Knowledge of, attitudes towards and perceptions of COVID-19 vaccination mandates and vaccine uptake among students attending a tertiary institution

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Background. In South Africa, COVID-19 vaccination was voluntary for the public. At the University of the Western Cape, a hard mandate policy for vaccination was imposed on all clinical disciplines, which was in alignment with the country's policy. Failure of students to be vaccinated resulted in their not being enrolled for the academic year.
Objectives. To explore knowledge of, attitudes towards and perceptions of implementing the COVID-19 vaccine hard mandate among tertiary students, at a time during 2022 when the COVID-19 infection rate was falling and the demand for vaccines was low.
Methods. An online questionnaire was distributed to clinical and non-clinical students (control group). Clinical students were from the faculties of Dentistry and Community and Health Sciences, and non-clinical students were from the faculties of Law and Arts and Humanities. A convenience sample was used, with a sample size of 250 for both the clinical and non-clinical students. Basic descriptive statistics were used to share the outcomes of the study.
Results. A total response rate of 46% was achieved from the clinical and non-clinical students. The majority of the participants (88%) were vaccinated. Some participants indicated doubt about the need for vaccination against COVID-19, and half believed that misinformation was spread. The results therefore indicated that vaccine hesitancy may have affected uptake of vaccination, even at a time when it was strongly advised.
Conclusion. Imposing vaccine mandates without engaging with and informing affected individuals could increase vaccine hesitancy, leading to resistance to implementation of the policy.

Keywords. COVID-19, vaccines, vaccination, hard mandate, hesitancy, tertiary students.

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The first five authors graduated with a BDS from the University of the Western Cape in 2023, and are working in South Africa. During their third year, they were required to develop a research protocol as part of the undergraduate research course. During fourth year the research was conducted in a 'dental research' module, and in the final year of their undergraduate degree, the work was presented at the University of the Western Cape Faculty of Dentistry's Research Day. Prof. Saadika Khan was their supervisor.

Vaccination is still considered one of the best ways to combat serious illnesses, hospitalisation and even death. It has been shown to be particularly important among the very young and old sectors of the population. Health authorities have therefore identified certain vaccinations to be compulsory for these age groups (2 - 12 years and >65 years) and for people with health conditions that make it necessary for them to be protected against serious illnesses.[1] With the information on the spread of COVID-19 among certain populations, this conversation on vaccinations is still considered important. Since the first report of COVID-19 by the World Health Organization and its being declared a global pandemic, researchers globally developed eight different vaccines.[1]

In South Africa (SA), vaccination was voluntary for the public.[2] Because of the global impact of the virus (spread and infectiousness), people were strongly encouraged to be vaccinated. However, vaccine hesitancy, defined as delay in acceptance of or refusal of safe vaccines despite availability of vaccination services and related evidence, remained a challenge even among public healthcare workers, including many front-line workers.[3] What was particularly concerning was that some healthcare workers resisted being vaccinated.[3] Vaccine hesitancy is connected to factors such as misinformation, complacency, inconvenience and lack of confidence, especially in newly developed vaccines like those for COVID-19.[3]

Owing to the nature of the global COVID-19 pandemic, vaccine mandates were developed out of necessity and for the protection of all (e.g. healthcare workers and patients). These mandates were found to be most effective in certain settings, such as workplaces, schools and healthcare facilities, or for high-risk groups.[3] Highlighting the risks and severe consequences of COVID-19 was a major factor encouraging

vaccine uptake in communities. By sharing the evidence that these newly developed vaccines were effective and not harmful, and combating misinformation, an increase in confidence and belief in the vaccines was achieved.[1] The evidence and information shared by researchers with the public focused on various aspects of COVID-19 disease progression and vaccine efficacy. They reported that the vaccine served as a mechanism to reduce the severity of the virus's effects, which in turn would lead to shortened recovery time and reduced morbidity and mortality.[4] They also made it clear that vaccination would not prevent one from acquiring the infection.

Healthcare workers chose their profession knowing the virtues of and risks associated with providing care to the public. Their actions should therefore always be geared to first protecting themselves, so that they can provide care to others.[5] Healthcare institutions, on the other hand, have a duty to protect patients and avoid the spread of nosocomial infections.[6] Furthermore, they have a responsibility to keep working efficiently during pandemics and disease outbreaks and meet the public's trust.[5] Galanakis *et al.*[5] noted that increased immunity rates among healthcare workers resulted in a better working and treatment environment for themselves, their patients and the public. Healthcare authorities therefore had a moral obligation to ensure that vaccination rates of 100% among healthcare workers were achieved.

SA officially began its national COVID-19 vaccination programme almost a year after the first case was reported. The aim of this campaign was to achieve herd immunity by initially vaccinating 67% of the population.[1] However, this did not occur, as vaccine acceptance ranged from 52% to 82%.[3] It was then discovered that there was lack of confidence regarding the safety of these vaccines among the general population, leading to hesitancy over being vaccinated.[3] The lack of confidence in the available vaccines was noted, and strategies to improve acceptance of vaccination were implemented in SA. Researchers identified that communication about the efficacy and safety of the vaccines was insufficient to gain the public's trust in the vaccination programme. For greater vaccine acceptance, vaccination programmes should have considered people's beliefs, culture, education, religion and political leanings, as these components form part of broader development and trust-building measures that focus on relationships, transparency, participation and justice.[7]

It was decided in some countries that mandatory COVID-19 vaccination certification should be introduced.[8,9] Mills and Rüttenauer[8] investigated the effect of certification on vaccine uptake, using a synthetic control model that compared the six countries (Denmark, Israel, Italy, France, Germany and Switzerland) that initially introduced certification with countries that did not require it. The results indicated that COVID-19 vaccination certification led to an increase in vaccinations 20 days before implementation and that the effect lasted up to 40 days. In addition, restriction of access to certain settings (nightclubs and events with >1 000 people) was associated with an increase in vaccinations in those aged <20 years.[8]

A study by Largent *et al.*[9] showed that demographic characteristics and partisanship were associated with acceptance of COVID-19 vaccine mandates. In contrast, mandates forced on employees by their employers did not gain majority acceptance where acceptability exceeded unacceptability. This meant that efforts on the part of employers to increase COVID-19 vaccine uptake had to be focused on specific individuals and groups such as frontline healthcare workers.[10,11]

Understanding of vaccine uptake and related barriers, including hesitancy, is especially important in view of the current mpox threat, considered a global public health emergency. Mpox can spread in hospital settings and via close contact with humans or contaminated objects.[12] Vaccines for mpox are available prophylactically and once exposed, and vaccination is especially important for vulnerable groups such as healthcare workers.[12]

Following the SA National Department of Health directive, the University of the Western Cape (UWC) implemented a hard mandate for a mandatory COVID-19 vaccination programme (referred to as a hard mandate) for certain faculties only, which was based on in-person attendance at lectures and for clinical work. Failure of students to be vaccinated resulted in their not being enrolled for the academic year. The aim of the present study was to determine knowledge of, attitudes towards and perceptions of UWC's hard mandate among tertiary students attending the institution. This understanding is important in view of the mpox health emergency, and related information can guide researchers and healthcare workers. Our objectives were:

- To determine students' knowledge, attitudes and opinions regarding the imposed hard mandate for vaccinations
- To ascertain to what extent students received communication and support from the university regarding its decision to apply different vaccination mandates.

Methods

A cross-sectional study design was employed for this research, as it compared diverse groups at a specific point in time. The cross-sectional design allowed the researchers to collect data from a large population during a limited data collection time period. The questionnaire was approved after being pretested in students who were not necessarily part of the study to improve the wording, format and structure of the questions. Pretesting is an essential phase in questionnaire development to ensure the instrument's clarity, reliability and validity.

Development of the research protocol for the present study commenced in 2021, after South Africa started its national vaccination programme on 17 February 2021. In 2021, students were strongly advised to be vaccinated. At the beginning of 2022, the year during which the research was conducted, the COVID-19 vaccination hard mandate was enforced at UWC. Unvaccinated students affected by the mandate would therefore not have been able to register at the start of the academic year in 2022.

The study was conducted via an online platform, as this involved minimal cost and enabled easy distribution to a large group of university students. The participants were a convenience sample of 500. The breakdown of the sample is described in detail below.

The sample was divided into clinical students and non-clinical students, all of whom were undergraduates. The clinical students (n=250) were given the hard mandate for vaccination (Table 1). The reason for this was that the faculties of Dentistry and Community and Health Sciences had clinical exposure to patients, in-person practical sessions and in-person assessments, therefore requiring vaccination. The non-clinical students (n=250) identified for the study, who were not affected by the hard mandate, were from the faculties of Law and Arts and Humanities. These faculties had transitioned to online learning with no physical in-person sessions required.

Students excluded from the sample were students from faculties at UWC other than Dentistry, Community and Health Sciences, Arts and Law, and students from other universities.

An information sheet on the study and including all ethical considerations, a consent form to participate in the study, and the questionnaire prepared by the student researchers were shared with identified participants (both clinical and non-clinical) via the UWC communications centre. The questionnaire was conducted via an online platform, and was formulated on Google Docs (Google LLC, USA). The questionnaire was sent out individually to the participants three times at 2-week intervals via the communications centre. The email addresses of potential participants were obtained from each faculty administrator's office. To ensure reliability, the survey was sent directly to the participants falling within the sample selection. The questionnaire was created so that response was anonymous, and the participants' details were not recorded or captured.

The questionnaire was divided into three sections: demographic information, questions related to COVID-19 vaccinations and misinformation about the vaccines, and the university's role with regard to vaccine support. All completed questionnaires obtained were included, and the data were analysed using appropriate statistical frequency tests. Responses were reported using graphs and charts, including comparisons across different groups.

Ethical clearance for the study was obtained from the UWC Biomedical Research Ethics Committee (ref. no. BM22/6/12).

Results

Of the total number of 500 questionnaires, 230 were completed and returned by participants from the different faculties, giving a response rate of 46%.

Demographic details of participants

Most of the responses received were from the Faculty of Arts (67%), with a total of 33% from the three other faculties (Table 2). The faculties of Arts and Law comprised the non-clinical groups, and the majority of the responses (*n*=179) were from these participants (Table 2).

In terms of gender, the largest response group (*n*=154, from the Faculty of Arts) had a male majority, but in the other faculties, higher proportions of respondents were female. Of the total sample (both clinical and non-clinical), 204 (88%) indicated that they had taken the COVID-19 vaccine, irrespective of the mandate proposed for the faculty in which they were studying. However, many respondents (*n*=108) expressed hesitancy about taking the vaccine, and had probably done so because of the university's policy, according to which all students were expected to be vaccinated, even without a hard mandate. This corresponds with the 41% (*n*=94) who indicated that they would not have taken the vaccine if the university had not required it (Fig. 1).

Regarding implementation of a hard mandate for COVID-19 vaccination, a number of participants (*n*=49) felt strongly that this rule was not justified (Fig. 2).

Perceptions of misinformation on the part of participants

Of the participants, 92 (40%) indicated that they obtained their information from various types of online media. In terms of misinformation, a fairly large number (*n*=83) believed that misinformation stemmed from personal views. The pandemic was considered a 'novel' pandemic, as many participants had not previously been exposed to a pandemic. This viewpoint clearly affected their responses, as people's reaction to information is generally affected by their own perceptions. And while we believe that the questions were truthfully answered, there may well have been 'uninformed' decisions relating to the vaccine and vaccinations. This possibility is supported by the fact that 50% of the participants (*n*=116) were of the opinion that there was misinformation circulating regarding COVID-19 vaccination (Fig. 3). This may also not necessarily be the case, but all considering all comments, the responses indicated that participants' personal views crept into the vaccination decision-making process.

Perceptions regarding the vaccination mandates and support from the university

Clearly 'hindsight is an exact science', and 44% of the participants (*n*=101) believed that it was not necessary to impose a hard mandate

Table 1. Description of sample and sample size proposed for the study

Group	Faculty	Sample size
Clinical students, hard mandate for vaccinations	Dentistry	***n***=250
	Community and Health Sciences	
Non-clinical students, not affected by the hard mandate	Law	***n***=250
	Arts and Humanities	
Total sample size		***N***=500

Table 2. Demographic details of participants and response rates (*N*=230)

	Faculty of Dentistry	Faculty of Community and Health Sciences	Faculty of Law	Faculty of Arts and Humanities
Responses, ***n*** (%)	48 (21)	3 (1)	25 (11)	154 (67)
Gender, ***n***	Female 40	Female 2	Female 15	Male 86
Age (years), mean	21	21	22	22

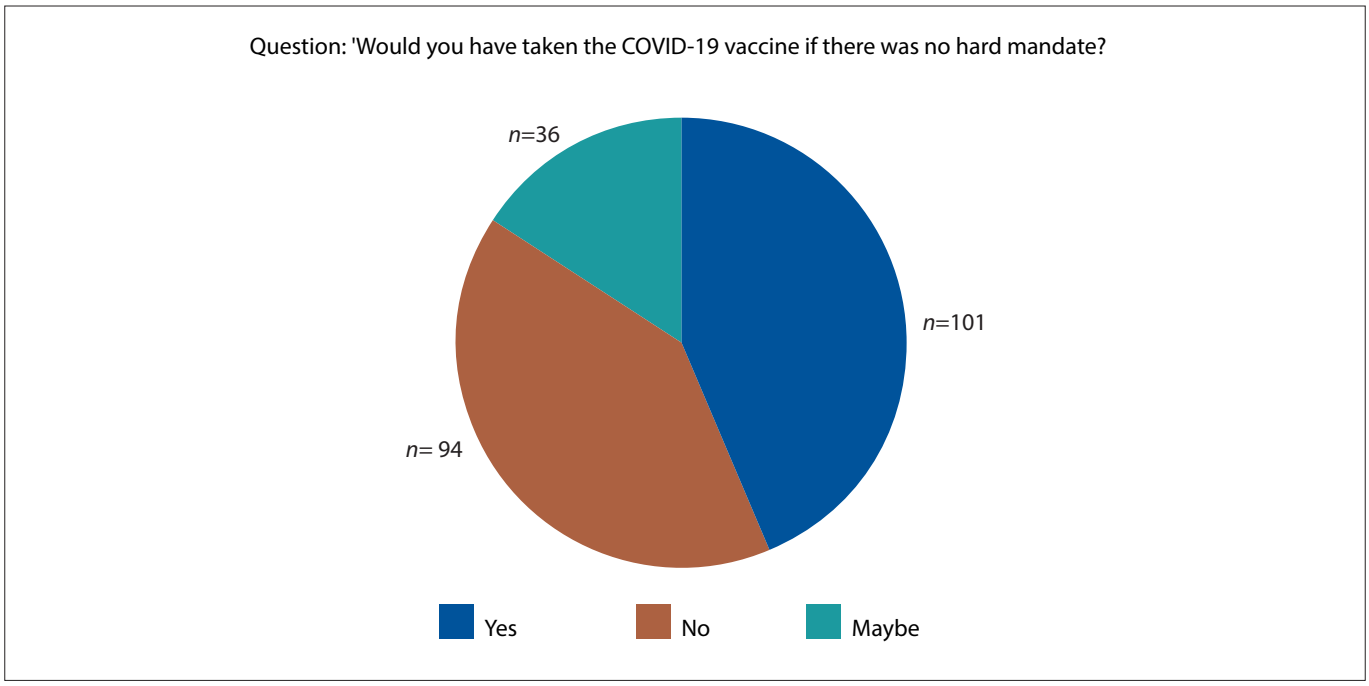

Fig. 1. Responses regarding taking the COVID-19 vaccine in the absence of the hard mandate.

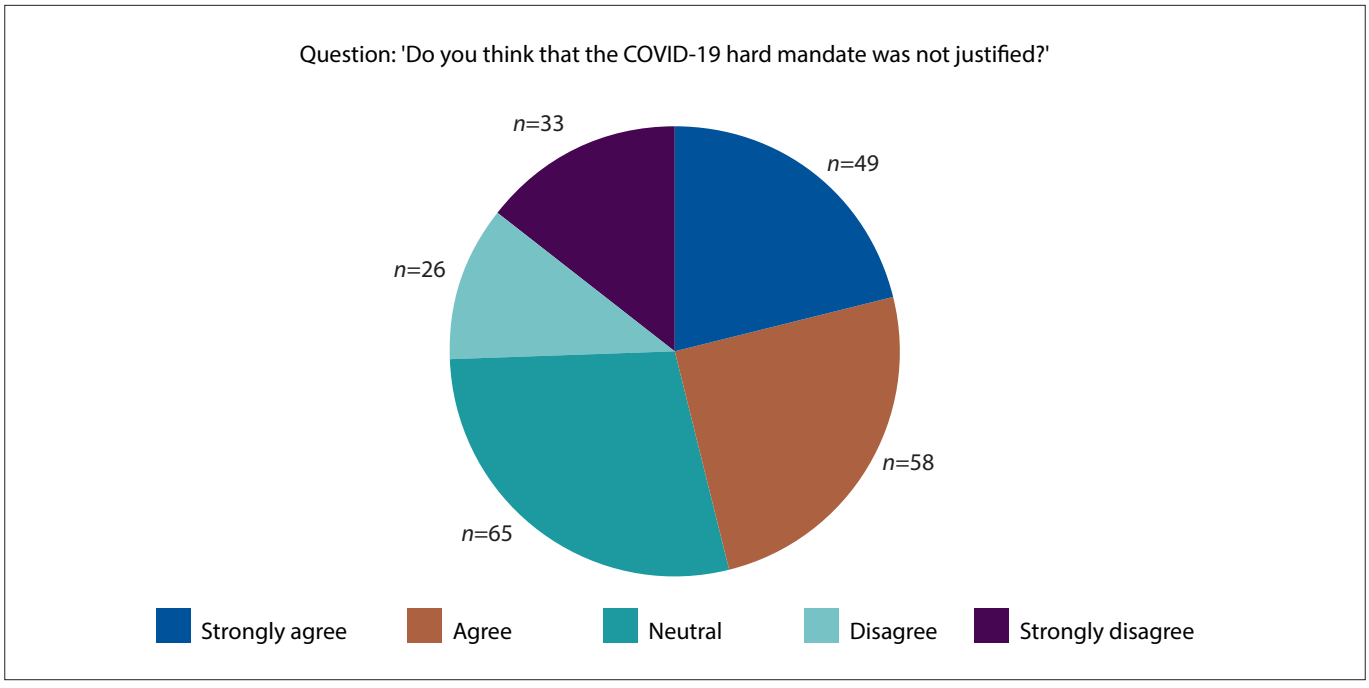

Fig. 2. Responses regarding justification of the hard mandate for COVID-19 vaccination.

for vaccination, as they would have taken the vaccine without it, while a similar number (*n*=94) indicated that they would not have been vaccinated had a hard mandate not been imposed (Fig. 1).

lDiscussion

The hard mandate approach to vaccination adopted by the university was in line with the national health authorities' campaign to keep the population safe. The participants had generally reacted positively regarding vaccination; in fact, many were vaccinated before any mandate was released. However, after the introduction of the mandate, and with the return to comparative normality during 2022 (the National State of Disaster ended on 4 April), some participants questioned whether vaccination was necessary.

Impact of the hard mandate on uptake of vaccination

With regard to the hard mandate on COVID-19 vaccination, in line with the country's policy, the study found that the majority of respondents had

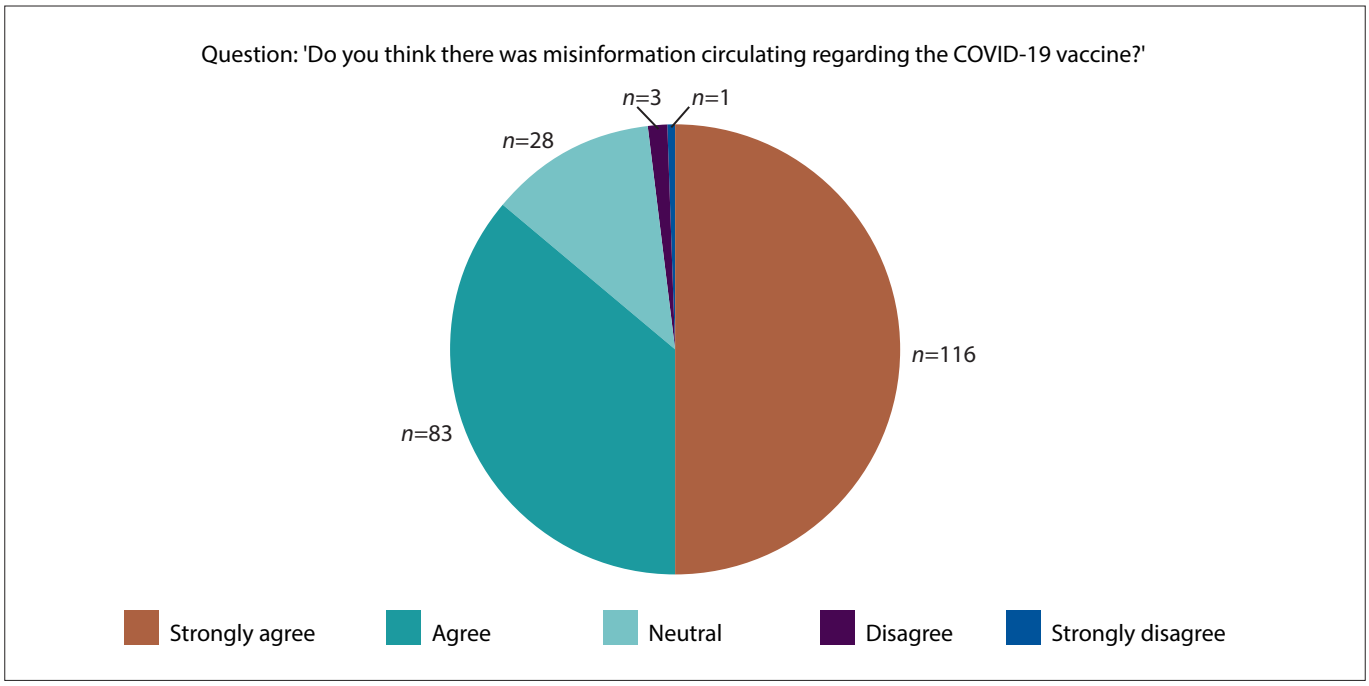

Fig. 3. Responses relating to misinformation about the COVID-19 vaccine.

already been vaccinated. Communications from the health authorities also made people aware, so they responded positively and were vaccinated. The participants clearly understood the benefits of the vaccine and were not guided by the university mandate. They understood the seriousness of the disease and that they needed to be protected and to protect others, at all costs. This was aligned with other evidence communicated via social media, where the vaccine mandates for healthcare workers increased the vaccination rate across the different health sectors, decreased COVID-19 diagnoses, and reduced related mortality rates.[3]

Guided by the vaccine mandates for healthcare workers, the Faculty of Dentistry implemented mandates for students, as school-entry mandates are considered effective in improving vaccination coverage among students. When personal beliefs and religious exemptions are eliminated, there is a lower refusal rate and a higher vaccination rate.[3] However, when the faculty implemented the requirement for vaccination, support in the form of counselling should have been provided to students, which could have reduced refusal rates and ensured an even lower risk of subsequent disease outbreaks. The university's stance seems rather harsh, but the nature and impact of the COVID-19 pandemic were such that most authorities responded in that manner. People do not appreciate being forced (discussed below) to take treatments they not comfortable with, and this should be taken into consideration in similar situations in the future.

Perceptions regarding misinformation about vaccination

More than half of the participants reported feeling vaccine hesitancy. Whether this was due to personal beliefs or to misinformation, it is a disconcerting proportion. Other studies have indicated that hesitancy seems to be the main barrier to vaccine uptake.[13] In the present study, however, the percentage of vaccinated respondents was high owing to the university's requirement for vaccination during 2021. Furthermore, this survey was done when more than half the country had already taken the vaccine, COVID-19 infections had reduced, and vaccination was no longer in high demand. Yet the findings indicate that vaccine hesitancy may have affected vaccine uptake, even when vaccination was strongly advised.

Results of studies investigating vaccine scepticism and misinformation performed during the COVID-19 pandemic[14] were similar to those of the present study. However, owing to a lack of longitudinal data, further interpretation of participants' willingness to be vaccinated was not possible. It was therefore unclear whether vaccinated individuals were hesitant in previously conducted studies, or if their reasons for acceptance of the vaccine were reflective of their current opinions.

Role of the university regarding the decision to apply different vaccination mandates and support to the academic community

The opinion of some participants regarding support needs to be highlighted. They felt that the university did not provide sufficient and satisfactory support in terms of the hard mandate policy, which could have been clarified further by the institution's authorities. The university followed the National Department of Health guidelines to impose a hard mandate because clinical students were at increased risk of contracting COVID-19. The hard mandate for vaccination was implemented by the university as a protective mechanism and was aligned to the country's policies. Based on their responses to the questionnaire, many respondents had come to believe that vaccination was not necessary, which may have been due to an uninformed decision and based on a personal viewpoint. The media, or perhaps interpretation of the media's message, played a significant role in the decision-making process of the study population. The role of the university management, and the fact that its decision to implement a hard mandate focused on the safety of students and patients, should have been shared on social media, as it was misunderstood by some study participants.

Effect of the hard mandate policy

The results obtained from this study may not be comparable to other national polls or surveys because of potential differences in the survey methods, sample populations and questions related to vaccination intent. A consideration that affects the effectiveness of the COVID-19 vaccination mandate is *enforceability*. The mandates in the Faculty of Dentistry relied on mechanisms (for example, administrative review of student registration data or completion of state reporting requirements) that function best at the start of the academic year. Imposing such mandates mid-year meant that unvaccinated students in clinical disciplines would have to relook at their decisions irrespective of their opinions, or they would have had to pause their studies. This is not the case when studies can be changed to remote learning programmes, as is possible in non-clinical disciplines. Owing to the nature of the dental course, a mid-year mandate with hesitancy is an undesirable prospect given the educational disruption the students have already endured. This enforcement problem eases with the advent of a new academic year.

Public communication of study results has shown that vaccine safety has been suboptimal.[15] Media reports have given greater prominence to the association of vaccines with specific adverse events than to their overall favourable benefit-to-risk ratio. These concerns contributed to a reduction in compliance with COVID-19 vaccination mandates in the absence of a concerted, sophisticated effort at public education. Active surveillance for adverse events following vaccination and clear and sophisticated communication of findings to the public are essential.[16] Imposing mandates does not remove the need for effective messaging to overcome vaccine hesitancy. Researchers must give appropriate emphasis to the major headline of the growing vaccine safety studies, and indicate that vaccines are indeed safe, and so create a more positive environment for vaccination mandates to take effect.

COVID-19 vaccines have shown more effectiveness in preventing infection with some variants than others, but their great value in preventing severe illness and death is clear.[16] Mandates can play a role in promoting uptake of these vaccines. University-entry mandate has been effective in improving uptake of the vaccine, and this was observed with the present study too. The safety of COVID-19 vaccines is sufficient to support the mandate.[16] COVID-19 vaccine requirements are effective when enforced by educational institutions. Considerations of all faculties to adopt the vaccine mandate had to be reviewed and commenced at the start of an academic year to minimise disruption.

It has been recommended that public health officials and their spokespersons maintain complete transparency in dealing with the public during all communication efforts relating to COVID-19 vaccination, as well as in their position on a hard mandate.[2] This could be achieved by avoiding over-assurance of general vaccine safety and rather disclosing the various associated risks, benefits, long- and short-term side-effects and possible complications related to the vaccine.[1] Recommendations were made to governments to develop strategies via the use of social media to disseminate the message of vaccinations and the hard mandate across a variety of groups.[1] This was effective because individuals with the same opinions were likely to see information only limited to their social circle. And as seen in the results of the present study, social media played a significant role in the spread of information about the different vaccines developed, vaccination processes and government recommendations. With the global nature of the pandemic, and with the appearance of different COVID-19 variants, more research related to different vaccination programmes or mandates was encouraged.

Even though most of the participants in the present study were vaccinated, some doubt about the need for vaccination against COVID-19 was evident, as was the belief that misinformation was spread. These findings indicated that there was a need for proper education regarding the benefits as well as the possible risks of vaccination against COVID-19, especially in the healthcare setting. The findings of this study show that institutional advice, guidance and support must be considered.

Study limitations

Research conducted among university students does present difficulties. For example, it was challenging to obtain a representative sample of all senior health science students, given that participation was voluntary and that the students were working and studying remotely too. Further, the participants' level of honesty, transparency and commitment would have affected the validity of the study if it did not provide a true reflection of their opinions. As mentioned earlier, obtaining longitudinal data was not an objective of the study, so investigating changes in individuals' opinions about being vaccinated was not possible.

The results obtained from this study may not be comparable to other national polls or surveys because of potential differences in the survey methods, sample populations and questions related to vaccination intent. It should also be noted that vaccine acceptance is a complex construct and is nearly impossible to assess with a single exact measurement. The results were not conclusive, as there were more participants in the control (non-clinical) group. This was an undergraduate project conducted among students, and the period for all the different stages was therefore very limited.

Implications of the study

The outcomes of this study can serve as a guide for future research with a student population in terms of sampling, access, reliability, and considerations to minimise the various biases. In terms of the concept of vaccination of students training in healthcare settings, and especially in the current emergency mpox outbreak, many lessons can be learnt, and more encompassing communication must be ensured to avoid the negativity experienced with the previous pandemic. The policies that guided the university during the COVID-19 pandemic were considered the best at the time, but we can learn how to modify these in different settings and at different times.

Conclusion

Largely based on analysis of the feelings, opinions and sentiments of affected parties, this study attempted to gain a better understanding of the effect that the COVID-19 pandemic and the university authority's hard mandate on vaccination had on these individuals. Additionally, the outcomes indicated that there is a need for improved means of conveying information to reduce uncertainty and to ensure that all students are well informed. Vaccine hesitancy remains the largest barrier that has to be overcome.

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AI declaration. The authors acknowledge the journal policy on the use of AI, and the requirement to disclose the use of any AI tools in manuscript preparation. They declare that NO use of any AI-assisted technologies (such as large language models, chatbots, or image creators) was involved in the production of the submitted work.

Author contributions. NML, ELL, YL, AM, KM: contributed to conception, protocol, data collection and analysis, and manuscript preparation and finalisation. SK: contributed to protocol finalisation, supervision of the study, and manuscript preparation and finalisation.

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Data availability statement. The datasets generated and analysed during the current study are available from the corresponding author (NML) upon reasonable request.

Conflicts of interest. None.

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