# Awareness and preparedness of healthcare workers for the initial wave of COVID-19 in Aotearoa New Zealand

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## ABSTRACT

**AIMS:** The TMGH-Global COVID-19 Collaborative was a multinational, multicentre, cross-sectional survey assessing the awareness and preparedness of healthcare workers (HCWs) during the first wave of the pandemic across 57 countries. Here, we report the results from Aotearoa New Zealand.

**METHODS:** This cross-sectional survey was conducted at Christchurch Hospital between February and May 2020. Data were collected from a convenience sample of HCWs and analysed using descriptive and multivariate regression to determine awareness (out of 40) and preparedness (out of 15) scores and influencing factors.

**RESULTS:** Of the 158 participants (response rate 20.8%), most were women (73%) and doctors (58%) with a median age of 38 years (interquartile range [IQR] 29–49). The median awareness and preparedness scores were 33.6 (IQR 31.1–35.1) and 8 (IQR 6–8), respectively. Mainstream media was the primary source of information on COVID-19 among HCWs. The awareness score was significantly affected by gender and profession, whereas the preparedness score was influenced by age, profession, clinical experience duration and COVID-19 training.

**CONCLUSIONS:** Although frontline HCWs had high awareness levels, preparedness was low. Variables influenced awareness and preparedness differently. These findings identified gaps in pandemic readiness and factors that can be leveraged to enhance future pandemic preparedness and response in New Zealand.


Coronavirus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The spread of the COVID-19 virus is attributed to waves of community transmissions.[1–3] Healthcare workers (HCWs) were at especially high risk due to their heightened exposure to individuals infected with the virus.[4,5]

During the initial wave of COVID-19 in China, around 4% of COVID-19 patients were HCWs,[6] whereas 2020 Ministry of Health data reported approximately 11% of Aotearoa New Zealand COVID-19 cases were HCWs.[6,7] The COVID-19 pandemic has contributed immensely to the physical, mental and emotional exhaustion of HCWs, placing significant strain on the New Zealand healthcare system.[8,9] The emergence of COVID-19 variants of concern has further compounded this strain.[10] The repercussions of this strain on HCWs and the healthcare system continue to be experienced 4 years after the onset of the global COVID-19 pandemic.[11]

It remains imperative to foster COVID-19 awareness and preparedness among HCWs to prevent and reduce transmission in healthcare facilities and safeguard the workforce. This continues to be important as we approach the tail-end of the COVID-19 pandemic to ensure continued vigilance and readiness for potential future infectious viral pandemics, thereby safeguarding the healthcare workforce.[12]

This study presents a sub-analysis of the TMGH-Global COVID-19 Collaborative, a multinational, multicentre, cross-sectional survey that examined COVID-19 awareness and preparedness among HCWs during the first wave of the pandemic (February–May 2020), which recruited 371 hospitals across 57 countries.[13] This study aimed to examine in detail the data collected at Christchurch Hospital, with a particular focus on early pandemic awareness and preparedness to further inform future pandemic preparedness and planning in New Zealand.[12]

## Methods

### Ethical approval

Māori consultation was conducted, and ethical approval was obtained from the University of Otago Human Ethics Committee (D20/063).

### Study design

This was a cross-sectional, descriptive study using a questionnaire survey and convenience sampling approach. Data collection was conducted at Christchurch Hospital, New Zealand.

### Data collection

Data acquisition was conducted at Christchurch Hospital as part of a multicentre, international, cross-sectional study examining COVID-19 awareness and preparedness among HCWs during the first wave.[13] Data collection spanned from February to May 2020.

All COVID-19 frontline HCWs were invited via email to participate in this study by completing an online survey. Inclusion criteria were all healthcare professionals working at Christchurch Hospital who were actively engaged in the provision of patient care and the management of individuals with suspected COVID-19 cases. Informed written consent was embedded into the initial page of the survey. Before commencing the survey, participants were provided with a description of the study. Potential participants were sent an email with a participant information sheet, and signified consent by clicking a link embedded in the document. Participants maintained the right to withdraw their consent at any point during the data collection period.

### Survey

The development, testing, validation and content of the final survey questionnaire are reported in detail in the parent study.[13] In brief, the survey was divided into two sections (32 questions in total). The first section (six questions) collected data related to HCWs' demographic and professional information. The second section (26 questions) comprised items related to participant awareness and preparedness for COVID-19. The awareness and preparedness questions were based on the most up-to-date United States Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) information and checklists.[13,14,15] The last question solicited suggestions on improving overall pandemic preparedness. The awareness score represented the sum of accumulated points over four topics with a maximum of 40. The preparedness score was the number of points accumulated based on responses from 15 questions (maximum score of 15). The English version of the survey questionnaire is available here.[13]

### Statistical analysis

Participants' characteristics were summarised using median and interquartile ranges (IQR) for numeric variables, and the number of participants and percentages for categorical variables were tabulated. A multilevel linear regression model was used to evaluate associations between variables that differed within the locality of this study (Christchurch Hospital). We generated a mean difference (MD) with 95% confidence intervals (95% CI) and p-values. As all questions were answered within these variables, a complete case method was used in our multilevel linear regression. MDs were compared to those from the parent study. The effect of COVID-19 training on awareness and preparedness scores was examined using a scatter plot. Data were analysed using SPSS Statistics (IBM SPSS Statistics for Windows, version 27, 2023), and R gpront (version 4.3.1) was used to produce the scatter plot.

## Results

### Demographics

A total of 158/761 HCWs returned completed surveys (response rate: 20.8%). Of these, 73% were women and 58% were doctors. The median (IQR) age of participating HCWs was 38 (29–49).

### Workplace characteristics and sources of COVID-19 information

Participants had a median of 10 years of work experience in their respective fields (IQR 4.2–24.3 years). The largest represented hospital department among respondents was the emergency department (n=28, 17.7%). However, there was a large number of respondents from other departments including pharmacy, physiotherapy and occupational health. Around 41% (n=65) of HCWs reported prior infectious outbreak experience, and only two (1.3%) participants had experience in treating a COVID-19 case at Christchurch Hospital at the time of the survey (Table 1).

Mainstream media (n=149, 94.3%) was the primary source of COVID-19 information among respondents, followed by government organisations (n=124, 78.5%) and work colleagues (n=100, 63.3%). Nearly half (46.8%) of respondents relied on social media websites and applications as their primary sources of COVID-19 information. At the time of the survey, only 22 (13.9%) respondents had participated in a COVID-19 training course

**Table 1:** Socio-demographic and work characteristics of participants (n=158).

| Characteristics | N (%) |
|---|---|
| **Socio-demographic** | |
| **Age**, years* (n=157) | 38 (29–49) |
| **Gender** | |
| Women | 116 (73.4%) |
| Men | 42 (26.6) |
| **Profession** | |
| Doctor | 92 (58.2%) |
| Nurse | 33 (20.9%) |
| Pharmacist | 7 (4.4%) |
| Other | 26 (16.5%) |
| **Work experience and workplace** | |
| **Work experience**, years* (n=157) | 10 (4.2–24.3) |
| **Hospital department** | |
| Emergency department | 28 (17.7%) |
| Intensive care unit | 15 (9.5%) |
| Outpatient clinics | 18 (11.4%) |
| Infectious disease department | 2 (1.3%) |
| Respiratory department | 15 (9.5%) |
| Other | 90 (57.0%) |
| **Previous outbreak experience** | |
| Any outbreak | 65 (41.1%) |
| SARS | 33 (20.9%) |
| MERS | 7 (4.4%) |
| Bird flu | 30 (19.0%) |
| Other outbreaks | 0 (0%) |
| **Confirmed SARS-CoV-2 cases** | |
| No | 2 (1.3%) |
| Yes, in my country | 155 (98.1%) |
| Yes, in my hospital | 1 (0.6%) |

*Reported as median and interquartile range.

**Table 2:** Sources of COVID-19 information.

| Variable (n=158) | N (%) |
|---|---|
| **Sources of information about COVID-19** | |
| Mainstream media (e.g., newspaper, television, radio, etc.) | 149 (94.3%) |
| Social networks/media (e.g., Facebook, Twitter, blog, etc.) | 74 (46.8%) |
| Academic training course | 11 (7.0%) |
| Colleagues | 100 (63.3%) |
| Government organisations (e.g., Ministry of Health) | 124 (78.5%) |
| Other | 5 (3.2%) |
| **Participated in a COVID-19 course** | 22 (13.9%) |
| **How satisfied you are with the medical equipment in your hospital** | |
| Very unsatisfied | 9 (5.7%) |
| Unsatisfied | 28 (17.7%) |
| Neutral | 57 (36.1%) |
| Satisfied | 48 (30.4%) |
| Very satisfied | 12 (7.6%) |
| **To what extent do you have confidence in handling suspected COVID-19 patients?** | |
| Not at all | 17 (10.8%) |
| To little extent | 32 (20.3%) |
| To some extent | 80 (50.6%) |
| To considerable extent | 23 (14.6%) |
| To great extent | 3 (1.9%) |

(Table 2). Overall, 23.4% (n=37) were unsatisfied with the availability of medical equipment required for COVID-19 management. The majority of HCWs had some degree of confidence in handling suspected COVID-19 cases while only 10.8% (n=17) had no confidence (Table 2).

## COVID-19 awareness and preparedness scores

All respondents completed the questions pertaining to the COVID-19 awareness and preparedness score sections. The median awareness score was 33.6 out of a possible 40 (IQR 31.1–35.1), with a mean (standard deviation [SD]) of 32.4±4.6. The median preparedness score was 8 out of a possible 15 (IQR 6–8), with a mean of 8.4±3.4.

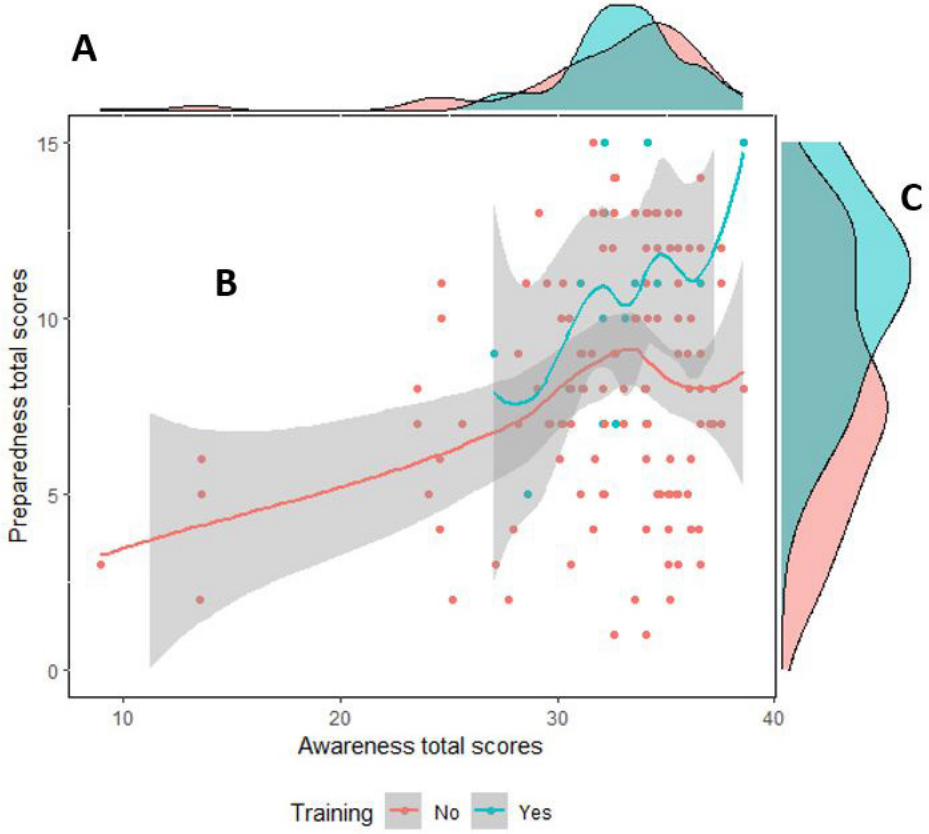
The awareness score was affected by several demographic variables (Table 3). Men had higher awareness scores compared to women, albeit with marginal statistical significance, (MD 1.645; CI=0.33–3.258; p=0.046). The other HCW category (n=26) had a significantly reduced awareness score compared to doctors (MD -5.129; -6.958–-3.229; p<0.001).

There was a significant increase in participant preparedness score with every 10-year increase in age (MD 0.663; CI=0.212–1.114; p=0.004) as

**Table 3:** Multilevel models for preparedness and awareness scores of participating healthcare workers.

| Variable | Local analysis (Christchurch Hospital) | | | Parent study | | |
|---|---|---|---|---|---|---|
| | MD | (95% CI) | p | MD | (95% CI) | p |
| **Awareness** | | | | | | |
| **Gender** | | | | | | |
| Women | Reference | | | Reference | | |
| Men | 1.645 | 0.33–3.258 | 0.046 | -0.02 | -0.19–0.15 | 0.791 |
| Age (10-year increase) | -0.149 | -0.760–0.463 | 0.632 | -0.16 | -0.34–0.01 | 0.068 |
| **Profession** | | | | | | |
| Doctor | Reference | | | Reference | | |
| Nurse | -0.424 | -2.092–1.245 | 0.617 | -1.97 | -2.16–-1.78 | <0.001 |
| Other | -5.129 | -6.958–-3.229 | <0.001 | -2.24 | -2.69–-2.19 | <0.001 |
| **Experience** (10-year increase) | 0.016 | -0.576–0.609 | 0.956 | 0.06 | -0.13–0.25 | 0.547 |
| **Previous outbreak experience** (Yes) | 0.389 | -1.067–1.854 | 0.601 | 0.49 | 0.33–0.66 | <0.001 |
| **COVID-19 training** (Yes) | 0.888 | -1.192–2.968 | 0.400 | | | |
| **Preparedness** | | | | | | |
| **Gender** | | | | | | |
| Women | Reference | | | Reference | | |
| Men | 0.346 | -0.886–1.577 | 0.580 | 0.35 | 0.23–0.47 | <0.001 |
| **Age** (10-year increase) | 0.663 | 0.212–1.114 | 0.004 | 0.40 | 0.28–0.53 | <0.001 |
| **Profession** | | | | | | |
| Doctor | Reference | | | Reference | | |
| Nurse | 0.346 | -0.886–1.577 | 0.580 | 0.66 | 0.54–0.81 | <0.001 |
| Other | -2.388 | -3.397–-0.979 | 0.001 | -0.86 | -1.13–-0.39 | <0.001 |
| **Experience** (10-year increase) | 0.731 | 0.299–1.163 | 0.001 | 0.10 | -0.03–0.24 | 0.136 |
| **Previous outbreak experience** (Yes) | 0.121 | -0.989–1.227 | 0.830 | 0.56 | 0.44–0.67 | <0.001 |
| **COVID-19 training** (Yes) | 2.66 | 1.146–4.177 | <0.001 | | | |

**Figure 1:** Two multivariate cowplots illustrating the effect of training on COVID-19 preparedness and awareness. Part A illustrates the distribution of awareness scores. Part B shows individual total scores of preparedness and awareness. The centre lines were computed using LOESS method with the shadow representing their 95% confidence intervals. Part C illustrates the distribution of preparedness scores (n=158).




well as every 10-year increase in professional experience (MD 0.731; CI=0.299–1.163; p=0.001). HCW type had a significant effect on preparedness score with the Other category (n=26)—containing, for example, pharmacists, physiotherapists and other allied health professionals—and had a significantly reduced score compared to doctors (MD -2.388; CI=-3.397–-0.979; p=0.001).

Although receiving COVID-19 training was associated with higher preparedness scores (MD 2.66; CI=1.146–4.177; p<0.001), awareness scores were not influenced by COVID-19 training status (Table 3). Awareness and preparedness scores of participating HCWs were positively correlated (Figure 1; Pearson correlation r=0.254; p=0.001).

## Discussion

### Summary of main findings

In this study, we provide evidence pertaining to the preparedness and awareness of COVID-19 in Christchurch Hospital during the initial wave globally and before the first major New Zealand outbreak.[10] Despite the low levels of previous outbreak experience, COVID-19 training and experience in treating COVID-19 cases within the cohort, most participants had some degree of confidence in handling suspected COVID-19 patients. A large proportion of respondents were unsatisfied or neutral towards availability of COVID-19 equipment. Social media was a common source of COVID-19 information among HCWs. Among the participants the awareness score was high; however, the preparedness score was low compared with the parent study.[13] The awareness score was affected by gender and profession, whereas preparedness was influenced by age, profession, clinical experience duration and COVID-19 training.

## Strengths and limitations

This study was conducted in the first international wave of COVID-19 and provides early insight from front-line staff during a novel viral pandemic. An additional strength was that this study was a part of a global multicentre study, allowing for comparison of locally collected data with other countries of varying healthcare systems and experiences.

The study's survey was developed based on CDC information on SARSCoV-2 and COVID-19 in the early stages of the pandemic. Much of the COVID-19 information and data provided then by the CDC have changed to due to new knowledge, understanding and studies. The information from the CDC was known to be true during the first wave of the pandemic.[14]

This study was also done at one single major hospital in New Zealand, with specific local demographics of both the public and HCWs. Thus, generalisability to other hospitals and healthcare settings in New Zealand is limited, especially rural areas. The single-centre nature of this study also limited the sample size to a comparably low number. Additionally, the survey may be affected by recall and selection bias, as participants might not accurately remember information and only those with the willingness and time to complete it are likely to participate. Finally, there were no follow-up studies throughout the pandemic to assess changes in awareness and preparedness levels over time.

## Comparison with previous research

Our study highlighted several issues related to the general pandemic preparedness and response in New Zealand. Prior experience with infectious outbreaks and participation in COVID-19 training courses were low among participants. Additionally, most had no exposure to a COVID-19 case due to the late arrival of COVID-19 on New Zealand's shores at the time of the survey (first global wave).[6,7] Furthermore, around one quarter were unsatisfied with the equipment on hand (e.g., personal protective equipment [PPE]) for the management of COVID-19. This might partly explain the low preparedness scores (discussed below)—either HCWs did not have knowledge of existing equipment and infrastructure, or it was not available to them, thus lowering preparedness for COVID-19.[16] Despite this, most participants were confident in handling suspected COVID-19 cases. Confidence in handling COVID-19 may be a basis of awareness, as by the time of the survey COVID-19 had affected most major healthcare systems but was relatively foreign to New Zealand.

The fact that a significant portion of respondents primarily relied on mainstream media (94.3%) and social media (46.8%) for their COVID-19 information could be concerning. This is because such information may have come from non-reputable sources and may not have undergone peer review. Nevertheless, it potentially contributed to a notable elevation in awareness levels among participants and the wider community.[17–19] Misinformation, spin and falsification of COVID-related information (e.g., rumours, conspiracy theories) in digital and physical milieu were widespread during the pandemic, which was labelled the "COVID-19 infodemic" by WHO.[13,17–19] Widespread misinformation was not only circulated by the public but also by some mainstream and social media outlets, community leaders and government officials, potentially influencing HCWs' clinical practice during the pandemic.[19] Although the power and value of social media could have been leveraged to distribute COVID-19 information as it developed rapidly through the initial phase of the pandemic, it is important that HCWs verify the accuracy and credibility of information, especially in a rapidly developing pandemic.[17] Our data further support the need for a pandemic public communication and messaging strategy in addition to the training of HCWs.[11]

## Local results compared to parent study (international data)

Interestingly, the cohort surveyed in our study had a higher awareness score, but a lower preparedness score, compared with the parent study.[13] This could be attributed to the low number of SARS-CoV-2 cases in New Zealand at the time of the survey, whereas COVID-19 prevalence was high in most of the other participating countries.[13] The lower COVID-19 preparedness could be due to the unknown nature of the disease in New Zealand. A lower preparedness score also might represent a lack of appropriate infrastructure or knowledge of existing infrastructure for the handling and treatment of COVID-19.[16] A sizeable proportion of participants were not satisfied with the availability of equipment required for the management of COVID-19 cases (e.g., PPE). In addition, a small proportion of participants received COVID-19 training, which might have contributed to the low

levels of preparedness. Internationally, COVID-19 preparedness would have been developed via exposure to and experience of handling COVID-19 cases, whereas awareness was developed from newly generated and growing knowledge disseminated rapidly via literature, mainstream media and social media networks at the initial stages of the pandemic, leading to this heightened awareness. The sheltered nature of New Zealand having not experienced any major COVID-19 outbreak early on in the pandemic resulted in reduced preparedness.[20]

The preparedness score largely depends on infection control protocols, procedures and infrastructure, such as PPE, isolation procedures and rooms, and hospital communication. This suggests there may be significant gaps in the resources available for managing highly infectious diseases.[16,21] This explanation is supported by findings from Howard et al., who examined gaps in COVID-19 infection control preparedness in emergency departments across New Zealand.[16] It is imperative that there are established protocols and infrastructure in place before infectious disease outbreaks. As discussed, there was a low number of participants who had undertaken an official training course on COVID-19. This could be due to the development of such a course specific to New Zealand taking place at the beginning of the pandemic or the lack of information about COVID-19 to develop such a course.

## Association between awareness and preparedness scores and demographics

We found little difference in awareness scores between demographic groups.[13] The Other HCWs category (i.e., pharmacists, physiotherapists and other allied health professionals) was the only variable that was associated with a significantly reduced awareness score. This may be partly explained by the reduced pertinence for COVID-19 awareness to their professional role compared to HCWs involved in the active management of COVID-19 patients, such as doctors and nurses.

Among examined variables, age, duration of clinical experience and profession had a significant effect on preparedness. Similar to awareness levels, we found the Other HCWs category (i.e., pharmacists and physiotherapists) to be associated with a significantly reduced preparedness score. On the other hand, age and clinical experience were positively associated with preparedness scores in contrast to the parent study that found older age and not clinical experience to be associated with better preparedness.[13] Older HCWs with longer work experience are likely to have had prior experience with infectious outbreaks and to have developed management and leadership skills. Higher scores among older, more experienced HCWs are underpinned by sharing experiences between staff and hospitals, demonstrating the importance of institutional memory.[13,22,23] Previous outbreak experience did not significantly change the preparedness score, whereas previous outbreak experience increased preparedness in the parent study, and as explored in Tsuei et al.[13,23] COVID-19 training was a positive predictor of increased preparedness score, indicating that those who participated in training courses were better prepared and more equipped for dealing with COVID-19.[24]

Howard et al. found similar preparedness limitations across New Zealand, with their survey focussed on policy, training and physical resources in emergency departments across the country.[16] They found that severe under-resourcing of New Zealand emergency departments contributed to patient–clinician transmission as there was inadequate policy surrounding PPE and space for physical distancing.[16] They also suggested that New Zealand has not adapted to recent scientific advances seen in policy elsewhere (Australia) regarding PPE policy, and pandemic-specific policy.[16]

## Implications for policy and practice

This TMGH-Global COVID-19 Collaborative study provided the first global insight into awareness and preparedness of COVID-19 during the initial phase of the pandemic. Utilising Christchurch Hospital data, we identified that HCWs who had undergone COVID-19 training had higher preparedness scores, with several international studies coming to the same conclusion. Localised training courses could provide better preparedness—for example, where PPE and critical isolation infrastructure is located in the facility, how to don and doff PPE, social distancing clinical requirements and, ultimately, tools and strategies to reduce the transmission of infectious diseases. This could be integrated into national- and hospital-level policies to better prepare for future pandemics. There is a heightened need for strengthened investment from the government to better prepare HCWs with a standardised training policy and reinforced infrastructure

in our already under-resourced emergency departments and hospitals.

## Conclusion

This survey was conducted in the initial phase of the COVID-19 pandemic when COVID-19 disease and its effects were not fully realised in New Zealand and internationally. This study identified strengths in the local COVID-19 awareness and preparedness among frontline HCWs. It also highlighted gaps in pandemic readiness and factors (staff- and hospital-related) that can be leveraged to enhance future pandemic preparedness and response in New Zealand. Further policy, training and infrastructure improvements are required before the inevitable next infectious outbreak or pandemic to lessen the burden on HCWs.

**COMPETING INTERESTS**
The authors declare no conflicts of interest.

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