



Australian Government
Department of Health

2022 · Volume 46

Communicable Diseases Intelligence

“Scary to get, more scary not to”: COVID-19 vaccine acceptance among healthcare workers in Central Queensland, Australia, a cross-sectional survey

Gwenda Chapman, Mahmudul Al Imam, Arifuzzaman Khan, Nicolas Smoll, Odewumi Adegbiya, Michael Kirk, Gulam Khandaker, Kerrie Wiley

<https://doi.org/10.33321/cdi.2022.46.30>

Electronic publication date: 19/5/2022

<http://health.gov.au/cdi>

Communicable Diseases Intelligence

ISSN: 2209-6051 Online

This journal is indexed by Index Medicus and Medline.

Creative Commons Licence - Attribution-NonCommercial-NoDerivatives CC BY-NC-ND

© 2022 Commonwealth of Australia as represented by the Department of Health

This publication is licensed under a Creative Commons Attribution-Non-Commercial NoDerivatives 4.0 International Licence from <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode> (Licence). You must read and understand the Licence before using any material from this publication.

Restrictions

The Licence does not cover, and there is no permission given for, use of any of the following material found in this publication (if any):

- the Commonwealth Coat of Arms (by way of information, the terms under which the Coat of Arms may be used can be found at www.itsanhonour.gov.au);
- any logos (including the Department of Health's logo) and trademarks;
- any photographs and images;
- any signatures; and
- any material belonging to third parties.

Disclaimer

Opinions expressed in Communicable Diseases Intelligence are those of the authors and not necessarily those of the Australian Government Department of Health or the Communicable Diseases Network Australia. Data may be subject to revision.

Enquiries

Enquiries regarding any other use of this publication should be addressed to the Communication Branch, Department of Health, GPO Box 9848, Canberra ACT 2601, or via e-mail to: copyright@health.gov.au

Communicable Diseases Network Australia

Communicable Diseases Intelligence contributes to the work of the Communicable Diseases Network Australia.
<http://www.health.gov.au/cdna>



Communicable Diseases Intelligence (CDI) is a peer-reviewed scientific journal published by the Office of Health Protection and Response, Department of Health. The journal aims to disseminate information on the epidemiology, surveillance, prevention and control of communicable diseases of relevance to Australia.

Editor

Noel Lally

Deputy Editor

Simon Petrie

Design and Production

Kasra Yousefi

Editorial Advisory Board

David Durrheim,
Mark Ferson, John Kaldor,
Martyn Kirk and Linda Selvey

Website

<http://www.health.gov.au/cdi>

Contacts

CDI is produced by the Office of Health Protection and Response, Australian Government Department of Health, GPO Box 9848, (MDP 6) CANBERRA ACT 2601

Email:

cdi.editor@health.gov.au

Submit an Article

You are invited to submit your next communicable disease related article to the Communicable Diseases Intelligence (CDI) for consideration. More information regarding CDI can be found at:
<http://health.gov.au/cdi>.

Further enquiries should be directed to:

cdi.editor@health.gov.au.

“Scary to get, more scary not to”: COVID-19 vaccine acceptance among healthcare workers in Central Queensland, Australia, a cross-sectional survey

Gwenda Chapman, Mahmudul Al Imam, Arifuzzaman Khan, Nicolas Smoll, Odewumi Adegbija, Michael Kirk, Gulam Khandaker, Kerrie Wiley

Abstract

Background

Behavioural and social drivers (BeSD) of coronavirus disease 2019 (COVID-19) vaccine acceptance among Australian healthcare workers (HCW) living and working in regional areas are not well studied. Understanding local HCWs' COVID-19 risk perceptions and potential barriers to COVID-19 vaccine uptake is crucial in supporting rollout. We aimed to understand the COVID-19 vaccine drivers among HCW in Central Queensland (CQ), Australia.

Method

A cross-sectional online survey of HCWs in CQ between 17 May and 31 May 2021, based on the BeSD framework adapted from the World Health Organization (WHO) Data for Action guidance, consisting of the five instrument domains: what people think and feel; social processes; motivations; practical issues; and vaccination uptake.

Results

Of the 240 responding HCWs within Central Queensland Hospital and Health Service, 78% were female. Of the participating HCWs, 64% percent had received at least one dose of a COVID-19 vaccine; of those who had not yet received a vaccine, 53% said they were willing to receive one. Factors associated with vaccine acceptance included: belief that the vaccine was important for their health (81%; odds ratio (OR): 7.2; 95% confidence interval (CI): 3.5–15.5); belief that their family and friends wanted them to have the vaccine (64%; OR: 6.7; 95% CI: 2.9–16.7); trust in the vaccine (72%; OR: 6.4; 95% CI: 3.5–12.0); and confidence in being able to answer patients' questions about the vaccine (99%).

Conclusions

These findings suggest that a combination of communications and educational material framed around the benefits and social norms of vaccination, along with materials addressing vaccine safety concerns, will encourage HCW to take up a COVID-19 vaccine.

Keywords: Attitudes, COVID-19 vaccine, healthcare worker, questionnaire, vaccine acceptance

Introduction

The coronavirus disease 2019 (COVID-19) pandemic, caused by transmission of the SARS-CoV-2 virus, continues to cause significant morbidity and mortality. As of 13 February 2022, more than 410 million cases and 5.8 million deaths have been reported globally,¹ with 1,874,367 confirmed cases and 4,149 deaths in Australia over the same period.²

Healthcare workers (HCW) are at increased risk of COVID-19 globally. Australian HCW have an estimated threefold increased risk of SARS-Cov-2 infection compared to the general community,⁴ making them a priority group for vaccine rollout.⁵ On 28 June 2021, the Australian Government mandated that all residential aged care workers receive their first dose of COVID-19 vaccine by mid-September.⁶ Further to this, some Australian states and territories mandated that all HCWs be fully vaccinated to access health facilities.^{7–9}

Successful immunisation requires high rates of acceptance. Globally there has been wide variation in COVID-19 vaccine hesitancy levels reported across settings and time.¹⁰ Willingness to vaccinate is high in some countries (> 80% in China, South Korea, Singapore), and lower in other countries (< 55% in Russia).¹¹ International studies suggest that many HCWs are hesitant about or are delaying COVID-19 vaccination, with one study reporting that 22.5% of HCWs worldwide had reported hesitancy, with side effects (60%) and safety concerns (48%) the most commonly cited reasons.^{12,13} During the first peak of COVID-19 (March 2020), an estimated 86% of Australian people surveyed indicated willingness to receive a COVID-19 vaccine, if it were available.¹⁴ More recent estimates (August 2020 to April 2021) suggest this figure has remained stable, at around 83%,¹⁵ despite ever-changing risk communication challenges.¹⁶

Most studies of HCW COVID-19 vaccine attitudes to date have focussed on hesitancy. While important, hesitancy is just one of many factors that affect vaccine uptake by individuals. A

useful framework for measuring a range of drivers of COVID-19 vaccine acceptance, including hesitancy, was developed by the World Health Organization (WHO) working group on the behavioural and social drivers (BeSD) of vaccination.¹⁷

Few studies have measured the drivers of COVID-19 vaccine acceptance among Australian HCWs, and fewer have considered such factors among those living and working in regional and rural areas. Understanding local HCWs' COVID-19 risk perceptions and potential barriers to COVID-19 vaccine uptake is crucial in supporting rollout. Thus, we aimed to measure the drivers of COVID-19 vaccination among HCW in Central Queensland (CQ), Australia.

Methods

Study population

We sought individuals ≥ 18 years of age, employed by Central Queensland Hospital and Health Service (CQHHS), and therefore eligible to receive a COVID-19 vaccine under the vaccine rollout plan at that time. During the study period, there were 4,752 staff employed by CQHHS, responsible for delivering health services across CQ, a region spanning 117,588 square kilometres with a population of approximately 250,000 people.¹⁸

COVID-19 vaccine availability, recommendations, and program rollout

Two COVID-19 vaccines were available in Australia during the study period: the Vaxzevria (AstraZeneca) viral vector vaccine, and the Comirnaty (Pfizer) mRNA vaccine. The emerging safety signal of Vaxzevria-associated thrombosis with thrombocytopenia syndrome (TTS) prompted the Australian Technical Advisory Group on Immunisation (ATAGI), on 8 April 2021, to recommend the Comirnaty vaccine as preferred for adults under 50 years of age.¹⁹ This was highly publicised in the Australian media,²⁰ potentially impacting vaccine confidence.¹⁶

In the study area, the COVID-19 vaccine rollout began on 11 March 2021 with the Vaxzevria vaccine offered to aged care and disability, fever clinic and intensive care unit, public health unit, air and seaport workers, quarantine staff and Queensland ambulance and police service staff. Subsequent vaccine rollout phases covered all remaining HCWs in the region from 22 March 2021. The Comirnaty vaccine became available on 19 May 2021 for people under 50 years of age. Thus, during the survey period, all survey respondents were eligible for a COVID-19 vaccination, although the type of vaccine individuals could access changed and was dictated by ATAGI age recommendations over the study period (Figure 1). No mandates were in force at the time of the survey.

Recruitment

All CQHHS staff were invited to participate in a self-reported online survey between 17 May and 31 May 2021. Participation invitations were distributed via internal email, using Citizen Space (Delib Ltd, Bristol, UK)²¹ for data collection.

Ethical considerations

Electronic consent was obtained from all participants. Ethical approval was obtained from the CQHHS Human Research Ethics Committee (LNR2021QCQ69608).

The survey instrument

The survey was adapted from the WHO Data for Action guidance on achieving high uptake of COVID-19 vaccines, which includes a survey for HCWs based on the BeSD framework (Figure 2).¹⁷ The survey was adapted to accommodate contextual factors, including applicable demographic questions, and the importance of travel which at the time was limited by locally-imposed restrictions. The questionnaire consisted of six primary sections: sociodemographic characteristics, including age, gender, education level, Indigenous Australian status, workplace and occupations, chronic illness; and questions from the five BeSD instrument

domains (what people think and feel about COVID-19 vaccines; social processes; motivations; practical issues; and vaccination uptake). The adapted survey was assessed for functionality and pretested with a convenience sample of the target study population using cognitive methods.²²

Response options were either binary (yes/no) or a four-point Likert scale. Open-ended questions asking participants how they felt about the COVID-19 vaccines were also included, and were analysed qualitatively using Framework methodology.²³ Genuine first names have not been used.

Statistical analyses

The primary outcome was vaccination status (receipt of either one or two doses of a COVID-19 vaccine). The relationship between vaccination status and all other variables was assessed using univariable logistic regression. All analyses were conducted using R software, version 4.1.0.

Doctors, dentists, allied health professionals and nurses (including midwives) were categorised as frontline HCWs while community health workers, Aboriginal and Torres Strait Islander health workers, administrators, operational service providers and other professionals were classified as non-frontline HCWs.

Results

Of the 4,752 invited CQHHS staff, 240 completed the survey (a 5% response rate). Of these 240 respondents, 64% (n = 153) had received at least one dose of COVID-19 vaccine at the time of the survey. The mean age of the participants was 48.1 years, 78% (n = 188) were female, and 52% (n = 124) were frontline HCWs (Table 1).

Socio-demographic characteristics and COVID-19 vaccine uptake

When comparing the cohort occupation category proportion to workforce data, similar

Figure 1: Timeline and context of COVID-19 vaccine rollout to health care workers in Central Queensland

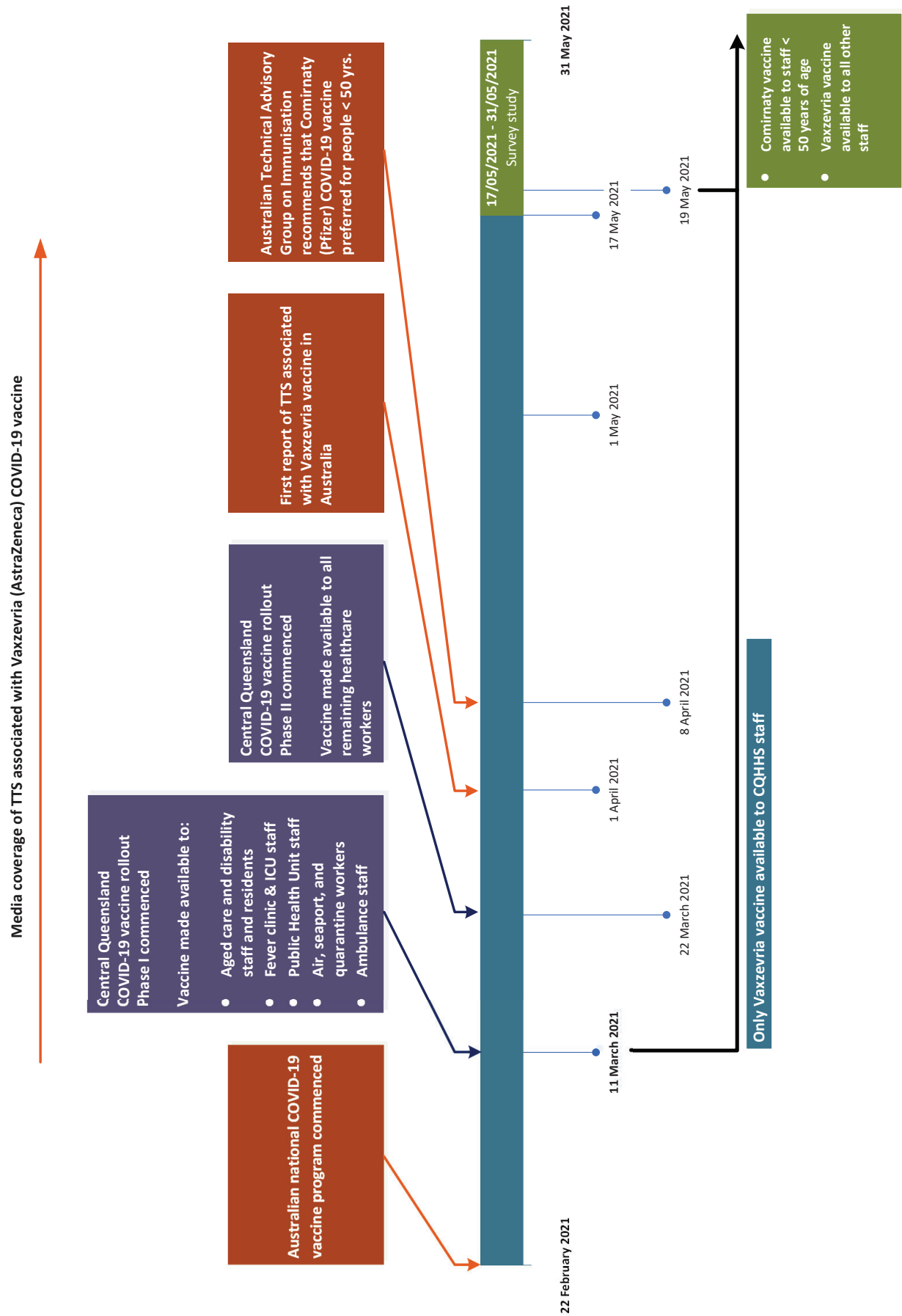
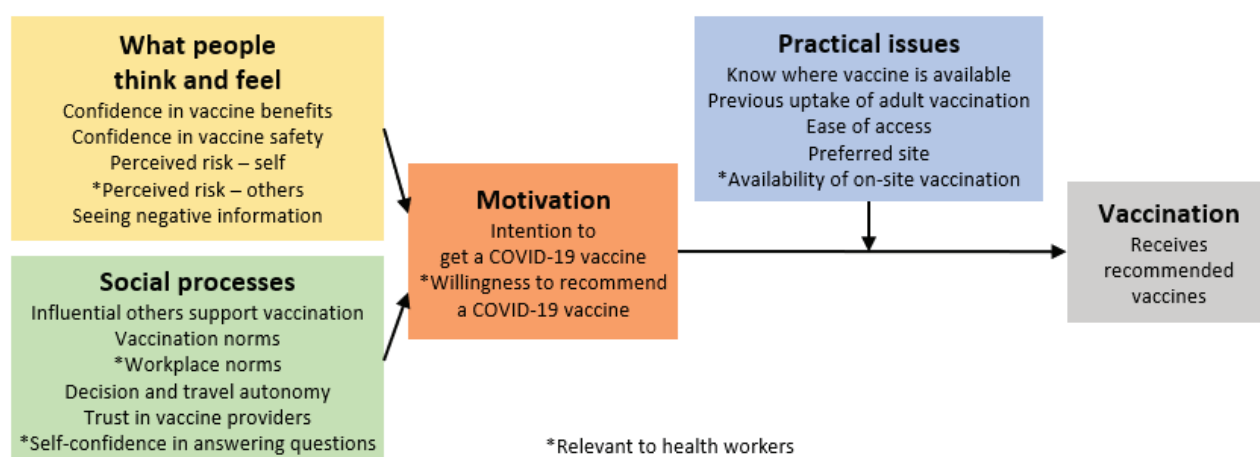


Figure 2: The Behavioural and Social Drivers (BeSD) of COVID-19 vaccination framework^a



a Source: Data for Action: achieving high uptake of COVID-19 vaccines, WHO, 2021.¹⁷

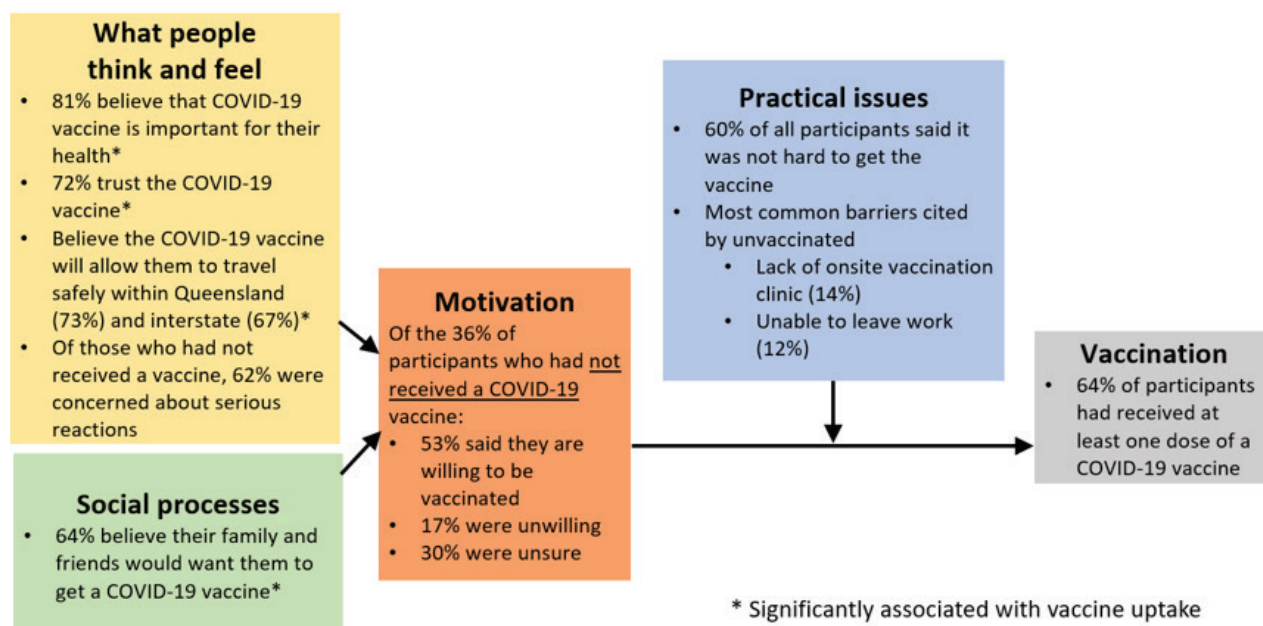
Table 1: Survey responses socio-demography according to vaccination status

Survey item	Response	Vaccine received		
		No n(%)	Yes n(%)	Odds ratio (univariate analysis), (95% CI; <i>p</i> value) ^{a,b}
Age (years)	(Mean (SD))	46.7 (11.8)	48.9 (12.7)	1.01 (0.99–1.04; <i>p</i> = 0.192)
Age group	18–30 years	8 (9.2)	18 (11.8)	Ref
	31–40 years	23 (26.4)	22 (14.4)	0.43 (0.15–1.15; <i>p</i> = 0.099)
	41–50 years	19 (21.8)	32 (20.9)	0.75 (0.26–2.02; <i>p</i> = 0.573)
	51–60 years	27 (31.0)	53 (34.6)	0.87 (0.32–2.21; <i>p</i> = 0.779)
	> 60 years	10 (11.5)	28 (18.3)	1.24 (0.41–3.76; <i>p</i> = 0.697)
Gender	Man	20 (23.0)	31 (20.3)	Ref
	Woman	66 (75.9)	122 (79.7)	1.19 (0.62–2.24; <i>p</i> = 0.588)
	Non-binary	1 (1.1)	0 (0.0)	
Education	Undergraduate diploma, vocational qualification	40 (46.0)	47 (30.7)	Ref
	Bachelor's degree and higher	47 (54.0)	106 (69.3)	1.92 (1.11–3.32; <i>p</i> = 0.019)
Occupation	Non-frontline healthcare worker	55 (63.2)	61 (39.9)	Ref
	Frontline healthcare worker	32 (36.8)	92 (60.1)	2.59 (1.51–4.50; <i>p</i> = 0.001)
Aboriginal or Torres Strait Islander	No	83 (95.4)	148 (96.7)	Ref
	Yes	4 (4.6)	5 (3.3)	0.70 (0.18–2.90; <i>p</i> = 0.604)
Chronic illness	No	64 (73.6)	116 (75.8)	Ref
	Yes	20 (23.0)	33 (21.6)	0.91 (0.49–1.74; <i>p</i> = 0.771)
	Not sure	3 (3.4)	4 (2.6)	0.74 (0.16–3.83; <i>p</i> = 0.694)

a Ref: reference state.

b Values shown in bold are those with $p \leq 0.05$.

Figure 3: Behavioural and social drivers (BeSD) of COVID-19 vaccination among health care workers in Central Queensland, Australia



proportions were doctors (cohort 10%; workforce 9%), a lower proportion were nurses (cohort 32%; workforce 50%), and a higher proportion were classified as allied health (cohort 23%; workforce 11%).

Univariate analysis revealed that those with higher education levels (bachelor's degree or higher) were more likely to have been vaccinated than others (odds ratio (OR): 1.9; 95% confidence interval (CI): 1.1–3.3), and front-line HCWs were 2.6 times (95% CI: 1.5–4.5) more likely to have been vaccinated than were non-frontline HCWs. Age, gender, Indigenous status, and presence of chronic illness were not significantly associated with vaccine uptake.

Vaccine uptake and what people think and feel about COVID-19 vaccine

Overall, participants reported a high level of trust and confidence in the vaccine, with 72% reporting they moderately or very much trusted the vaccine; 81% reporting belief that the vaccine was moderately or very important to their health (Figure 3); and 80% reporting moderate to high levels of confidence that getting the vaccine would protect others (Table 3). Moderate to high COVID-19 disease risk perception was reported by fewer than half of the participants in this sample: 43% reported moderate to high concern about giving COVID-19 to their patients; 49% reported moderate to high concern about giving COVID-19 to their family or friends; and 42% reported moderate to high concern about contracting COVID-19 themselves. Of the 87 respondents who had not received a COVID-19 vaccine at the time of the survey, 54 (62%) were moderately to very concerned about the vaccine causing a serious reaction. Almost all (99%, $n = 159$) of the participants who reported having contact with patients were willing to recommend COVID-19 vaccine to their patients.

Univariate analysis showed that participants who were confident in answering patients'

Table 2: What people think and feel about COVID-19 disease and vaccine uptake survey responses according to vaccination status

Survey item	Response	Vaccine received		
		No n(%)	Yes n(%)	Odds ratio (univariate analysis), (95% CI; p value) ^{a,b}
How confident are you that you could answer patient questions about getting a COVID-19 vaccine?	Not confident/a little confident	23 (26.4)	30 (19.6)	Ref
	Moderately/very confident	25 (28.7)	96 (62.7)	2.94 (1.46–5.96; $p = 0.002$)
	No patient contact	39 (44.8)	27 (17.6)	0.53 (0.25–1.10; $p = 0.090$)
How much do you think getting a COVID-19 vaccine for yourself will protect other people in your community from COVID-19?	Not confident/a little confident	33 (37.9)	15 (9.8)	Ref
	Moderately/very confident	54 (62.1)	138 (90.2)	5.62 (2.88–11.44; $p < 0.001$)
	Not important /a little important	33 (37.9)	12 (7.8)	Ref
How important do you think getting a COVID-19 vaccine is for your health?	Moderately/very important	54 (62.1)	141 (92.2)	7.18 (3.54–15.45; $p < 0.001$)
	Not at all/a little	45 (51.7)	22 (14.4)	Ref
	Moderately/very much	42 (48.3)	131 (85.6)	6.38 (3.48–12.01; $p < 0.001$)
How concerned are you about your patients getting COVID-19 from you?	Not concerned /a little concerned	33 (37.9)	69 (45.1)	Ref
	Moderately/very concerned	25 (28.7)	51 (33.3)	0.98 (0.52–1.85; $p = 0.939$)
	Not applicable	29 (33.3)	33 (21.6)	0.54 (0.28–1.04; $p = 0.066$)
How concerned are you about your close family and friends getting COVID-19 from you?	Not concerned /a little concerned	39 (44.8)	83 (54.2)	Ref
	Moderately/very concerned	48 (55.2)	70 (45.8)	0.69 (0.40–1.16; $p = 0.161$)
	Not concerned/a little concerned	39 (44.8)	101 (66.0)	Ref
How concerned are you about getting COVID-19?	Moderately/very concerned	48 (55.2)	52 (34.0)	0.42 (0.24–0.71; $p = 0.002$)
	Not important /a little important	9 (10.3)	9 (5.9)	Ref
	Moderately /very important	78 (89.7)	144 (94.1)	1.85 (0.69–4.91; $p = 0.213$)
Do you think that getting a COVID-19 vaccine will allow you to safely travel? (within Queensland)	No	22 (25.3)	4 (2.6)	Ref
	Yes	50 (57.5)	125 (81.7)	13.75 (4.97–48.81; $p < 0.001$)
	Not sure	15 (17.2)	24 (15.7)	8.80 (2.74–34.75; $p = 0.001$)
Is the ability to travel important to you? (interstate)	Not important /a little important	31 (35.6)	35 (22.9)	Ref
	Important	56 (64.4)	118 (77.1)	1.87 (1.04–3.33; $p = 0.035$)
	No	20 (23.0)	4 (2.6)	Ref
Do you think that getting a COVID-19 vaccine will allow you to safely travel? (interstate)	Yes	45 (51.7)	116 (75.8)	12.89 (4.58–46.19; $p < 0.001$)
	Not sure	22 (25.3)	33 (21.6)	7.50 (2.45–28.52; $p = 0.001$)
	Not important /a little important	45 (51.7)	67 (43.8)	Ref
Is the ability to travel important to you? (overseas)	Important	42 (48.3)	86 (56.2)	1.38 (0.81–2.34; $p = 0.237$)
	No	26 (29.9)	28 (18.3)	Ref
	Yes	29 (33.3)	57 (37.3)	1.83 (0.91–3.68; $p = 0.090$)
Do you think that getting a COVID-19 vaccine will allow you to safely travel? (overseas)	Not sure	32 (36.8)	68 (44.4)	1.97 (1.00–3.91; $p = 0.050$)
	Already vaccinated	0 (0.0%)	153 (100.0)	
	Not concerned/a little concerned	33 (37.9)	0 (0.0)	
How concerned are you that a COVID-19 vaccine could cause you to have a serious reaction? Would you say...	Moderately/very concerned	54 (62.1)	0 (0.0)	NA

^a Ref: reference state; NA: not applicable.

^b Values shown in bold are those with $p \leq 0.05$.

Table 3: Social processes and vaccine uptake survey responses according to vaccination status

Survey item	Response	Vaccine received		
		No n(%)	Yes n(%)	Odds ratio (univariate analysis), (95% CI; <i>p</i> value) ^{a,b}
Social processes and vaccine uptake				
Have you been treated poorly during the COVID-19 pandemic because you are a health worker?	No	70 (80.5)	130 (85.0)	Ref
	Yes	10 (11.5)	15 (9.8)	0.81 (0.35–1.95; <i>p</i> = 0.623)
	Not sure	7 (8.0)	8 (5.2)	0.62 (0.21–1.82; <i>p</i> = 0.367)
Do you think most of your close family and friends would want you to get a COVID-19 vaccine?	No	19 (21.8)	9 (5.9)	Ref
	Yes	37 (42.5)	117 (76.5)	6.68 (2.85–16.70; <i>p</i> < 0.001)
	Not sure	31 (35.6)	27 (17.6)	1.84 (0.73–4.90; <i>p</i> = 0.207)
Do you think your religious leaders would want you to get a COVID-19 vaccine?	No	7 (8.0)	4 (2.6)	Ref
	Yes	18 (20.7)	46 (30.1)	4.47 (1.20–18.87; <i>p</i> = 0.029)
	Not sure/don't know	62 (71.3)	103 (67.3)	2.91 (0.84–11.47; <i>p</i> = 0.099)
Do you think your community leaders would want you to get a COVID-19 vaccine?	No	1 (1.1)	1 (0.7)	Ref
	Yes	68 (78.2)	138 (90.2)	2.03 (0.08–51.84; <i>p</i> = 0.619)
	Not sure/don't know	18 (20.7)	14 (9.2)	0.78 (0.03–20.84; <i>p</i> = 0.863)
Do you think most adults outside of work you know will get a COVID-19 vaccine, if it is recommended to them?	No	16 (18.4)	22 (14.4)	Ref
	Yes	30 (34.5)	66 (43.1)	1.60 (0.73–3.47; <i>p</i> = 0.235)
	Not sure	41 (47.1)	65 (42.5)	1.15 (0.54–2.44; <i>p</i> = 0.711)
Do you think most of the people you work with will get a COVID-19 vaccine?	No	9 (10.3)	14 (9.2)	Ref
	Yes	57 (65.5)	118 (77.1)	1.33 (0.53–3.22; <i>p</i> = 0.531)
	Not sure	21 (24.1)	21 (13.7)	0.64 (0.22–1.79; <i>p</i> = 0.402)

a Ref: reference state; NA: not applicable.

b Values shown in bold are those with *p* ≤ 0.05.

questions related to COVID-19 vaccine were more likely to have been vaccinated than those who did not have contact with patients (OR: 2.9; 95% CI: 1.5–6.0). Similarly, those who were confident that the vaccine would protect others (OR: 5.6; 95% CI: 2.9–11.4); who were confident that the vaccine was important for their health (OR: 7.2; 95% CI: 3.5–15.5); and who trusted the vaccine (OR: 6.4; 95% CI: 3.5–12.0) were more likely to have been vaccinated. In contrast, respondents who were concerned about self-risk of COVID-19 disease had significantly lower vaccine uptake (OR: 0.4; 95% CI: 0.2–0.7).

Social processes and vaccine uptake

Eighty-six percent of participants thought that their community leaders would want them to receive a COVID-19 vaccine; 64% believed that family and friends would want them to get the vaccine; and 27% believed that their religious leaders would want them to get the vaccine. While 73% thought their work colleagues would get a COVID-19 vaccine, only 40% thought most adults outside of work would be vaccinated.

Univariate analysis showed significantly higher likelihood of vaccine uptake among those who thought their family and friends would want them to get a COVID-19 vaccine (OR: 6.7; 95% CI: 2.9–16.7), and those who thought their religious leaders would want them to receive a vaccine (OR: 4.5; 95% CI: 1.2–18.9).

Motivation for vaccination among the unvaccinated

Of the 87 respondents who did not receive a COVID-19 vaccine, 17% (n = 15) reported being unwilling to have one (Table 4).

Practical issues and vaccine uptake

Most respondents had received another vaccine during adulthood (98%; n = 234), and a majority of those had received a COVID-19 vaccine (65%; n = 153). Most participants nominated 'hospital' as a preferred place of vaccination (68%; n = 164) followed by 'workplace' (52%; n = 124) and 'a medical practice' (43%; n = 104). While most respondents reported no difficulties in accessing COVID-19 vaccine (60%; n = 145), reported barriers included inability to leave their workstation (12%; n = 28) and lack of on-site vaccination at workplace (14%; n = 33).

Unadjusted analysis showed participants who knew the vaccination sites (OR: 9.8; 95% CI: 2.5–64.8) and found the vaccination process moderately or very easy (OR: 2.2; 95% CI: 1.1–4.7) had a higher likelihood of vaccine uptake (Table 4).

"How do you feel about the COVID-19 vaccines?": Open-ended, qualitative responses

Themes inductively arising from the responses to the open-ended question, "How do you feel about the COVID-19 Vaccines?" included general thoughts and feelings about the vaccine, and more specific themes such as vaccine side effects; risk and trust; and experiences.

Responses to this question carried both positive/neutral and negative sentiment (Tables 5 and 6).

General thoughts and feelings

There were a range of general feelings expressed covering uncertainty and apprehension, ambivalence, hopefulness, and happiness and satisfaction concerning the COVID-19 vaccine, with a number of participants expressing concerns that an annual booster will be required in future:

"Ok it needs to happen more concerned we will need a yearly update" – Pat,ⁱ nurse

Vaccine side effects

Participants held both long- and short-term concerns about vaccine side effects, with generally negative sentiment. Participants demonstrated strong awareness of the different safety profiles of the available vaccine brands, with some indicating a willingness to receive a COVID-19 vaccine if they could choose which brand:

"OK with the Pfizer but huge reservations about the others" – Casey, nurse

There was strong awareness of the risk of TTS and concern about unknown long-term side effects:

"If there was a guarantee that there were no issues such as infertility or long-term illnesses I would be more accepting of the vaccine" – Jessie, administrative role

i Names of all individuals quoted in this study have been changed so as to meet privacy considerations.

Table 4: Practical issues and motivation survey responses according to vaccination status

Survey item	Response	Vaccine received		
		No n(%)	Yes n(%)	Odds ratio (univariate analysis), (95% CI, <i>p</i> value) ^{a,b}
Practical issues				
Have you ever received a vaccine as an adult?	Yes	81 (93.1)	153 (100.0)	
	No	2 (2.3)	0 (0.0)	NA
	Not sure	4 (4.6)	0 (0.0)	
Do you know where to go to get a COVID-19 vaccine?	No	10 (11.5)	2 (1.3)	Ref
	Yes	77 (88.5)	151 (98.7)	9.81 (2.51–64.83; <i>p</i> = 0.004)
Where would you prefer to get a COVID-19 vaccine? Select all that apply	Hospital	47 (54.0)	117 (76.5)	NA
	Medical practice	32 (36.8)	72 (47.1)	
	Workplace	36 (41.4)	88 (57.5)	
	Pharmacy	15 (17.2)	37 (24.2)	
	Community centre/meeting hall	9 (10.3)	38 (24.8)	
	Local shop (hardware or grocery store)	1 (1.1)	7 (4.6)	
	Mobile van	9 (10.3)	28 (18.3)	
	I don't want the vaccine	21 (24.1)	0 (0.0)	
	Somewhere else	1 (1.1)	1 (0.7)	
	Not at all easy/a little easy	18 (20.7)	16 (10.5)	Ref
Once eligible, how easy is it to get a COVID-19 vaccine for yourself? Would you say ...	Moderately/very easy	69 (79.3)	137 (89.5)	2.23 (1.07–3.98; <i>p</i> = 0.032)
	It's not hard	35 (40.2)	110 (71.9)	NA
	Vaccination costs too much	3 (3.4)	1 (0.7)	
	The opening times are inconvenient	6 (6.9)	15 (9.8)	
	I am unable to leave work duties	9 (10.3)	19 (12.4)	
	There is no on-site vaccination at my place of work	16 (18.4)	17 (11.1)	
	Mobile vaccination is not available	3 (3.4)	5 (3.3)	
	The waiting time is too long	4 (4.6)	10 (6.5)	
	COVID–19 vaccination is not yet available for me	15 (17.2)	1 (0.7)	
	Something else	19 (21.8)	11 (7.2)	
Motivation				
If a COVID-19 vaccine is available to you, will you get it?	Already vaccinated	0 (0.0)	153 (100.0)	NA
	Yes	46 (75.4)	0 (0.0)	
	No	15 (24.6)	0 (0.0)	
	Not sure	26 (29.9)	0 (0.0)	
Would you recommend a COVID-19 vaccine to eligible patients?	Yes	36 (41.4)	123 (80.4)	Ref
	No	1 (1.1)	1 (0.7)	0.29 (0.01–7.52; <i>p</i> = 0.389)
	No patient contact	50 (57.5)	29 (19.0)	0.17 (0.09–0.30; <i>p</i> < 0.001)

a Ref: reference state; NA: not applicable.
b Values shown in bold are those with $p \leq 0.05$.

Table 5: Prominent themes emerging from responses to the question, “How do you feel about the COVID-19 vaccines?”, with positive or neutral sentiment

Emergent theme				
Motivation	Risk and trust		Experience	General thoughts and feelings
<i>Responses giving reasons why people feel the vaccine is needed, or why they would want to have one</i>	<i>Responses relating to faith in vaccine development and licensing / approval processes, vaccine effectiveness, and weighing of risks and benefits</i>		<i>Responses mentioning previous vaccination experiences</i>	<i>Responses describing a general sentiment or thought about the COVID-19 vaccine</i>
Sub-theme	Sub-theme		Sub-theme	Sub-theme
Protection	Travel	Supportive, trust the system	Benefits outweighs the risk	Previous good or acceptable vaccination experience
- Vaccine needed to protect self - Vaccine will protect the community through herd immunity - Vaccine will stop them from inadvertently infecting loved ones and those with vulnerabilities - Need for protection often tempered with a worry or doubt to overcome	- Vaccine will enable domestic and international travel - Vaccine will enable reconnection with family overseas - Opening borders will help with trade - Vaccine will enable freedom to move	- Trust in regulatory system expressed - Supportive of vaccine as a positive step toward pandemic control	- Understanding of vaccine risks - Understanding of COVID-19 risks - General acceptance of vaccine risks to gain benefits	- Reports of nil or minimal side effects among vaccinees - Those with minimal side effects reported willingness to have second dose - Those with minimal side effects often reported apprehension prior to first dose, which lessened following acceptable experience
				- Sentiment of hopefulness that the vaccine works and progresses the community toward “normal” situation - Hopefulness that others get vaccinated - Some expressed satisfaction and happiness with the vaccine
				Hopeful, satisfied, grateful

Table 6: Prominent themes emerging from responses to the question, “How do you feel about the COVID-19 vaccines?”, with negative sentiment

Emergent theme				
Side effects		Risk and trust		General thoughts and feelings
<i>Responses mentioning vaccine side effects</i>		<i>Responses relating to faith in vaccine development and licensing / approval processes, vaccine effectiveness, and weighing of risks and benefits</i>		<i>Responses describing a general sentiment or thought about the COVID-19 vaccine</i>
Sub-theme		Sub-theme		Sub-theme
Brand choice	Specific – TTS risk	Generic and long-term side effects	Not enough testing / research	Vaccine effectiveness
- Evidence of awareness of the different vaccine safety profiles - Preference for the Pfizer vaccine over the AZ brand - Demand for the ability to choose which vaccine they receive. - Some saw inequity in the way certain groups are prioritized for certain brands. - Others acknowledged choice not always possible.	- Fear of TTS was expressed - Some acknowledgment that it's a rare side-effect and to be expected with a large program - Some complaints about messaging and communication methods about TTS risk	- Fear about non-specific safety and side effects expressed - Even some who had received the vaccine expressed feeling nervous about long term effects - Fear about unknown possible side effects often linked to beliefs about inadequate vaccine testing / research	- Concern that the vaccines have not been researched or tested properly - Concern that there are still too many “unknowns” to be able to be confident in the vaccine - Some acknowledgment of the requirement for fast rollout but nevertheless wary	- Concern about whether the vaccine protects against all strains - Concern that the vaccine fails to prevent transmission
				- Suffering ill effects following initial vaccine dose was reported by some - Some reported being hesitant after witnessing colleagues feeling ill after receiving the vaccine
				- Many expressed apprehension, uncertainty or nervousness - Concern about an anticipated need for yearly boosters

Risk and trust

Responses regarding risk and trust were both positive/neutral and negative in sentiment and fell into three categories: trust in the safety and effectiveness of the vaccine; trust in the vaccine development and regulatory approval processes; and weighing risks and benefits. Most responses in this theme indicated some acknowledgement and acceptance of risk. For example:

“Scary to get, more scary not to get. I am sure we all feel like this” – Riley, administrative role

Experiences

Both positive and negative vaccination experiences were reported as contributing to how people feel about the COVID-19 vaccines, with the majority reported as positive or at least, acceptable. Many reported concerns prior to their first vaccine dose which diminished after an acceptable first vaccination experience. For example:

“Would have waited for the Pfizer vaccine if available earlier but still good for the second Astra Zeneca vaccine given first dose was uneventful” – Chris, doctor

Negative experiences usually related to side effects either suffered by the participant, or experienced vicariously through colleagues:

“I know I need to get it but am concerned about the side effects. Some colleagues I know have had very bad reactions to the vaccine” – Robin, nurse

Discussion

Using the BeSD model of COVID-19 vaccination behaviour¹⁷ as a framework (Figure 2), ours is one of the first studies from Australia reporting what HCWs think and feel about COVID-19 vaccines. Of those who were not yet vaccinated, over half signalled willingness to be vaccinated; 47% were unwilling or unsure. Most participants reported that practical barriers to receiving the vaccine had been minimised or removed; the

most common barriers encountered by unvaccinated participants were a lack of onsite vaccination clinics and not being able to leave their workstation to get vaccinated (Figure 3).

Belief that the vaccine was important for their health, and that family and friends wanted them to have the vaccine, were strongly associated with COVID-19 vaccine uptake in this group. Trust in the vaccine and confidence in being able to answer patient questions about the vaccine were also associated with vaccine acceptance.

There are few published studies on HCW COVID-19 vaccine uptake, the majority instead focussing on intention to vaccinate, having been undertaken prior to vaccine availability. A global rapid review of the COVID-19 vaccine attitudes of HCWs identified a wide variation in intention to vaccinate, between 28% and 77%.²⁴ A recent American single-centre study of 4,448 HCWs reported 9% had taken up a vaccine and 60% intended to.²⁵

This study was undertaken in a context where no mandates had been introduced. The subsequent introduction of vaccine mandates in some jurisdictions has increased the need to support HCWs' decision-making. While mandates may well be lawful for HCWs,²⁶ evidence suggests they could dampen voluntary response and increase vaccine rejection in some cases.²⁷ Multifaced campaigns with a range of policy and organisation measures remain the preferred method of encouragement to achieve adequate coverage.²⁸ Coercive policies need strong justification²⁹ and may be appropriate when substantive criteria such as adequate disease containment and sufficient safety and efficacy information have been met.³⁰

What people think and feel

The HCWs in this study reported largely positive attitudes towards COVID-19 vaccine, with high levels of trust in the vaccine, and belief in its importance and effectiveness. Those reporting concern about contracting COVID-19 were

less likely to have been vaccinated than those who did not report this concern. This is likely the result of the confounding effect of trust in the vaccine: those reporting trust in the vaccine were more likely to have received it. It therefore makes sense that those same vaccinated people would report a lower COVID-19 risk perception than those who were not vaccinated.

The open-ended qualitative questions provide insight into risk and trust among the participants. Positive or neutral responses revealed trust in the vaccine development and approval processes, and a general understanding and acceptance of the risk-benefit of the vaccine. Responses framed with negative sentiment centred on concerns that the vaccines had not been properly tested, and on perceived associated “unknowns”, as well doubts about vaccine efficacy. Of the 36% of respondents who had not received a COVID-19 vaccine, 62% reported concerns about the serious reactions to the vaccine. Qualitative responses addressing side effects included fear of specific side effects such as TTS, and fear of short-term side effects experienced either by themselves or vicariously through others. Fear of unknown long-term side effects was also reported. Concerns of specific side effects associated with specific vaccine brands is not surprising given the changing health advice and ongoing media coverage, and less specific fears of long-term side effects have been previously reported in both HCWs and other professions.³¹ Recent research with vaccine-hesitant and refusing parents revealed that information needs varied with the level of hesitancy, requiring nuanced differences in the information provided, depending on the level of hesitancy and the specific concerns held.³² Materials addressing specific concerns such as the level of testing required for vaccines, and vaccine side effects versus the relative risks of COVID-19, may be beneficial for those who are uncertain. Similarly, messaging centred on vaccine safety and benefits, including vaccination enabling travel, could leverage existing positive sentiment identified in our study. A

recent Canadian study of COVID-19 vaccine intentions among the public made similar recommendations.³³

Social processes

Participants who thought their family and close friends would want them to have a COVID-19 vaccine were significantly more likely to have received a vaccine. While not statistically significant in this study, other social norms related to vaccination—such as the actions of work colleagues and others—are known to be positively associated with vaccine uptake.³⁴ Choice architecture has shown that people are likely to be persuaded by social consensus.³⁵ The tendency for people to follow social norms provides an opportunity to construct an environment that normalises COVID-19 vaccination, something that can also be harnessed for messaging campaigns.

Motivation for vaccination among the unvaccinated

Encouragingly, 53% of the unvaccinated participants in this study were willing to receive the COVID-19 vaccine. Efforts are needed to understand why this group remained unvaccinated; considerations of the practical issues identified among this group are discussed below. The findings on what this study's participants thought and felt about the COVID-19 vaccine can inform interventions that might encourage the 30% who reported being unsure toward vaccinating. Research with parents who refuse vaccines for their children has shown that while many remain intractable in their position, for some, vaccine refusal is not a static destination, but a position that changes via a process of constant risk re-evaluation.³⁶ Over the course of the pandemic to the completion of this study, CQ had remained mostly unaffected. The CQ region saw fewer than 50 COVID-19 cases, compared to 63,825 and 37,333 in New South Wales and Victoria to September 2021.² These low case numbers, and less time spent in lockdowns, potentially affected the perceived risk and uptake of the vaccine. Rolling COVID-19

vaccine sentiment research in Australian adults has shown that the proportion of people unwilling to have the vaccine has remained relatively stable since September 2021, even with increased infection rates resulting in widespread and prolonged lockdowns in some states.³⁷ Similar to our findings, this same research identified fear of side effects and/or worry that the vaccine was unsafe as the most commonly cited reason for not wanting the vaccine. While it is possible that the 17% who said they were unwilling to be vaccinated would not change their minds, it is also possible that some may re-assess their position when presented with clear and up-to-date risk/benefit information on the vaccine and the disease, including updated safety information, as more data became available.

Practical issues and vaccine uptake

Most of the practical barriers to receiving a COVID-19 vaccine have been removed for these participants. Lack of onsite clinics and inability to leave work duties were the most reported barriers in this group. Increasing accessibility through provision of more on-site vaccine clinics and working with supervisors to allow time during shifts for vaccination would be a logical first step, while follow-up studies could explore other solutions.

Limitations

This study has several limitations. The low response rate of 5%, convenience sampling and underrepresentation of nurses could affect the generalisability of our findings. However, as there is no literature currently available it is not possible to tell the effect of this skewed sample. Our focus on the CQHHS staff means that only HCWs employed by a public hospital were recruited. Participants may be different from the overall regional healthcare workforce, which also includes HCWs in general practices, private hospitals and residential aged care facilities. Previous studies have shown that while hospital HCWs had higher vaccine uptake rates than non-hospital workers, the determinants of their vaccination uptake were similar,³⁸ and our

findings therefore may still have broad applicability. Future studies including both hospital and community HCWs are needed.

Conclusion

COVID-19 vaccines reduce transmission and severe infections³⁹ among HCWs,⁴⁰ making vaccination crucial to the pandemic response. These findings suggest communications and educational material framed around the benefits and social norms of vaccination, along with targeted materials addressing vaccine safety and effectiveness concerns, would encourage HCWs to accept COVID-19 vaccines. Such materials coupled with an implementation plan removing all possible practical barriers to vaccination would likely result in optimal vaccine coverage among HCWs.

Declaration of competing interest

All authors declare no competing interests.

Contributors

GC, NS,OA, GK and KW conceived and designed the study. GC communicated, collected and extract the data. GC, MHAI, AK, NS, GK and KW performed the primary analysis and interpretation of the data. GC, NS, MK, GK and KW critically reviewed the data analysis and interpretation. GC, MHAI, NS and KW drafted the manuscript and all authors contributed with critical revision to the content of the manuscript. The final version of the manuscript was approved by all authors.

Funding

This work was supported by a Queensland Advancing Clinical Research Fellowship awarded to Prof. Gulam Khandaker by Queensland Health's Health Innovation, Investment and Research Office (HIRO), Office of the Director-General. The funders had no role in study design, data collection or analysis, writing of the article, or the decision to publish.

The corresponding author had access to all the data in the study and the final responsibility for the decision to submit the article for publication.

Data sharing

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Author details

Mrs Gwenda Chapman¹
Mr Mahmudul Al Imam^{1,2}
Dr Arifuzzaman Khan^{1,3}
Dr Nicolas Smoll¹
Dr Odewumi Adegbija¹
Dr Michael Kirk⁴
Prof. Gulam Khandaker^{1,2}
Dr Kerrie Wiley⁵

1. Central Queensland Public Health Unit, Central Queensland Hospital and Health Service, Rockhampton, Queensland, Australia
2. CQUniversity, Rockhampton, Queensland, Australia
3. School of Public Health, The University of Queensland, Australia
4. Rockhampton Business Unit, Central Queensland Hospital and Health Service, Rockhampton, Queensland, Australia
5. Sydney School of Public Health, Faculty of Medicine and Health, The University of Sydney, New South Wales, Australia

Corresponding author

Professor Gulam Khandaker
Address: 82-86 Bolsover Street, Rockhampton
Qld Australia 4700
Phone: 07 49206989
Email: gulam.khandaker@health.qld.gov.au

References

1. World Health Organization (WHO). WHO Coronavirus Disease (COVID-19) dashboard. [Internet.] Geneva: WHO; 2021. Available from: <https://covid19.who.int/>.
2. Australian Government Department of Health. Coronavirus (COVID-19) case numbers and statistics. [Internet.] Canberra: Australian Government Department of Health; 2021. Available from: <https://www.health.gov.au/health-alerts/covid-19/case-numbers-and-statistics>.
3. Wouters OJ, Shadlen KC, Salcher-Konrad M, Pollard AJ, Larson HJ, Teerawattananon Y et al. Challenges in ensuring global access to COVID-19 vaccines: production, affordability, allocation, and deployment. *Lancet*. 2021;397(10278):1023–34. doi: [https://doi.org/10.1016/S0140-6736\(21\)00306-8](https://doi.org/10.1016/S0140-6736(21)00306-8).
4. Quigley AL, Stone H, Nguyen PY, Chughtai AA, MacIntyre CR. Estimating the burden of COVID-19 on the Australian healthcare workers and health system during the first six months of the pandemic. *Int J Nurs Stud*. 2021;114:103811. doi: <https://doi.org/10.1016/j.ijnurstu.2020.103811>.
5. Australian Government Department of Health. *Australia's COVID-19 vaccine national roll-out strategy*. Canberra: Australian Government Department of Health; 2021. Available from: <https://www.health.gov.au/sites/default/files/documents/2021/01/covid-19-vaccination-australia-s-covid-19-vaccine-national-roll-out-strategy.pdf>
6. Prime Minister of Australia. National Cabinet Statement. [Media statement.] Canberra: Australian Government Department of the Prime Minister and Cabinet; 28 June 2021. Available from: <https://www.pm.gov.au/media/national-cabinet-statement-5>.
7. Government of Western Australia. Mandatory COVID-19 vaccines for Western Australian health care workers. [Internet.] Perth: Government of Western Australia, Department of the Premier and Cabinet; 2 September 2021. Available from: <https://www.wa.gov.au/government/announcements/mandatory-covid-19-vaccines-western-australian-health-care-workers>.
8. NSW Health. Vaccination requirements for workers. [Internet.] Sydney: Government of New South Wales, NSW Health; 2021. Available from: <https://www.nsw.gov.au/covid-19/health-and-wellbeing/covid-19-vaccination-nsw/vaccination-for-workers>.
9. Tasmanian Government. Health Care Settings. [Internet.] Hobart: Tasmanian Government, Department of Premier and Cabinet; 2021. Available from: <https://www.coronavirus.tas.gov.au/business-and-employees/health-care-settings>.
10. Sallam M. COVID-19 Vaccine hesitancy worldwide: a concise systematic review of vaccine acceptance rates. *Vaccines*. 2021;9(2):160. doi: <https://doi.org/10.3390/vaccines9020160>.
11. Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K et al. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med*. 2021;27(2):225–8. doi: <https://doi.org/10.1038/s41591-020-1124-9>.
12. Biswas N, Mustapha T, Khubchandani J, Price JH. The nature and extent of COVID-19 vaccination hesitancy in healthcare workers. *J Community Health*. 2021;46(6):1244–51. doi: <https://doi.org/10.1007/s10999-021-10000-0>.

org/10.1007/s10900-021-00984-3.

13. Associated Press – National Opinion Research Center (AP-NORC) Center for Public Affairs Research. Safety concerns remain main driver of vaccine hesitancy. [Internet.] Chicago: AP-NORC; 28 February 2021. Available from: <https://apnorc.org/projects/safety-concerns-remain-main-driver-of-vaccine-hesitancy>.
14. Dodd RH, Cvejic E, Bonner C, Pickles K, McCaffery KJ, Sydney Health Literacy Lab COVID-19 Group. Willingness to vaccinate against COVID-19 in Australia. *Lancet Infect Dis*. 2021;21(3):318–9. doi: [https://doi.org/10.1016/S1473-3099\(20\)30559-4](https://doi.org/10.1016/S1473-3099(20)30559-4).
15. Biddle N, Edwards B, Gray M, Sollis K. *Vaccine willingness and concerns in Australia: August 2020 to April 2021*. Canberra: Australia National University Centre for Social Research and Methods; 5 May 2021. Available from: https://csrcm.cass.anu.edu.au/sites/default/files/docs/2021/5/Vaccine_willingness_and_concerns_in_Australia_-_August_2020_to_April_2021.pdf
16. Leask J, Carlson SJ, Attwell K, Clark KK, Kaufman J, Hughes C et al. Communicating with patients and the public about COVID-19 vaccine safety: recommendations from the Collaboration on Social Science and Immunisation. *Med J Aust*. 2021;215(1):9–12.e1. doi: <https://doi.org/10.5694/mja2.51136>.
17. WHO. *Data for action: achieving high uptake of COVID-19 vaccines. Interim guidance*. Geneva: WHO; 1 April 2021. Available from: <https://www.who.int/publications/i/item/WHO-2019-nCoV-vaccination-demand-planning-2021.1>.
18. Queensland Health. About CQ Health. [Internet.] Brisbane: Queensland Government, Queensland Health; 12 October 2018. Available from: <https://www.health.qld.gov.au/cq/about>.
19. Australian Government Department of Health. ATAGI statement on AstraZeneca vaccine in response to new vaccine safety concerns. [Internet.] Canberra: Australian Government Department of Health; 8 April 2021. Available from: <https://www.health.gov.au/news/atagi-statement-on-astrazeneca-vaccine-in-response-to-new-vaccine-safety-concerns>.
20. McGowan M. Australia records first death from blood clots likely linked to AstraZeneca Covid vaccine. [Online news article.] Manchester: The Guardian; 17 April 2021. [Accessed on 14 August 2021.] Available from: <https://www.theguardian.com/australia-news/2021/apr/16/australia-records-first-fatality-from-blood-clots-linked-to-astrazeneca-covid-vaccine>.
21. Delib. Citizen Space. [Website.] Bristol: Delib; 2021. Available from: https://www.delib.net/citizen_space.
22. Collins D. Pretesting survey instruments: an overview of cognitive methods. *Qual Life Res*. 2003;12(3):229–38. doi: <https://doi.org/10.1023/a:1023254226592>.
23. Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Method*. 2013;13(1):117. doi: <https://doi.org/10.1186/1471-2288-13-117>.
24. Li M, Luo Y, Watson R, Zheng Y, Ren J, Tang J et al. Healthcare workers' (HCWs) attitudes and

related factors towards COVID-19 vaccination: a rapid systematic review. *Postgrad Med J*. 2021. doi: <https://doi.org/10.1136/postgradmedj-2021-140195>.

25. Kociolek LK, Elhadary J, Jhaveri R, Patel AB, Stahulak B, Cartland J. Coronavirus disease 2019 vaccine hesitancy among children's hospital staff: a single-center survey. *Infect Control Hosp Epidemiol*. 2021;42(6):775–7. doi: <https://doi.org/10.1017/ice.2021.58>.
26. Kevat DA, Panaccio DC, Pang SC, Dean JM, Farmer CC, Mahar PD. Medico-legal considerations of mandatory COVID-19 vaccination for high risk workers. *Med J Aust*. 2021;215(1):22–4. e1. doi: <https://doi.org/10.5694/mja2.51128>.
27. Sprengholz P, Betsch C, Böhm R. Reactance revisited: consequences of mandatory and scarce vaccination in the case of COVID-19. *Appl Psychol Health Well Being*. 2021;13(4):986–95.
28. Booy R, Rashid H, Yin JK, Khandaker G, Leask J. Mandating influenza vaccination in health-care workers. *Lancet*. 2011;378(9803):1626. doi: [https://doi.org/10.1016/S0140-6736\(11\)61697-8](https://doi.org/10.1016/S0140-6736(11)61697-8).
29. Leask J, Seale H, Williams JH, Kaufman J, Wiley K, Mahimbo A et al. Policy considerations for mandatory COVID-19 vaccination from the Collaboration on Social Science in Immunisation. *Med J Aust*. 2021. doi: <https://doi.org/10.5694/mja2.51269>.
30. Mello MM, Silverman RD, Omer SB. Ensuring uptake of vaccines against SARS-CoV-2. *N Engl J Med*. 2020;383(14):1296–9.
31. Szmyd B, Karuga FF, Bartoszek A, Staniecka K, Siwecka N, Bartoszek A et al. Attitude and behaviors towards SARS-CoV-2 vaccination among healthcare workers: a cross-sectional study from Poland. *Vaccines (Basel)*. 2021;9(3):218. doi: <https://doi.org/10.3390/vaccines9030218>.
32. Berry NJ, Danchin M, Trevena L, Wittelman HO, Kinnersley P, Snelling T et al. Sharing knowledge about immunisation (SKAI): an exploration of parents' communication needs to inform development of a clinical communication support intervention. *Vaccine*. 2018;36(44):6480–90.
33. Ogilvie GS, Gordon S, Smith LW, Albert A, Racey CS, Booth A et al. Intention to receive a COVID-19 vaccine: results from a population-based survey in Canada. *BMC Public Health*. 2021;21(1):1017. doi: <https://doi.org/10.1186/s12889-021-11098-9>.
34. Ng TWY, Cowling BJ, So HC, Ip DKM, Liao Q. Testing an integrative theory of health behavioural change for predicting seasonal influenza vaccination uptake among healthcare workers. *Vaccine*. 2020;38(3):690–8.
35. Thaler RH, Sunstein CR. *Nudge: Improving decisions about health, wealth, and happiness*. New Haven: Yale University Press; 2008.
36. Wiley KE, Leask J, Attwell K, Helps C, Degeling C, Ward P et al. Parenting and the vaccine refusal process: a new explanation of the relationship between lifestyle and vaccination trajectories. *Soc Sci Med*. 2020;263:113259. doi: <https://doi.org/10.1016/j.socscimed.2020.113259>.
37. Melbourne Institute. Vaccine hesitancy tracker. [Webpage.] Melbourne: University of Melbourne, Melbourne Institute; 2021. Available from: <https://melbourneinstitute.unimelb.edu.au/publica->

tions/research-insights/ttpn/vaccination-report.

38. Rebmann T, Wright KS, Anthony J, Knaup RC, Peters EB. Seasonal influenza vaccine compliance among hospital-based and nonhospital-based healthcare workers. *Infect Control Hosp Epidemiol*. 2012;33(3):243–9.
39. Chia PY, Xiang Ong SW, Chiew CJ, Ang LW, Chavatte JM, Mak TM et al. Virological and serological kinetics of SARS-CoV-2 Delta variant vaccine-breakthrough infections: a multi-center cohort study. *medRxiv*. 2021. doi: <https://doi.org/10.1101/2021.07.28.21261295>.
40. Benenson S, Oster Y, Cohen MJ, Nir-Paz R. BNT162b2 mRNA Covid-19 vaccine effectiveness among health care workers. *N Engl J Med*. 2021;384(18):1775–7.