency services (surgical room for Caesarean section surgery/ any obstetric emergency surgery/procedure) were not available for maternity patients for suspected or confirmed cases of COVID-19, and 11.5% of them said that they were not sure that their hospitals/ obstetric units were prepared to manage COVID-19 pandemic.

Meanwhile, at the present time, majority 393 (96.1%) respondents said that currently they have been informed by their hospitals/obstetric units regarding the protocol for triage and isolation for suspected COVID-19 cases and 96.8% of them said that they have been informed regarding the isolation procedure. In addition, majority 397 (97.1%) respondents said that currently their hospitals/obstetric units provided isolation rooms for suspected or confirmed COVID-19 cases for maternity patients, and 83.1% of them said that obstetric emergency services (surgical room for Caesarean section surgery/ any obstetric emergency surgery/procedure) were available for maternity patients for suspected or confirmed cases of COVID-19.

Moreover, majority 378 (92.4%) respondents said that currently they knew how to report potential cases for COVID-19 and were ready to do so, 96.3% of them knew the protocol that need to be adhered to if they had any signs of contracting COVID-19, 86.8% of them knew the safety measures for aerosol transmission for maternity patients infected with COVID-19, 93.9% of them knew how to make an assessment for a patient who was under investigation, and 95.6% of the respondents were sure that their hospitals/obstetric units was prepared to manage the COVID-19 pandemic currently. However, there were 119 (29.1%) respondents said that there were no training courses for COVID-19 management been given, and 29.6% of them said that there were no dedicated teams provided by the hospital/obstetrics unit in the management and treatment of pregnant/maternity mothers who have COVID-19 (Table 4- in supplement).

The mean score for obstetric service preparedness is 25.93 ± 4.87 (total score = 32). Majority 362 (88.3%) respondents had good level of obstetric service preparedness during the COVID-19 pandemic (Table 5- in supplement).

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Relationship between background of respondents, knowledge, awareness, attitudes, and obstetric services preparedness

A paired t-test was done to identify any significant differences between previous one year ago (the peak time of the COVID-19 pandemic) and the present time for MHC workers' knowledge and awareness factor, attitudes factor, and obstetric services preparedness during the COVID-19 pandemic.

The findings showed significant differences ($p < 0.05$) between the previous one year (the peak time of the COVID-19 pandemic) and the current time for the following factors which were: 1) knowledge of proper use of PPE in the event of exposure to COVID-19; 2) adequate preparation of PPE in the obstetric unit; 3) adequate provision of soap, water and disinfectants for health workers, patients, and visitors in the obstetric unit; 4) adequate provision of adequate face masks for health workers, patients, and visitors in the obstetric unit; 5) increased level of self-stress; 6) feeling protected from COVID-19 infection at work; 7) work as a health worker who gets stigma from society; 8) always feeling very tired from work caused by the COVID-19 pandemic; 9) feeling ready to manage the COVID-19 pandemic; 10) knowledge of the protocols to be made in case of any signs of contracting COVID-19; and 11) knowledge of safety measures for aerosol transmission for maternity patients infected with COVID-19 (Table 6- in supplement).

Linear regression analysis was done to look at predicting factors that have the potential to influence the level of obstetric services preparedness. The confidence interval (CI) was set at 95% and the *p*-value < 0.05 was set as statistically significant. Before conducting a multiple linear regression (MLR) test, all factors or variables went through a simple linear regression test by using the 'Enter' method. Following that the MLR test was conducted using the '*Forward*', 'Backward' and 'Stepwise' methods. For the last model, the 'Stepwise' method was selected.

The results showed that there were significant direct linear relationships ($p < 0.001$) between: 1) the work duration factor with obstetric services preparedness (B = −1.721, 95% CI: −3.392, −0.050, $p < 0.001$); 2) knowledge and awareness factor with obstetric service preparedness (B = 0.926, 95% CI: 0.666, 1.185, $p < 0.001$); 3) attitude factor with obstetric services preparedness (B = 0.463, 95% SK: 0.313, 0.613, $p < 0.001$) (Table 7 and 8).

This means that respondents who have one more year of work duration will have a higher obstetric service preparedness score of 1.721, respondents who have one more point for knowledge and awareness score will have a higher obstetric service preparedness score of 0.926,

and respondents who have one more point for the attitude score will have a higher obstetric service preparedness score of 0.463. Therefore, the longer the work duration, the more knowledge and awareness they had, and the more positive their attitude towards the COVID-19 pandemic, the more prepared they were to provide obstetric services.

The adjusted value of R^2 for this test was 0.188. This suggests that 18.8% of the variance in obstetric service preparedness can be predicted from working duration factor, knowledge, and awareness factor as well as attitude factor. Additionally, no interaction between these three factors was found. The variant-inflation factor (VIF) was less than 10, indicating that multicollinearity was not a problem in this model.

However, for other factors such as age, gender, profession, number of hours worked per week, total number of shifts in a month, place of work, information resources, history of previous pandemic experiences, and confidence in the management of the COVID-19 pandemic showed a *p*-value of more than 0.05. Therefore, there was no provable relationship or association between these factors and the level of obstetric services preparedness.

Discussion

COVID-19 infection has put the health system under unprecedented pressure. Therefore, foresight and planning for service preparedness are key factors to avoid disaster. Every facility that provides obstetric services requires a certain level of readiness to be able to handle at least a suspected COVID-19 pregnant woman waiting for a test report, and for those who need to be managed as COVID-19 positive patients until a report is available. Therefore, these facilities need to have triage or screening areas and isolation rooms for suspected COVID-19. Healthcare facilities need to have designated areas for COVID-19 positive patients or have a referral relationship with a designated COVID-19 positive hospital. Preparations are needed including structural restructuring by providing facilities for suspected COVID-19 and COVID-19-positive maternal patients in sufficient spaces, as well as extensive training among MHC workers on infection control practices and proper use of PPE [18].

In this study, a majority 88.3% of the respondents had a good level of obstetric services preparedness during the COVID-19 pandemic. This percentage was higher than in the study conducted by Afulani et al. (2020) where only 27.8% of respondents had a good level of service preparedness [26], as well as in the study by Elhadi et al. (2020) of which only 7.8% of respondents had a good level of obstetric services preparedness [18]. The mean score for obstetric services preparedness in this study was 25.93 ± 4.87. This score was slightly higher than in a study

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by Afulani et al. (2020) with the mean score of 24 ± 8.9 [26].

COVID-19 pandemic management training

Only 62.3% of respondents in this study stated that they received a training course for the management of the COVID-19 pandemic. This can also be seen in studies by Afulani et al. (2020) and Elhadi et al. (2020) which stated just over half (54% and 56% respectively) of respondents were able to participate in training for COVID-19 case management [18, 26]. Similarly, a study by Huy et al. (2021) found that out of 17,302 healthcare workers, less than half of the respondents which was only 6,287 people (36.6%) were able to participate in training for COVID-19 management [27]. Similar reports from studies in India also show that only about half (56.1%) of respondents received COVID-19-related training and < 50% were satisfied with the quality of training [28].

If more training was given to healthcare workers including MHC workers in preparation for the pandemic as advised by WHO, this will contribute to more trained workforce and better services readiness [28]. To ensure adequate resources and staff, it is necessary to rapidly train many healthcare workers including MHC workers who are at the forefront. Ideally, training and education in preparation for the threat of new infectious diseases should continue and be meticulously planned. Specialized training in equipping healthcare workers including MHC workers with knowledge and skills is necessary to provide safer and better care for patients, to reduce mortality during the pandemic and to prevent and control nosocomial infections [29, 30].

Although there are key capacities considered in the evaluation for this study, the current COVID-19 pandemic has highlighted the need to increase the number of healthcare workers including sufficiently trained MHC workers. There is still an urgent need for best practices in the development and implementation of training programs during this COVID-19 pandemic [31].

Screening, procedures, and isolation rooms

In this study, most respondents stated that they had been informed by their hospitals/obstetric units about protocols for screening and isolation procedures for suspected COVID-19 cases (96.1% and 96.8% of respondents respectively). Compared to previous one year which only 67.7% of respondents stated that isolation rooms for suspected or confirmed COVID-19 cases were provided for maternity patients, currently majority (97.1%) of respondents reported an increase in the provision of this facility.

Meanwhile, in the study by Elhadi et. al (2020) showed that only about 63% of respondents reported that they had isolation procedures, only 43% of hospitals had screening or screening areas for cases of pregnant women suspected of COVID-19, and only 63.8% and 61.5% of respondents stated there were isolation rooms for suspected COVID-19 cases and screening procedures for maternity patients with COVID-19 symptoms respectively [18]. Whereby in the study by Afulani et al. (2020), only 76% of respondents knew how to report suspected COVID-19 cases and only two-thirds reported that they had isolation wards for COVID-19 cases at the health facility [26].

Based on the findings of this study, as for screening measures, majority 92.4% of respondents knew how to report potential cases for COVID-19 and were ready to do so compared to previous one year which was only 79.7%. Majority (96.3%) of respondents also knew what protocols to do if they had signs of contracting COVID-19 and 93.9% of respondents said they knew how to make an assessment for patients under investigation (PUI). The study by Afulani et al. (2020) also found that a majority 80% of the respondents reported that their health facilities had protocols for screening for potential COVID-19 patients [26].

However, this contrasts with a study by Elhadi et al. (2020) in which only two-thirds of respondents (66.7%) reported they knew what to do if they suspected a patient might have COVID-19, only as many as 22% said they knew how to manage confirmed COVID-19 cases, and only a third of respondents (32.8%) were sure about where to quarantine at home without contact with their family [18].

In addition, 45.1% of doctors and 37.0% of nurses were not ready to manage cases that had signs and symptoms of COVID-19 infection. There were only 21.2% of doctors and 23.9% of nurses who knew the criteria for evaluating people investigated for COVID-19 infection, and only 25.0% of doctors knew how to report potential COVID-19 cases. This can lead to an unexpected increase in undiagnosed cases, thus increasing the burden of infection in the community. This situation can highlight the risk of cross-contamination in hospitals and can lead to higher rates of hospital-acquired infections [18].

Moreover, in this study, majority (86.8%) of respondents were aware of safety measures for aerosol transmission for maternity patients infected with COVID-19. Meanwhile, in the study by Elhadi et. al (2020) showed that only about 67.0% of respondents were not prepared to take safety precautions to prevent the transmission of aerosols through individuals suspected of COVID-19 infection, and only about 68% of the participants were aware of measures to prevent the transmission of the COVID-19 virus [18].

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These issues raised fears and concerns over the safety of healthcare workers including MHC workers and their ability to access safety measures as well as question the ability of the healthcare system to prevent hospital-acquired infections. Hospitals can also be contagious sites that spread COVID-19 infections into communities and healthcare workers had the potential to transmit the infection to family members at home [32].

Obstetric emergency services and dedicated teams for obstetric services

For obstetric emergency services which include the operating room for Caesarean section or any obstetric emergency procedure, in this study it was found that more than 80% of respondents stated that it was provided for maternity patients for suspected or confirmed cases of COVID-19. This is in line with the results of a study by Elhadi et al. (2020) in which 81.0% of respondents thought that they could provide care for obstetric emergency cases and 89.1% of respondents stated that their health facilities could perform cesarean section [18].

As for the dedicated team in the management and treatment of pregnant women, in this study showed only over 60% of the respondents said it was provided by their hospitals/obstetric units. However, the results of the study by Elhadi et. al (2020) showed as many as 70.1% of respondents reported that there was no dedicated team that was designated to treat patients with COVID-19 in the maternity ward [18].

Relationship between significant factors with obstetric services preparedness

In this study, majority or 380 (92.7%) respondents had more than 5 years of working experience. It differs from the study by Elhadi et al. (2020) where only about half of respondents (53.4%) had more than 5 years of working experience [18], as well as in a study by Huynh et al. (2020) where most of them had less than 5 years (62.9%) experience [33].

The findings of this study through multiple linear regression conducted showed that the working duration factor showed a statistically significant direct linear relationship ($p < 0.05$) with obstetric services preparedness. This is because the more time the respondents' work experience had, the more prepared they will be to provide good obstetric services during the COVID-19 pandemic. This was equivalent to a study by Zewudie et al. (2021) that showed the working duration factor had a statistically significant relationship with service preparedness during COVID-19 ($p < 0.001$). The findings in the study also showed that having more than five years of working experience is one of the factors (which independently and significantly) predicts readiness to work (AOR = 4.04, CI:

1.05–15.58) [34]. This was different from the results of studies by Elhadi et al. (2020) and study by Huynh et al. (2020) in which this factor was not statistically significant ($p > 0.05$) [18, 33].

Recent studies of knowledge, attitudes and practices or preparedness about COVID-19 reported considerable level of knowledge and positive attitudes contributing to good services preparedness in some countries [33–37]. In other studies, such as from the previous H1N1 outbreaks, knowledge was found to correlate strongly with practice scores or preparedness and attitudes [38]. Interestingly, the same study found that higher knowledge scores were a significant predictor of higher practice scores or preparedness. It was also found that higher knowledge was also a significant predictor of higher attitude scores. This data demonstrates the importance of having sufficient knowledge to be able to provide optimal patient care and good service preparedness.

Based on the findings of this study, knowledge and awareness factors had a mean score of 14.20 ± 1.66 (total score = 17) and majority 92.2% of respondents had good level of knowledge and awareness. Similarly in a study by Huynh et al. (2020) in which a total of 327 eligible healthcare workers had a mean knowledge factor score of 8.17 ± 1.3 (range 4–10) and as many as 289 (88.4%) respondents showed good level of knowledge [33]. This may be due to the success in communication for the prevention and control of COVID-19 in the state of Selangor which contributes to the improvement of knowledge and practices for healthcare workers including MHC workers.

Before an effective approach to supporting healthcare workers including MHC workers can be developed, it is important to understand the source of their concerns and fears in detail. This means that focusing more on addressing those concerns should be the focus of support efforts, rather than teaching generic approaches to stress reduction or resilience.

Additionally, this discussion has consistently focused on eight sources of concern, namely: 1) access to appropriate PPE; 2) being exposed to COVID-19 at work and bringing infection home to their families; 3) not having quick access to tests if they experience COVID-19 symptoms and at the same time fear of spreading infection at work; 4) uncertainty that their organization will support/care for their personal and family needs if they are infected with the infection; 5) access to childcare during working hours due to increased school closures; 6) support for other personal and family needs as working hours and demand increase (food, hydration, accommodation, transportation); 7) wether they can be provided with efficient knowledge of medical care if placed in a new area (for example, not an ICU nurse but need to function as an ICU nurse); and 8) lack of access to

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the latest information and communications. Recognizing the source of these concerns can enable leaders and healthcare organizations to develop targeted approaches to address these concerns and provide specific support to their healthcare workforce [39].

As there were significant differences ($p < 0.05$) between previous one year (the peak time of the COVID-19 pandemic) and the present time of this study for many factors in this study, various efforts need to be made continuously to ensure improvement in knowledge, awareness, and attitudes for MHC workers so that they can always be prepared in providing good obstetric services especially during an outbreak or pandemic.

Therefore, several recommendations are proposed, which are: 1) to provide regular educational courses for the knowledge of the correct use of PPE in the event of exposure to COVID-19; 2) to always ensure adequate supply and preparation of PPE in the obstetric unit; 3) to always ensure adequate supply and preparation of soap, water and disinfectants for health workers, patients, and visitors in the obstetric unit; 4) to always ensure adequate supply and preparation of masks for health workers, patients, and visitors in the obstetric unit; 5) to provide counselling or psychiatric services and perform peer group support for MHC workers who experience increased levels of stress, work fatigue and depression. MHC workers are also advised to take self-care measures to create a healthy and cheerful work culture such as working effectively as a team to ease the burden of tasks, building good relationships between colleagues and family members, ready to share and listen to views and advice in case of problems, practice exercise and breathing control techniques to reduce stress, and get enough rest and practice a balanced diet; 6) to ensure that all safety measures and SOPs are carried out carefully in all parts and levels in the hospital so that MHC workers feel protected from COVID-19 infection at work; 7) to increase and expand awareness campaigns to the community through various mass media so that jobs as health workers are less stigmatized from the community; 8) adopting the concept of regular rounds of work (Job Rotation) and reducing the number of hours and shifts worked so that MHC workers feel less tired and burn-out from work caused by the COVID-19 pandemic; 9) to always provide effective training and continuous education as well as the need for adequate equipment so that MHC workers can feel better prepared to manage the COVID-19 pandemic; 10) to provide ongoing and up-to-date information from the management of facilities and obstetric units to the MHC workers on the protocols and safety measures to reduce aerosol transmission from maternity patients infected with COVID-19.

There were several limitations identified that arose during this study, which were: 1) The data collection period was relatively short (two months); 2) In this study, previous mental health history was not measured. This decision was made to respect the privacy of MHC workers. As a result, this study lacks pre-COVID-19 data to compare the stress, anxiety, and work fatigue levels before the pandemic in relation to the attitudes towards the COVID-19 outbreak; and 3) This was a cross-sectional study conducted online among MHC workers after nearly two years since the COVID-19 pandemic commenced. Furthermore, the data presented in this study were self-reported and partially reliant on the honesty of the participants and their ability to recall. Therefore, the results may be subject to recall and measurement bias. Despite these limitations, the findings of this study provide valuable information on the knowledge, awareness, and attitudes of MHC workers regarding COVID-19, as well as their level of preparedness to provide obstetric services during the pandemic.

Conclusions

Overall, the mean of total score and the level of obstetric services preparedness found from this study was high. Majority of the respondents had good knowledge (99.5%) and awareness (96.8%), as well as a good level of obstetric services preparedness (96.8%). However, only about half of them had a positive attitude towards COVID-19 (54.0%). Among all the factors involved in this study, there were three predictors that influenced the level of obstetric services preparedness, namely the working duration factor, knowledge, and awareness factor about COVID-19 and attitude factor towards the COVID-19 pandemic. Based on the findings of this study, we proposed several recommendations that are considered appropriate for this study to increase the knowledge and awareness of MHC workers, as well as a positive attitude, so that they can provide better and more optimal obstetric services in the future pandemic/outbreak, considering that as there were still MHC workers with poor knowledge and awareness of COVID-19 and about half of them had negative attitude towards the COVID-19 pandemic.

Abbreviations
WHO	World Health Organisation
CDC	Centers for Disease Control and Prevention
COVID-19	Coronavirus Disease 2019
MHC	Maternal Healthcare
IPC	Infection Prevention and Control
PPE	Personal Protective Equipment
HIC	High-Income Countries
LMICs	Low- and Middle-Income Countries
SOPs	Standard Operating Procedures

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Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12884-025-07474-7.

Additional file 1.

Additional file 2.

Data availability

The dataset analyzed in this study is available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The informed consent to participate was obtained from all the participants in the study and was completed first before proceeding to participate in the questionnaire.The permission to perform this study was sought from the Selangor State Health Department, and the study proposal was approved by the Medical Research and Ethics Committee, Ministry of Health, Malaysia (NMRR ID-21–02291-DV9) and the Ethics and Research Committee of Universiti Kebangsaan Malaysia (The National University of Malaysia) (Project code: FF-2021–347). Before any data being collected at each of the hospitals, permission was also obtained from the hospital's Director, Clinical Research Centre (CRC) officer, and the Head of the Obstetrics & Gynecology Department.

Competing interests

The authors declare no competing interests.

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