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**An Education Intervention Addressing Health Students' COVID-19 Vaccine Knowledge,
Attitudes, and Behaviours**

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Abstract

Background: COVID-19 impacted higher education (HE) students studying health degrees with an embedded placement in a unique way. At the height of the pandemic AHPRA declared that health students completing placements were required to be vaccinated against COVID-19 and be competent at providing advice and information about the COVID-19 vaccine to the public. It is yet to be determined if there is hesitancy amongst students studying health degrees. This study aimed to determine if offering an evidence-based targeted educational intervention changes health student knowledge, attitudes, and willingness to have the vaccine.

Methods: An evidence-based educational intervention was developed and delivered to students studying health. A purpose developed survey was designed to assess health students' knowledge, and willingness to have the COVID-19 vaccine, before and after this targeted educational intervention.

Results: A total of 290 students from eight health disciplines completed the intervention and pre- and post-surveys. Analyses demonstrated a statistically significant increase in participants' willingness to receive the COVID-19 vaccine, and how confident participants felt about explaining Covid vaccines and their safety, with an increase in accuracy of knowledge about professional responsibility.

Conclusion: This study shows that targeted educational intervention can positively influence HE health care students. Increasing the knowledge and confidence of our trainee health professionals is paramount to enable them to be sources of accurate information and advice in relation to Covid vaccination.

I INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic is ongoing, and new variants of the causative virus continue to emerge (Department of Health, 2021c). The key to reducing the spread of this highly infectious disease is widespread uptake of the COVID-19 vaccine (Commonwealth of Australia Department of Health, 2021; Department of Health, 2021b). To date, there are four registered vaccines approved for use in Australia: the Comirnaty (Pfizer/Biontech), Spikevax (Moderna), Vaxzevria (Oxford/AstraZeneca), and Nuvaxovid (Novavax) vaccine (Commonwealth of Australia Department of Health, 2021). To prevent serious illness and death, almost the entire Australian population needs to be vaccinated twice in a two dose primary series and then again three months later with a booster, or third dose (Commonwealth of Australia Department of Health, 2021). It is currently accepted that COVID-19 will likely become endemic and continue to circulate in an ongoing form; therefore, it is increasingly likely that additional COVID-19 vaccines will be recommended to provide ongoing protection. Health professionals and health students have played and will continue to play a vital role in improving ongoing vaccine uptake (Malik et al., 2020).

At the commencement of the COVID-19 vaccine rollout, there were high levels of vaccination hesitancy—a reluctance or refusal to be vaccinated despite availability (Grech & Borg, 2020; Grech et al., 2020; Kwok et al., 2021; Papagiannis et al., 2021). While vaccination hesitancy is not a new concept, there appeared to be more hesitancy towards the COVID-19 vaccine than other vaccines; however, the vaccine roll-out in Australia gained momentum and by December 2021 was reported one of the highest vaccination rates globally. There was a change in thinking and individuals who were hesitant saw that on a global stage, billions of vaccines had been administered and that safety and effectiveness data continued to accumulate. Consistent with what happened globally, Australia experienced waves of the virus. The second wave of the virus led most of the country into its second lockdown. This resulted in people being confined and only allowed to leave their home for essential goods, such as food. Strict border controls divided States and Territories and led to a fractured federation. The Government informed the public that the lockdown would only be lifted when 80% of the population were vaccinated. When 70% of eligible Australians were vaccinated, vaccinated individuals enjoyed greater freedoms as they could leave lockdown earlier and go shopping with other vaccinated individuals. This acted as an extra incentive for individuals to be vaccinated.

COVID-19 impacted university students across the country and impacted students studying health degrees with embedded placement(s) in a unique way. Inherent with completing a health degree, is the requirement for students to complete placement(s) in practice settings such as hospitals, clinics, and primary care. In 2020 and 2021 these settings were considered high-risk for COVID-19 (ACT Government, 2021). In March 2021, the Australian Health Practitioner Regulation Agency (AHPRA) and the National Registration Boards' position statement on *Registered Health Practitioners and Students and COVID-19 Vaccination* was released (AHPRA & National Boards, 2021). This statement covered three main aspects related to health professionals and health students; being vaccinated against COVID-19, administering COVID-19 vaccines, and providing advice and information about the COVID-19 vaccine to the public (AHPRA & National Boards, 2021).

This position statement, while at this point not mandated, encouraged all health students undertaking placements to have the COVID-19 vaccine unless medically contraindicated (AHPRA & National Boards, 2021). Students completing a placement in health care settings were eligible to have the vaccine in the very early phases of the national rollout (Phase 1B) at no financial cost to themselves (Department of Health, 2021d). Universities, including the University of Canberra, strongly encouraged students to have the vaccine prior to their placements, both for their own protection and for those for whom they provided care. Additionally, the National Board states that students studying health degrees must provide evidence-based information about the COVID-19 vaccine to the public, including when using social media and advertising (AHPRA & National Boards, 2021). Students who promote anti-vaccination narratives, which disagree with scientific

evidence, may be in breach of the codes of conduct and may be subject to investigation and regulatory action (AHPRA & National Boards, 2021).

It is yet to be determined if, during the height of the COVID-19 pandemic, there was hesitancy amongst students studying health degrees. Further, student knowledge and understanding of the COVID-19 vaccine has not been explored in the Australian context. To date, there is a paucity of research to determine if offering an evidence-based targeted education intervention, changes student knowledge, attitudes, and willingness to have the vaccine.

II METHOD

A Participants and Procedure

Four hundred and thirty-two health science students from various professional disciplines within the Faculty of Health at the University of Canberra were initially invited to complete a Qualtrics online survey via the student online learning system. The survey was designed following a review of the literature and by experts in vaccine hesitancy to assess health students' knowledge, attitudes, and willingness to have the COVID-19 vaccine, before and after a targeted educational intervention. Members of the research team not involved in the development of the survey piloted the survey for readability, usability, and to enhance content validity before distribution. Students were required to watch the educational lecture prior to placement as part of their coursework; however, participation in the pre- and post-survey was voluntary and anonymous. This project was reviewed and approved by the authors' university's Human Research Ethics Committee (approval 0096). Of the 432 who started the survey, 142 participants did not complete the post-intervention survey; there were no significant differences in age, $t(427) = 1.247$, $p = .213$, or self-reported gender, $\chi^2(1, 3) = 6.811$, $p = 0.78$, between completers and non-completers. There were also no significant differences in vaccination history between completers and non-completers.

The final sample ($n = 290$) were mostly female students completing a bachelor's degree (see Table 1 for a full breakdown of participant demographics). Most of the sample (77.1%) indicated that they had received the influenza vaccination in 2020, and 58.3% indicated that they had received it in 2021. Approximately a quarter (22.9%) of participants had received at least one dose of any COVID-19 vaccination at the time of the pre-intervention survey (see Table 1).

Table 1.
Participant Demographic Data

	Percent	<i>n</i>
Gender		
Male ($M_{age} = 26.79$, $SD_{age} = 7.05$)	26%	76
Female ($M_{age} = 26.80$, $SD_{age} = 8.36$)	72%	206
Non-binary (38 yrs)		
Not disclosed ($M_{age} = 30.00$, $SD_{age} = 10.68$)		
Degree		
Bachelor's	66.1%	187
Master's	32.9%	93
PhD	1.1%	3
Discipline		
Physiotherapy	31.7%	92
Nursing	23.1%	67
Pharmacy	10.7%	31
Speech therapy	6.9%	20
Occupational therapy	4.8%	14
Psychology	5.5%	16
Medical imaging	12.4%	36
Other	4.8%	14
Vaccination status (yes)		
Influenza 2020	77.1%	222
Influenza 2021	58.3%	168
COVID 19	22.9%	66

B Educational Intervention

The educational intervention was an evidence-based lecture explicitly developed for health students attending placements in healthcare settings. The lecture covered the different types of COVID-19 vaccines, how they work in the body to stimulate an immune response, expected and unexpected side effects, and the current evidence about vaccine safety and efficacy. It also explored common myths and facts about the vaccine and the National Boards statement and how, as health students, they should communicate to the public about COVID-19 vaccines.

The lecture was offered to all health disciplines, that have embedded professional placements, in the Faculty of Health at the University of Canberra in June 2021, covering the disciplines of Pharmacy, Physiotherapy, Nursing, Midwifery, Exercise Physiology, Speech Therapy Occupational Therapy, Clinical Psychology, Counselling, Medical Imaging, and Vision Science. Each of the disciplines' Professional Practice Conveners (staff who facilitate student clinical placements) embedded the educational video in the relevant online learning management system (Canvas LMS). Originally this lecture was to be provided face to face; however, COVID-19 lockdown restrictions in the geographical location of the university at the time prevented this from occurring.

C Measures

Participants completed a series of brief questions about their attitudes and knowledge about COVID-19 vaccinations (detailed below).

1 Willingness

Participants were asked about their willingness to have the COVID-19 vaccination with a single item “How willing are you to have the COVID-19 vaccine?” pre- and post-intervention. This item was rated on a 7-point scale (1 = *extremely unwilling*; 7 = *extremely willing*).

2 Importance

The degree to which participants thought the COVID-19 vaccinations were important for healthcare workers and patients were assessed with the following two questions, pre- and post-intervention: “How important is it for health professionals to have the COVID-19 vaccine for their own protection?” and “How important is it for health professionals to have the COVID-19 vaccine for the protection of their patients?”. Both of these items were rated on a 7-point scale (1 = *extremely unimportant*; 7 = *extremely important*).

3 Confidence

The degree to which participants felt confident about explaining COVID-19 vaccinations and their safety, were assessed with the following two questions pre- and post- intervention: “How comfortable are you explaining the need for COVID-19 vaccination to the public?” and “How confident are you that the COVID-19 vaccines are safe?”. These items were both rated on a 7-point scale (1 = *extremely uncomfortable/unconfident*; 7 = *extremely comfortable/confident*) with their relevant adjectives.

4 Knowledge

Vaccine knowledge was assessed with a series of three questions, asking participants to select the appropriate correct responses for each question. The knowledge questions covered knowledge about the available COVID-19 vaccinations (5 response options, 3 of which were correct), knowledge about potential side effects from vaccination (5 response options, 4 of which were correct), and knowledge about their professional responsibility as registered health practitioners in the communication of accurate information to the public (5 response options, 2 of which were correct). An accuracy of knowledge percentage was calculated for each question by summing the selected true correct and unselected true incorrect responses and dividing this by the sum of the true correct, unselected true incorrect, selected wrong, and wrongly unselected responses. These accuracy scores were calculated for both pre- and post- survey items.

D Qualitative Data

At the completion of both the pre- and post-intervention surveys there was an open-ended question “Are there comments you would like to make about the COVID-19 vaccine?” The data for this question were coded by one researcher (author initials) using axial coding and validated by other authors (authors’ initials). The codes were formulated based upon the key terms and concepts from the categories of willingness, attitudes, and knowledge. As defined by Strauss and Corbin (1990), axial coding is the procedure whereby data are reconstructed in new ways after open/previous coding by making connections between categories. Axial coding assists researchers to explore data utilising an analytic framework(s), to link categories with subcategories and to interrogate how these are related (Charmaz, 2006).

III RESULTS

A series of repeated measure *t*-tests were conducted on each of the willingness, importance, confidence, and knowledge questions. Variations in the degrees of freedom are due to some participants not responding to all post-intervention survey questions. The results, as reported in Table 2, indicated an increase in willingness pre- to post-intervention to receive a COVID-19 vaccination, the belief that health professionals should be vaccinated for their own protection and that of their patients’, the extent to which students were confident that COVID-19 vaccines were safe, and how confident they felt explaining COVID-19 vaccine safety. For the knowledge questions, there was only a significant increase in accuracy of knowledge about professional

responsibility from pre- to post-intervention, with no significant change in accuracy of knowledge about vaccines themselves and their potential side effects (see Table 2).

Table 2.
Means, Standard Deviations, T-Scores, and Effect Sizes for Changes Pre to Post Across Target Variables

	Pre- Intervention		Post- Intervention		<i>t</i> (<i>df</i>)	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Willingness to receive COVID-19 vaccination	5.53	1.42	5.88	1.31	5.94 (284)	<.001	0.70
Importance of health professional being vaccinated for:							
patient protection	5.76	1.55	6.18	1.39	5.13 (289)	<.001	0.61
own protection	5.81	1.66	6.27	1.38	5.72 (288)	<.001	0.68
Confidence:							
in explaining Covid vaccine safety	4.84	1.38	5.45	1.25	9.78 (288)	<.001	1.15
that Covid vaccines are safe	4.80	1.39	5.59	1.20	12.64 (288)	<.001	1.49
Knowledge about:							
professional responsibility	84.55	21.53	91.45	16.43	5.93 (289)	<.001	0.70
vaccine side effects	61.57	25.10	63.10	24.34	1.17 (289)	.242	
types of vaccines	79.79	19.79	80.76	18.02	0.84 (289)	.400	

A Qualitative Analyses

For the open questions there were 27 participants to the pre-education package question and 18 participants to the post-education question. Five themes were generated in the response to the question. Some comments covered two of the themes so there is some duplication.

1 Pre-Education

Willingness. There were two sub themes under the student participants' willingness to get the COVID-19 vaccine before undertaking the education package; they include queries around making the vaccine mandatory and access to the vaccine.

Mandatory. A prominent theme was whether vaccination should be mandatory, with six participants revealing that they have strong feelings about this. Two participants commented that if vaccination were mandatory, they would discontinue their studies and forfeit their careers. Some participants also commented that vaccination should be mandatory and others were neutral with comments such as "*we should have the right to refuse*" and "*in the trial phase it should not be compulsory*".

Access. Participants expressed they were worried that they could not access the vaccine easily in country areas. Students also suggested education providers (i.e., Universities) should provide the vaccine to the students.

Attitudes. There was one prominent subtheme under the student participants' attitude to get the COVID-19 vaccine before undertaking the education package, with 10 participants making comments around confidence.

Knowledge. There were two sub themes under the student participants' knowledge about getting the COVID-19 vaccine before undertaking the education package; they include lack of knowledge and concern around side effects. A prominent theme centred around a lack of knowledge, with seven participants articulating a comment around the lack of knowledge they and the community have about the vaccine.

"There is poor information out there and the risk of contracting covid in Australia is low compared to other places". Health Student 1

"I admit I don't have a great knowledge about the details of how all the vaccines work, so I'm looking forward to this education package" Health Student 2

One participant linked SARS-CoV-2 to influenza namely;

"I would like to see more information about how we manage Influenza generally. If the public had more understanding about the capacity of viruses to change and how vaccines are continuously modified to account for this, it may help people better appreciate the complexity of creating 'a covid vaccine'." Health Student 3

The next most predominant theme was around the concern of side effects with five participants expressing concerns surrounding side effects. The most common concern voiced was around blood clots with three participants expressing concerns from the media around blood clots especially in relation to Astra Zeneca. Other participants were concerned about the safety regarding fertility and breast feeding and there was one outlying comment about a conspiracy theory, that was not coded as it did not fit with the themes.

2 Post-Education

For the comment section at the end of the post-intervention survey, most of participants answered "no". Comments received in the post education survey matched the initial themes except for the theme about lack of knowledge.

There was one comment about confidence ("sounds better than the virus"), about the vaccination being mandatory (positive that it should be mandatory), about side effects, and access. There was still the same outlying comment about the COVID-19 vaccine conspiracy, and one participant commented that they were "sick of hearing about this". In general, the qualitative comments from the pre- and post-education survey support the hypothesis that the education package met the needs of the health students at the time of delivery.

IV DISCUSSION

In our study, students demonstrated an increase in their knowledge about the vaccine post-intervention. The knowledge regarding the adverse effects, however, did not change significantly. This is interesting and may be in part related to the extensive media reporting of the adverse effects of the vaccine and may contribute to the attitudes towards the vaccine seen in the study. A study in China that explored nursing students' knowledge of the vaccine examined the sources of information used by students and found that mobile phones and television ranked in the top four sources (Jiang et al., 2021).

A scoping review of healthcare workers attitudes towards COVID-19 vaccination using studies from across the world, found the importance of increasing knowledge in healthcare workers was important in reducing the burden of the pandemic (Biswas et al., 2021). Increasing the knowledge of our trainee health professionals is therefore paramount. Li et al., (2021) suggests tailored communication strategies are required to increase knowledge and the results demonstrate the effectiveness of this intervention.

Even before the COVID-19 vaccine, Marrota et al., (2017) recognised the need for health students, our future health care workers, to increase their knowledge in order to deal with and promote vaccination. This intervention has shown a positive influence on students' knowledge about the vaccine and reinforced their ability to understand adverse effects and make recommendations.

Healthcare professionals are considered reliable sources of information about vaccinations. Vaccine hesitancy amongst healthcare professionals has been studied and a strong relationship has been found between attitudes and willingness to be vaccinated themselves and their recommendation for patients (Kose et al., 2021; MacDonald & Dubé, 2015). In this study, healthcare students were asked about their opinions on COVID-19 vaccinations before and after

an education program. Vaccination willingness was 81.9% pre-intervention and 87.6% post-education, which is in the upper range of willingness reported in other studies (Di Giuseppe et al., 2021; Graupensperger et al., 2021; Jiang et al., 2021; Qiao et al., 2020; Sun et al., 2020). Most of the literature so far has focused on attitudes and willingness to accept a vaccine; our study also looked at how an education program changed the willingness of healthcare students.

Qiao et al., (2020) concluded that education campaigns should be tailored for young adults as they tend to have comparative optimism and heightened sense of invulnerability. Fostering positive vaccine specific attitudes is important to get behavioural change. Perception of risk and risk assessment, as well as education on facts versus “fake news”, is what this generation requires in an education program. Evidence is accumulating that the level of concern and perceived vulnerability to COVID-19 are motivating factors to seeking vaccination (Pastorino et al., 2021). Pastorino et al. (2021) concluded that since university students have an active social life, their uptake of the vaccination plays an important role in fighting the spread of the virus.

The role that education plays in acceptance of vaccination has been explored by several authors (Di Giuseppe et al., 2021; Jiang et al., 2021; Kelekar et al., 2021; Manning et al., 2021). Manning et al., (2021) suggested that “armed with an understanding of student and faculty concerns about the safety of the vaccine, nurse leaders can develop vaccination programs that include evidence on the side effects and efficacy of the COVID-19 vaccine”. In our study, education included vaccine development, trials, and safety monitoring. This may have contributed to the increase in participants’ vaccination willingness. Kelekar et al., (2021) also called for expansion of the medical and dental curriculum to include vaccination counselling. They found that willingness again was related to personal experience and understanding of the seriousness of the virus.

V CONCLUSION

The COVID-19 pandemic has been a whirlwind of disruption, fast paced changes, and pressure for Australian tertiary healthcare students. Due to departmental government, healthcare facilities, and University policies, these healthcare students have been strongly encouraged or mandated to be vaccinated against COVID-19. In addition to this, AHPRA requires registered health practitioners and students to be sources of accurate information and advice in relation to COVID-19 vaccination with anti-vaccination sentiments considered a breach of codes of conduct and subject to investigation and possible regulatory action. This study shows that a targeted education intervention can positively impact university healthcare students’ willingness to receive the COVID-19 vaccine, which may ultimately mitigate the spread of this highly infectious disease to the students themselves and their patients. Further, this study shows that targeted education improves university students’ confidence and knowledge about the vaccine, which may improve ongoing vaccine uptake.

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