A cross-sectional survey exploring vaccine hesitancy in students attending a South African university

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Abstract

Background:

Vaccine hesitancy is a global problem. This phenomenon is context specific and has a changing nature. It may be difficult to address vaccine hesitancy with a one-size-fits-all approach. The causes of vaccine hesitancy should thus be known in order to properly address this phenomenon. The aim of this study was to explore vaccine hesitancy in students attending a South African university.

Methodology:

The study was performed via an electronic survey, namely the Student Vaccine Hesitancy Questionnaire. Data was gathered during alert level 4 of the first official Covid lockdown in SA and the students were only reachable via the electronic student platform of the University. The study population was approximately 57 000 university students and 1016 students participated.

Results:

The students' answers were analysed and the results showed vaccine hesitancy to be prevalent in 24.3% (n=247) of the participants. It was found that age and mother tongue were the only two demographic factors addressed in this study that had a significant association with vaccine hesitancy. Healthcare workers is a trusted and preferred source of information. Healthcare environments (like healthcare centres and pharmacies) are preferred locations to receive information and be vaccinated. Take into consideration that family plays an important role when it comes to vaccination decisions.

Conclusion:

Vaccine hesitancy is a context specific phenomenon and as this study shows it would be important to always investigate the specific preferences of persons in a context before any vaccination programmes are being launched.

Keywords: Vaccination, Vaccine hesitancy, SAGE Working Group's Matrix of Determinants, Students, Student Vaccine Hesitancy Questionnaire, South Africa, Submitted: 18th/11/2022 Accepted: 29th/11/2022

1. Background

'With the exception of safe water, no other modality, not even antibiotics, has had such a major effect on mortality reduction and population growth,' Plotkin and Plotkin (2008:1) stated in reference to vaccination.

Smallpox was thought to be eradicated in 1977 as a result of vaccination (Hinman, 1999:212, 214; McLean, 1998:545; Riedel, 2005:25). Potentially fatal diseases like diphtheria and tetanus are prevented from going out of control by vaccination (Lupu *et al.*, 2017:128, Moynan *et al.*, 2018:16 & South Australia Health, 2019). Vaccination

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prevents epidemics and the unavoidable emergency measures that go along with it (Lupu *et al.*, 2017:128). These can include quarantine and isolation, as seen from strategies used from the mid fourteenth century with the Black Death through to 2002 and 2003 with severe acute respiratory syndrome (Yan *et al.*, 2007:202), as well as with the current coronavirus disease 2019 (Covid-19) pandemic (Staunton *et al.*, 2020:5). Vaccination aids society in two desirable ways: Medically, it is better to prevent than to cure and economically, prevention is better than treatment (Lupu *et al.*, 2017:129). Despite these arguments in favour of vaccination, some individuals still do not trust vaccines (Hashmi *et al.*, 2016:739).

To prevent disease outbreaks and high rates of mortality, it is important to know why people hesitate to be vaccinated. There is a difference between being vaccine hesitant and denying vaccines. A person can be vaccine hesitant (not sure about being vaccinated) but not a vaccine denier (refusing all vaccines).

The definition of vaccine hesitancy that the Strategic Advisory Group of Experts on Immunization (SAGE) Working Group formulated encompassed three things (WHO SAGE WG, 2014b:7):

- Vaccine hesitancy is context specific;
- it
- its influences include complacency, convenience and confidence.

Vaccine hesitancy was found to be a worldwide problem, specific to contexts, time, places, programmes and vaccines (WHO SAGE WG, 2014b:14). Strategies to address vaccine hesitancy need to be modified according to each population that is targeted, that population's reasons for being vaccine hesitant and the specific context of the population itself (Jarrett *et al.*, 2015:4180). A means of measuring vaccine hesitancy is thus necessary. For the purpose of this study, the researcher focused on the work done by the SAGE Working Group between 2012 and 2014 (WHO SAGE WG, 2014b:11,19).

The Matrix of Determinants was used as a measurement because of its completeness and effectivity in capturing the influences of vaccine hesitancy (WHO SAGE WG, 2014b:11,19). Determinants of vaccine hesitancy in this Matrix came from various sources, such as research studies and results from the Working Group's immunisation managers' survey (WHO SAGE WG, 2014b:13).

The SAGE Working Group requested that pilot testing and validation must happen in all settings possible (WHO SAGE WG, 2014b:33). The SAGE Working Group indicated that 'these example survey questions represent a range of questions to draw from which could be considered based on the circumstances and context' (WHO SAGE WG, 2014a:51).

Several studies showed that in high-risk groups, specifically university students, most individuals do not adhere to non-pharmacological preventative measures (Mitchell *et al.*, 2011:S143 & Hashmi *et al.*, 2016:742) like self-isolation. A study performed by Mitchell *et al.* (2011:S143) described how many students did not self-isolate despite an onset of acute respiratory infection after the H1N1 virus outbreak in 2009. Another study by Hashmi *et al.* (2016:741) found that less than 50% of participants (who were also university students) modified their behaviour during an influenza outbreak. Several studies came to the conclusion that some university students, for example in Poland and the United States also have a negative attitude towards vaccines and having their children or themselves vaccinated (Benjamin & Bahr, 2016; Hashmi *et al.,* 2016; Jadhav *et al.,* 2018; Zarobkiewicz *et al.,* 2017).

Lower rates of vaccination are being associated with persons with relatively higher education levels and professional status (Bryden *et al.*, 2019:4528; Smith *et al.*, 2004:187). Characteristics of persons in populations with low rates of vaccination include inter alia having a bachelor's degree and higher, holding a managerial position and being a professional (Bryden *et al.*, 2019:4528,4529).

At the age students enter university, they start to make their own choices, including choices affecting their health, and their university years are

also the start of their independent life (Barnard *et al.*, 2017:2). Establishing healthy behaviours while individuals are at the above-mentioned stage in their lives may lead to the maintenance of specific healthy behaviours needed to combat disease as they grow older (Von *et al.*, 2004:472). Addressing general vaccine hesitancy of university students could establish pro-vaccination behaviour in these students as they grow older.

Social ecology, that is, the way that individuals react and respond to their environment and how it affects society, shapes vaccine refusal (Rozbroj *et al.*, 2019:5986) and thus will also have an influence on vaccine hesitancy. The social ecology of all areas is not the same and thus the reasons for general vaccine hesitancy will also not be the same. By doing a study on the preferences of university students, strategies to address vaccine hesitancy of university students can be developed for the future (Seanehia *et al.*, 2017:2682, Shapiro, Tatar, Amsel *et al.*, 2018:203).

University students could, for example, be future teachers (Monteiro *et al.*, 2018:2), shaping the minds of young people. They could also be our future leaders and policy makers, with some being in positions carrying the responsibility to make decisions affecting the health of the entire population. University students have access to the internet on campus via Wi-Fi and computer laboratories. Because of this, university students could be exposed to information about vaccination, including anti-vaccination sentiments (Casara *et al.*, 2019:355). Myths about influenza vaccines (Ryan *et al.*, 2019:6), for example, exist in populations with a high level of education.

Outbreaks of vaccine-preventable diseases in some places have happened in the past (Arend & Hussey, 1997:29). Evidence has shown that outbreaks will surely continue in the future as this trend grows. Although measles is a vaccine-preventable disease, the following events still occurred: By 14 March 2019 there had been confirmation of over 300 cases of measles throughout New York, with over 150 cases in New York City and 146 in Rockland County (Thebault, 2019). In the period between 3 September 2018 and 21 February 2019, Madagascar had 82 905 cases of measles, with 926 resulting in death (WHO, 2019).

The Covid-19 (caused by the virus SARS-CoV-2) was pronounced a global pandemic by the World Health Organization (WHO) on 11 March, 2020 (Chitiga-Mabugu *et al.*, 2021:82). It resulted in a global medical and economic crisis (Susskind & Vines, 2020:S1). In South Africa, the lockdown regulations due to Covid-19 caused many people to lose their jobs; there was social unrest and there was not enough personal protective equipment in the healthcare system (Mbunge 2020:1812).

An understanding of what lead individuals to be in favour of vaccination or against vaccination (i.e. vaccination in general) is thus important.

2. Methods

2.1.

2.1.1. Study setting

The university in South Africa where the study took place, has three campuses: two campuses located in one province, and another campus in a different province.

2.1.2. Design

Survey design was used, more specifically, a cross-sectional electronic survey.

2.2. Sample

The study was conducted in 2020 among approximately 57 000 university students (NWU, 2021:33). Non-probability sampling was used.

To be included in the study, participants had to:

- be a student on one of the three campuses of the university;
- be any gender;
- be born between 1994 and 2002;
- have any culture, religion, marital status, origin, educational- and economic background and health status; and
- be English-literate.

The responses of university students who fell into the excluded age categories were removed from the data before the data analysis took place.

According to the South African Government (2022), South Africa's first Covid-19 lockdown was from midnight 26 March 2020 to 30 April 2020. Alert level 4 existed in the country from 1 May 2020 to 31 May 2020, with alert level 3 starting on 1 June 2020. The university students completed the questionnaire online after the first lockdown implementation, while the country was on alert level 4. Data collection happened in May, during alert level 4 and therefore the students were only reachable through the online student platform of the University.

The inclusion and exclusion criteria did not exclude small exclusive groups for example, a student with a disability.

2.3. Measures

The questions were formulated to be context specific, using the Matrix of Determinants of the Strategic Advisory Group of Experts on Immunization (SAGE) Working Group as a basis. Determinants, and the survey questions that measure them, were chosen from the WHO SAGE Working Group guidelines (2014a: 52-57) and were adapted for the compilation of the SVHQ. To extend the questions regarding participants' preferences in the SVHQ, the Health Information National Trends Survey (HINTS) 5 was used. HINTS is administered by the National Cancer Institute every few years, starting from 2003, in the United States (Westat, 2018:1).

The initial questions for the questionnaire were tested for face validity and readability by sending the questionnaire to personnel and registered postgraduate pharmacy students of a university in South Africa (nine individuals in total). They provided comments and suggestions, and the necessary changes were then made accordingly. The changes improved the understanding of the questions, for example 'Completed academic year' was changed to 'Highest academic year registered for in 2020' (Section A, Question 4) and 'Age' was changed to 'Age at last birthday' (Section A, Question 8). The changes ensured that the terminology used was understandable to the study population, for example 'I know a person that experienced severe adverse reactions following vaccinations. (Severe adverse reactions include: anaphylactic reactions, abscess/ulcer and seizures.)' was changed to 'I know a person that experienced severe side effects following vaccinations. (Severe side effects include: allergic reactions and fits.)' (Section B, Question 16). The changes also ensured consistency in the questionnaire, for example the word 'side effect' was used in both Questions 16 and 40 in Section B.

The measuring battery used in this study [the Student Vaccine Hesitancy Questionnaire (SVHQ)] was administered as an electronic questionnaire, using SurveyMonkey. SurveyMonkey allows you to create your own survey from scratch, either by using a template or having SurveyMonkey create a survey for you (SurveyMonkey, s.a.:8).

The SVHQ consisted of two parts, namely demographical questions (Section A) and questions related to vaccine hesitancy (Sections B, C and D). The first section (Section A) consisted of nine multiple-choice questions, with some questions asking for specifications when the option 'Other' was chosen.

- **Question one** asked for the participant's student number. To ensure each participant could only complete the questionnaire once, an identifier was necessary for participants, which was the student number in this case. Anonymity of university students was not compromised, however, because the data administrator substituted the student numbers with unique identifiers before the researcher and statistician had access to the data.
- **Question two** was about the religion of the participants, since religion plays a role in vaccination decision-making (de Munter et al., 2020:13; Grabenstein, 2013:2012; Harapan et al., 2020:8). Some religions were listed as options to choose from and the option 'Other' was given as well.
- **Question three** asked for an indication of the participant's citizenship and only required a choice between having South African citizenship or not. The university accepts international university students and this question is thus necessary to have a clearer understanding of the study population.

• **Question four** inquired about the participants' highest academic year they were registered for at the time of the study (2020). This shows how far their academic knowledge and independence may have grown.

• In order to have a more complete description of the study population, participants had to indicate on which campus they were studying, as well as their gender (**Question five** and **Question six**, respectively).

• **Question seven** was an inquiry into the faculty the participant was part of. The faculties on all three campuses of the university in South Africa were given as options to choose from, along with the option 'Other', with provided space to specify the answer.

• **Question eight** asked for an indication of the participant's age at last birthday. This was an important question as age was one of the inclusion criteria.

• The last question in Section A (**Question nine**), was about the mother language of the participant. The 11 official languages of South Africa were given as options to choose from, along with the option 'Other' and space to specify the answer.

The SVHQ has three sections following the demographical questions in **Section A**. **Section B** consists of 45 Likert-type questions. Questions using the Likert scale format in the proposed survey had six response categories. Six categories may have an increased criterion validity, better item-whole correlations and a higher overall convergent validity (Preston & Colman, 2000:11). Table 1 to Table 5 gives an exposition of how the questions were chosen from the list of questions the Working Group developed (WHO SAGE WG, 2014a:52-57) and then adapted.3: Development of, and changes made to, questions in the SHVQ: Individual and group influence.

2.3.1. Table 1: Development of, and changes made to, questions in the SHVQ: Contextual influences

2.3.2. Table 4: ***Development of, and changes made to, questions in the SHVQ: Vaccine- or vaccination-specific issues***

Section C has five Yes/No multiple-choice questions. This section of the SVHQ determined preferences related to receiving vaccinations and vaccination information. Questions included 'I trust the following people for information regarding vaccines' with options such as Community/Religious leaders, Family, Friends, Government, and Healthcare worker. And 'I would prefer that vaccinations are done' with options like At school, At the workplace, and During a vaccination campaign.

To extend the Yes/No questions of the SVHQ, Section C, the Health Information National Trends Survey (HINTS) 5 was used. The way in which the HINTS 5 was used can be seen in Table 6below.Table6:Original questions from HINTS 5 and how they were used in Section C oftheSVHQ*

Section D has two open-ended questions, namely 'What does a vaccine do to the body?' and 'Any other comments?'

Each question came with instructions on how the question should be answered. Participants could take as long as they needed to complete the questionnaire, with the average time taken to complete being no longer than 15 minutes. Participants were provided with clear instructions on what to do before each question. The informed consent was the first page of the electronic questionnaire. Informed consent was acknowledged electronically and until this had been done, the questionnaire was not accessible to the participant.

2.4. Analysis

The data were analysed utilising descriptive statistics. The Frequency distribution was determined for demographic questions and questions with regards to participants' preferences in Section C of the SVHQ, along with percentage. Infer-

Table 1: Development of, and changes made to, questions in the SHVQ: Contextual influences.

Influence	**Communication and media environment**
Original	'Who do you trust the most for information? Who do you trust the least?' (WHO SAGE WG, 2014a:52)
SVHQ	Participants had to indicate YES or NO to options provided for the question 'I trust the following people for information regarding vaccines'.
Influence	**Influential leaders, gatekeepers and anti- or pro-vaccination lobbies**
Original	'Do leaders (religious, political, teachers, healthcare workers) in your community support vaccines for infants and children?' (WHO SAGE WG, 2014a:52) 'Has your imam/priest/rabbi ever advocated against vaccination? Did you follow this advice?' (WHO SAGE WG, 2014a:53)
SVHQ	Participants had to indicate YES or NO to options provided for the question 'The following people would influence my choice to be vaccinated'.
Influence	**Historical influences**
Original	'Do you remember any events in the past that would discourage you from getting a vaccine(s) for yourself or your children?' (WHO SAGE WG, 2014a:52)
SVHQ	Used in a six-point Likert scale question as 'I remember event(s) that discourage me from getting vaccinated'.
Influence	**Religion, culture, gender and socio-economics**
Original	1. 'What do you consider more important- vaccination of boys or vaccination of girls? Why?' (WHO SAGE WG, 2014a:53) 2. 'Have you ever refused a vaccine as you considered it to include porcine or other animal derived ingredients (non-halal, non-kosher)?' (WHO SAGE WG, 2014a:53) 3. 'Would you refuse a vaccine for you/your child if the vaccinator was male/female or from a different ethnic background/religion than yourself?' (WHO SAGE WG, 2014a:53)
SVHQ	The following were used in six-point Likert scale questions as follows: 1. Changed to two separate statements, namely 'It is important to vaccinate boys' and 'It is important to vaccinate girls'. 2. Changed to 'I will refuse a vaccine if it contains animal contents'. 3. Split into three statements, namely 'I will refuse to be vaccinated if the gender of the person administering it differs from mine'; 'My culture forbids me to get vaccinated by somebody from a different culture than me' and 'My religion forbids me to get vaccinated by a person that does not share my religion'.
Influence	**Politics and policies (mandates)**
Original	1. 'Did you ever disagree with the choice of vaccine or vaccination recommendation provided by your government?' (WHO SAGE WG, 2014a:52) 2. 'The only reason I have my child get shots is so they can enter daycare or school' (WHO SAGE WG, 2014a:53).
SVHQ	The following were used in six-point Likert scale questions as follows: 1. Changed to 'I support the choice of vaccines recommended by my government'. 2. Changed to 'I will get vaccinated if my university requires it (for example a vaccine against meningitis or hepatitis)'.

Table 2: Development of, and changes made to, questionsin the SHVQ: Individual and group influences.

Influence	**Experience with past vaccination**
Original	1. 'Have you ever not accepted a vaccination for your child? What was the reason?' (WHO SAGE WG, 2014a:54) 2. 'Do you know of a child with a serious disease/ disability because they were not vaccinated?' (WHO SAGE WG, 2014a:55)
SVHQ	The following were used in six-point Likert-scale questions by being changed to: 1. 'I would refuse a vaccination in the future'. A positive answer to this question (Question 28) is a specific indication of vaccine hesitancy. 2. 'I know of a person with a serious disease/disability because they were not vaccinated'.
Influence	**Beliefs and attitudes about health and prevention**
Original	1. 'It is my role as a parent to question shots' (WHO SAGE WG, 2014a:54). 2. 'It is better for my child to develop immunity by getting sick than to get a shot' (WHO SAGE WG, 2014a:55). 3. 'Do you believe that there are other (better) ways to prevent diseases which can be prevented by a vaccine?' (WHO SAGE WG, 2014a:55) 4. 'Can you tell me what a vaccine is? What does it do to the body?' (WHO SAGE WG, 2014a:54)
SVHQ	1. Used in a six-point Likert scale question as 'It will be part of my role as a parent to question vaccination'. 2. Used in a six-point Likert scale question as 'It will be better for a person to get sick than to receive the vaccine'. 3. Used in a six-point Likert scale question as 'There are other ways to prevent diseases instead of being vaccinated'. 4. Used as an open question, worded 'What does a vaccine do to the body?'
Influence	**Knowledge or awareness**
Original	1. 'Do you feel that you know which vaccines you should get for yourself? Your children?' (WHO SAGE WG, 2014a:54) 2. 'Would you prefer to receive more information on vaccination at your health center? Do you think this would change your choice in favour of a vaccine?' (WHO SAGE WG, 2014a:55)
SVHQ	1. Used in a six-point Likert scale question as 'I know which vaccines I should get for myself'. 2. Split into two closed questions. Participants had to indicate YES or NO to options provided for the questions 'Where would you prefer to receive information on vaccination?' and 'Who should give the information to you?'

ential statistics, namely Pearson's chi-square test of independence (to examine the association between the demographic questions in Section A and questions about participants' preferences in Section C of the SVHQ) was also used. Cross tabulations were done for vaccine-hesitant and non-hesitant participants and certain demographical characteristics, namely campus, gender, age at last birthday, highest academic year registered for in 2020, mother language, religion, and faculty, as well as between demographic questions and questions about participants' preferences in Section C of the SVHQ.

The statistical analysis was done by the Statistical Consultation Services of NWU, with IBM® Statistical Package for the Social Sciences (SPSS®) Version 27 Software. All statistical tests were two-tailed and the type I error rate was set to 5% (=0.05). Since a convenience sample was used instead of a random sample, Pearson's chi-square test's p-values are only reported for the sake of completeness and will not be interpreted.

Cross-tabulations with Cramer's V were inter-

Table 3: Development of, and changes made to, questionsin the SHVQ: Individual and group influence.

Influence	**Risk vs benefit (perceived, heuristic)**
Original	1. 'How concerned are you that any one of the childhood shots might not be safe?' (WHO SAGE WG, 2014a:54) 2. 'Do you think vaccines are still needed even when the disease is no longer prevalent?' (WHO SAGE WG, 2014a:54) 3. 'I believe that many of the illnesses shots prevent are severe' (WHO SAGE WG, 2014a:54). 4. 'How concerned are you that your child might have a serious side effect from a shot?' (WHO SAGE WG, 2014a:55) 5. 'How concerned are you that a shot might not prevent the disease?' (WHO SAGE WG, 2014a:55)
SVHQ	The following were used in six-point Likert scale questions as follows: 1. Changed to 'I am concerned that one of the vaccines currently available might not be safe'. 2. Changed to 'Vaccinations are still needed even when the disease is no longer common'. 3. Changed to 'Vaccination prevents severe illnesses'. 4. Changed to 'I am concerned that I might have a serious side effect from a vaccination'. 5. Changed to 'I am concerned that a vaccine might not prevent the disease'.
Influence	**Immunisation as a social norm vs it being unnecessary or harmful**
Original	1. "I agree that it is important for everyone to get the recommended vaccines for themselves and their children' (WHO SAGE WG, 2014a:54). 2. 'Do you think it's important to get a vaccine to protect those that cannot get vaccinated?' (WHO SAGE WG, 2014a:54) 3. 'Are you worried that some mothers in your community are delaying or refusing vaccines, putting your infant at risk for these diseases, e.g. pertussis?' (WHO SAGE WG, 2014a:55)
SVHQ	The following were used in six-point Likert scale questions: 1. Split into two statements, namely 'It is important for everyone to get the recommended vaccines for themselves' and 'It is important that children get the recommended vaccines'. 2. Changed to 'It is important to get a vaccine to protect those that cannot be vaccinated'. 3. Split into two statements, namely 'I am worried that people, who refuse vaccination, put me at risk' and 'I am worried that people, who refuse vaccination, put my family at risk'.

preted as follows (Cohen, 1992:156):

• 0 no association; 0.1 small/weak effect; 0.3 medium/moderate; 0.5 large/strong effect size.

Permission to perform the study was obtained from:

• The scientific committee of Medicine Usage in South Africa (MUSA) on 18 October 2019;

• North-West University Health Research Ethics Committee (HREC) (Ethics number: NWU- 00956-19-S1) on 13 November 2019, and

• North-West University Research Data Gatekeeper Committee (NWU RDGC) on 17 January 2020.

This study was thus approved before Covid-19 was declared a pandemic, which happened on 11 March 2020 (WHO Regional Office for Europe, 2020).

3. RESULTS

3.1. Demographic results:

Figure 1 illustrates the number of participants for this study. From the study population of 57000, 1046 answered questionnaires were received from the data administrator. The low response may be attributed to the Covid level 4 restrictions under which the data was gathered. Students were not on the campuses and were only reachable through the electronic study platform of the university. From the 1046, 30 participants'

Table 4: Development of,and changes made to, questions in the SHVQ: Vaccine- or vaccination-specificissues

Influence	**Risk vs benefit (scientific evidence)**
Original	1. 'Do you believe vaccines are safe for yourself? Your child/children? For those in your community?' (WHO SAGE WG, 2014a:56) 2.'Me or my child never experienced severe adverse reactions following immunisation' (WHO SAGE WG, 2014a:57).
SVHQ	Used in six-point Likert scale questions: 1. Split into 'Vaccines are safe for myself' and 'Vaccines are safe for children'. 2. Changed to 'I know a person that experienced severe adverse reactions following vaccinations. (Severe adverse reactions include: anaphylactic reactions, abscess/ulcer and seizures)'.
Influence	**Introduction of a new vaccine or new formulation**
Original	1. 'What is the first thing you want to know when a new vaccine is introduced or announced? Would you rather wait and see what other people do?' (WHO SAGE WG, 2014a:56,57) 2.'Do you feel your child to be at risk of diarrhoea/ cervical cancer? Do you think a vaccine is needed to prevent these diseases?' (WHO SAGE WG, 2014a:57) 3.'New vaccines are not trailed to the same rigorous standard as any normally prescribed drug?' (WHO SAGE WG, 2014a:57)
SVHQ	Used in six-point Likert scale questions: 1. Changed to 'I wait and see what other people do when a new vaccine is introduced'. 2. Split into 'A vaccine can prevent diseases like diarrhoea' and 'A vaccine can prevent diseases like cervical cancer'. 3. Changed to 'Prescribed drugs are more rigorously tested than vaccines'.
Influence	**Mode of administration**
Original	1. 'Do you fear the pain/ to you/your child or fear the needles when receiving a vaccine make you hesitate to be immunized?' (WHO SAGE WG, 2014a:57) 2. 'Do you trust your HCW to safely administer the vaccine to you/ your child?' (WHO SAGE WG, 2014a:57)
SVHQ	Used in six-point Likert scale questions: 1. Split into 'My fear for needles makes me hesitant to get vaccinated' and 'My fear for pain makes me hesitant to get vaccinated'. 2. Changed to 'I trust my healthcare worker (nurse, pharmacist, doctor) to safely administer the vaccine'.
Influence	**Design of vaccination programme or mode of delivery** 1. 'Would you rather
Original	receive a vaccine as conveniently as possible or with as much medical consultation as
SVHQ	possible? Why?' (WHO SAGE WG, 2014a:57) 2. 'What would you prefer for yourself/your child: Receive a vaccine at your health center/from your doctor or from door-to-door vaccinators/ during mass vaccination campaigns/school-based programmes? Why?' (WHO SAGE WG, 2014a:57) 1. Split into 'I want to receive a vaccine as conveniently as possible' and 'I want to be vaccinated with as little medical consultation as possible' and used in six-point Likert scale questions. 2. Changed into 'I would prefer that vaccinations are done at' with options, requiring a YES or NO indication.

Table 5: Development of, and changes madeto, questions in the SHVQ: Vaccine- or vaccination-specific issues

Influence Original SVHQ	**Reliability and/or source of vaccine supply** 'Did you ever decide against a vaccine as it was produced by a manufacturer you did not trust? Do you believe vaccines made in Europe or America are safer than those made in middle income countries?' (WHO SAGE WG, 2014a:57) Split into 'I will decide against a vaccine if I don't trust the manufacturer producing it' and 'The country where a vaccine is produced determines its safety' and used in six-point Likert scale questions.
Influence Original SVHQ	**Vaccination schedule** 1. 'How sure are you that following the recommended shot schedule is a good idea for your child?' (WHO SAGE WG, 2014a:57) 2. 'If you had another infant today, would you want him/her to get all the recommended shots?' (WHO SAGE WG, 2014a:57) Changed and used in six-point Likert scale questions: 1. 'A vaccination schedule is a good idea for children'. 2. 'If I had a child today, I would want him/her to get all the recommended vaccinations'.
Influence Original SVHQ	**Costs** 1. 'Which medication do you consider more effective- the free-of-charge drugs provided at your health care centre/doctor/ by your government or the ones you need to pay for yourself? Why?' and 'Do you consider all important vaccines provided/ covered by your health insurance/ health care plan/ health care provider? Would you pay for additional vaccines yourself?' (WHO SAGE WG, 2014a:57). 2. 'Would you be willing to pay for a vaccine privately? If so, for which ones?' (WHO SAGE WG, 2014a:57). Changed and used in six-point Likert scale questions: 1. 'All important vaccines are provided by the government'. 2. 'I would be willing to pay for a vaccine myself'.
Influence Original SVHQ	**Role of healthcare professionals** 'Did healthcare professionals ever treat you without respect (e.g. in regard to your appearance, education or cultural background) so that you will hesitate to return to the healthcare facility?' (WHO SAGE WG, 2014a:56,57) Split into 'Healthcare professionals (nurse, pharmacist, doctor) always treat me with respect' and 'The way healthcare professionals treat me determines whether I return to their healthcare facility' and used in six-point Likert scale questions.

answers were excluded from the analyses as they fell outside the age inclusion criteria (they were either younger than 18 years or older than 26 years). Section A and Section B of the Student Vaccine Hesitancy Questionnaire (SVHQ) were completed by 1 016 participants. Forty-three participants did not complete Section C and 64 participants did not answer the question relating to their knowledge about what a vaccine does in Section D. It might be that the participants deemed the questionnaire as too long to answer fully. It might also be that they experienced a power outage and did not return to the questionnaire to complete it. However these participants completed Section A and B of the SVHQ, and it was decided to keep their answers to enhance the completeness of the results of the Likert scale in Section B of the questionnaire. Thus, the final number of participants for this study was 1,016.

Most (60.8%; n=618) were female. The modal age of university students who participated was 20 years (20.9%, n=212), with the range from 18 to 26 years. Most of the participants were registered for their second year in 2020 (25.7%, n=261). The largest portion of participants were Afrikaans-speaking (39.3%, n=399), with Venda chosen the least (0.6%, n=6). The largest portion of participants identified as Christians (79.7%, n=810) while Judaism constituted the lowest proportion (0.2%, n=2). Of the 1 016 participants,

Table 6: Original questions from HINTS 5 and how they were used in Section C of the SVHQ*

Original HINTS 5 questions	**Application for use in Section C**
'The most recent time you looked for information about health or medical topics, where did you go first? Mark only one. 1) Books 2) Brochures, pamphlets, etc. 3) Cancer organisation 4) Family 5) Friend/Co-worker 6) Doctor or health care provider 7) Internet 8) Library 9) Magazines 10) Newspapers 11) Telephone information number 12) Complementary, alternative, or unconventional practitioner' 'In general, how much would you trust information about cancer from each of the following? (Scale of not at all=4, a little=3, some=2, a lot=1) 1) A doctor 2) Family or friends 3) Newspapers or magazines 4) Radio 5) Internet 6) Television 7) Government health agencies 8) Charitable organisations 9) Religious organisations and leaders' 'Imagine that you had a strong need to get information about cancer. Where would you go first? Mark only one. 1) Books 2) Brochures, pamphlets, etc. 3) Cancer organisation 4) Family 5) Friend/Co-worker 6) Doctor or health care provider 7) Internet 8) Library 9) Magazines 10) Newspapers 11) Telephone information number 12) Complementary, alternative, or unconventional practitioner 13) Other – Specify'	**Question 1**: I trust the following people for information regarding vaccines: 1) Community/Religious leaders 2) Family 3) Friends 4) Government 5) Healthcare worker 6) Internet 7) Magazine/ Newspaper 8) Pamphlets 9) Radio 10) Scientific literature 11) Social media 12) Television 13) Traditional healer 14) Other and specify **Question 2**: The following people would influence my choice to be vaccinated: 1) Celebrities 2) Family members 3) Friends 4) Healthcare worker 5) Lecturers 6) Political leaders 7) Religious leaders 8) Traditional healer 9) Other and specify **Question 4**: Who should give the information to you? 1) Family 2) Friends 3) Government 4) Healthcare worker 5) Leaders (political, religious, etc.) 6) Manufacturer 7) Researcher 8) Spokesperson 9) Traditional healer 10) Other and specify **Question 5**: I would prefer that vaccinations are done: 1) At school 2) At the workplace 3) During a vaccination campaign 4) Healthcare worker's office 5) My healthcare centre, such as a clinic 6) Pharmacy 7) Other and specify

* Department of Health and Human Services: National Institutes of Health, 2018

Figure 1: Number of participants in the study

95.7% (n=972) had Republic of South Africa (RSA) citizenship. Students from the Faculty of Economic and Management Sciences made up 24.9% (n=253) of the participants, while only 1.0% (n=10) of the students came from the Faculty of Theology.

3.2. Vaccine hesitancy:

Question 28 of the Likert scale questions in Section B of the SVHQ ('I would refuse a vaccination in the future') was the determining question in categorising university students into being vaccine hesitant or not. Most of the participants (75.7%, n=769) in this study were not vaccine hesitant, with close to a quarter of the 1 016 participants (24.3%, n=247) classified as vaccine hesitant.

The preferences of participants when it comes to trusting people for vaccine information, influences on their vaccination choice, receiving vaccination information (where and from who) and receiving vaccinations (where) can be seen in Table 7 and Table 8.

Healthcare workers were trusted the most for information regarding vaccines, by 93.4% (n=909) of the participants, followed by 89.0% (n=866) of the participants who trusted scientific literature. Social media was trusted the least, by 7.2% (n=70) of the participants, with traditional healers trusted second-least, by 11.3% (n=110) of the participants.

Healthcare workers were seen as having the most influence on 91.6% (n=891) of the participants' choice to be vaccinated, followed by family members (75.3%, n=733). Celebrities had the least influence on the participants (8.4%, n=82), followed by the influence of traditional healers as second-least (13.1%, n=127). Some of the answers provided under the option 'Other' were people who could be described as 'knowledgeable' or 'competent'; several participants indicated that they rather rely on themselves and their 'own view' than being influenced by anyone; negative feelings toward vaccines were given (such as 'too [many] side effects, contaminating the body, no evidence that it does not cause autism') and different types of 'media' were mentioned (such as 'medical literature' and 'the news'). The FDA, CDC and WHO were also mentioned as influences on participants' choices to be vaccinated.

Of the participants, 93.7% (n=912) preferred to receive vaccination information at pharmacies, followed closely by 93.3% (n=908) of the participants preferring hospitals. Participants preferred to receive vaccination information the least at home (58.9%, n=573), followed by preference of the workplace (59.1%, n=575). Some of the answers provided under the option 'Other' were different types of media (such as 'medical journals', 'on videos relevant to the topic' and 'radio') and people (such as 'researchers' and 'health professionals'). 'Health reality shows' and a 'health drive' were also mentioned as options where participants preferred to receive vaccination information.

Participants preferred that healthcare workers should give the vaccination information to them the most (95.7%, n=931), followed by researchers (85.8%, n=835). Participants preferred to receive vaccination information from traditional healers the least (12.0%, n=117), followed by political or religious leaders (29.4%, n=286). Some of the answers provided under the option 'Other' were people who could be described as 'perceived knowledgeable' or 'perceived competent' (such as 'Competent people who have researched their opinions') were indicated several times as being preferred to give the vaccination information, and negative feelings toward vaccines were also provided again ('too much side effects; contaminating the body; no evidence that it does not cause autism.'). A 'journalist' was also mentioned as someone who should provide vaccination information by one participant.

Of the participants, 92.9% (n=904) preferred that vaccinations be done at healthcare centres, followed by 89.3% (n=869) of the participants preferring pharmacies. The workplace was indicated as the least preferred venue for vaccination (44.6%, n=434), followed by schools (51.4%, n=500). Some of the answers provided under the option 'Other' were vaccinations done at 'home' (several mentions) and in areas that are clean and/or safe, '...everywhere for easy access...' and 'military'. Negative feelings toward vac-

cines/vaccinations were again described, such as 'vaccines are poison'.

Cross tabulations were performed between certain demographic questions namely campus, gender, age at last birthday, the highest academic year registered for in 2020, mother language, religion, and faculty, and vaccine-hesitant participants and non-hesitant participants. The results can be seen in Table 9 and Table 10.

The practical significance of the association between age and vaccine hesitancy (=0.15) and between mother language and vaccine hesitancy (=0.16) leant towards being practically visible. In most of the age categories and the mother language categories, the majority of the participants indicated that they were not hesitant to receive vaccines. However, in the 25-year age group, there was an almost equal split between vaccine-hesitant (48.8%, n=21) and non-hesitant (51.2%, n=22) participants. Excluding the 'Other' group, those speaking African languages were somewhat more vaccine hesitant (ranging from 23.9% to 38.7%) than the other two groups namely Afrikaans speakers (17.8%, n=71) and English speakers (22.7%, n=27).

The results of the cross tabulations with practically significant associations between certain demographic questions and questions about participants' preferences can be seen in 1able 11 Cross tabulations with practically significant associations.

The following preferences were investigated: providers of vaccine information, sources of vaccine information, choice of vaccination site, and possible influencers on the choice to be vaccinated.

Catholics trusted family the most (77.1%, n=27), followed by participants who indicated their religion as Traditional African (75.7%, n=28). Only 28.6% (n=16) of Atheists trusted family as a source of vaccination information. Less than half of the vaccine-hesitant participants seemed to trust the government (43.3%, n=103), while most non-hesitant participants trusted the government (74.1%, n=545). Most participants in both vaccine-hesitant (81.9%, n=195) and non-hesitant (97.1%, n=714) categories trusted healthcare workers. Only 35.6% (n=224) of the participants on Campus 2 trusted the radio, with 69.8% (n=141) of Campus 1 participants feeling the same way. The radio was trusted the least by participants who were categorised in the faculty option 'Other (all)' (33.3%, n=6). The radio was trusted the most by participants in the Faculty of Humanities (61.1%, n=77). Most participants in both vaccine-hesitant (79.8%, n=190) and non-hesitant (92.0%, n=676) categories trusted scientific literature. Only 25.3% (n=159) of participants on the Campus 2 trusted television. Participants on the Campus 1 trusted television the most (57.9%, n=117). Only 5.4% (n=3) of Atheists and 6.7% (n=42) of participants on the Campus 2 trusted traditional healers. These healers were trusted the most by participants who indicated their religion as Traditional African (54.1%, n=20) and participants on the Campus 1 (22.3%, n=45).

Most of the participants on the Campus 2 were not influenced by celebrities (95.1%, n=598), with the most of celebrities' influence being on the Campus 1 (16.8%, n=34). Family members influenced choices the least for Atheists (41.1%, n=23) and the most for Catholics (91.4%, n=32). Both vaccine-hesitant (76.9%, n=183) and non-hesitant participants (96.3%, n=708) indicated that a healthcare worker would influence their choice. Only 19.1% (n=120) of participants on the Campus 2 and 37.1% (n=75) of participants on the Campus 1 were influenced by religious leaders. Only 7.1% (n=4) of Atheists and 7.5% (n=47) of participants on the Campus 2 were influenced by traditional healers. These healers influenced choices the most for participants who indicated their religion as Traditional African (43.2%, n=16) and participants on the Campus 1 (24.3%, n=49).

Both vaccine-hesitant (80.3%, n=191) and non-hesitant (92.9%, n=683) participants preferred to receive vaccination information at a clinic. Both vaccine-hesitant (82.8%, n=197) and non-hesitant (93.5%, n=687) participants preferred to receive vaccination information at a healthcare worker's office. Both vaccine-hesitant (84.0%, n=200) and non-hesitant (96.3%, n=708) partic-

Table 7: Participants' preferences regarding sources with regards to vaccines and vaccination

Question	**Yes**	**Non (%)**	**n (%)**
I trust the following people for information regarding vaccines:			
• Community/Religious leaders	260 (26.7)		**713 (73.3)**
• Family	**651 (66.9)**		322 (33.1)
• Friends	372 (38.2)		**601 (61.8)**
• Government	**648 (66.6)**		325 (33.4)
• Healthcare workers	**909 (93.4)**		64 (6.6)
• Internet	370 (38.0)		**603 (62.0)**
• Magazines/Newspapers	308 (31.7)		**665 (68.3)**
• Pamphlets	376 (38.6)		**597 (61.4)**
• Radio	451 (46.4)		**522 (53.6)**
• Scientific literature	**866 (89.0)**		107 (11.0)
• Social media	70 (7.2)		**903 (92.8)**
• Television	342 (35.1)		**631 (64.9)**
• Traditional healers	110 (11.3)		**863 (88.7)**
• Other	135 (13.9)		**838 (86.1)**
Where would you prefer to receive information on vaccination?			
• At home	**573 (58.9)**		400 (41.1)
• At school	**674 (69.3)**		299 (30.7)
• At the workplace	**575 (59.1)**		398 (40.9)
• Clinic	**874 (89.8)**		99 (10.2)
• Healthcare worker's office	**884 (90.9)**		89 (9.1)
• Hospital	**908 (93.3)**		65 (6.7)
• At a pharmacy	**912 (93.7)**		61 (6.3)
• Other (please specify)	44 (4.5)		**929 (95.5)**
Who should give the information to you?			
• Family	**554 (56.9)**		419 (43.1)
• Friends	351 (36.1)		**622 (63.9)**
• Government	**676 (69.5)**		297 (30.5)
• Healthcare worker	**931 (95.7)**		42 (4.3)
• Leaders (political, religious, etc.)	286 (29.4)		**687 (70.6)**
• Manufacturer	**561 (57.7)**		412 (42.3)
• Researcher	**835 (85.8)**		138 (14.2)
• Spokesperson	306 (31.4)		**667 (68.6)**
• Traditional healer	117 (12.0)		**856 (88.0)**
• Other	37 (3.8)		**936 (96.2)**

Table 8: Participants' preferences regarding influences and locations with regardsto vaccines and vaccination

Question	yes n (%)	no n(%)
The following people would influence my choice to be vaccinated:		
• Celebrities	82 (8.4)	**891 (91.6)**
• Family members	**733 (75.3)**	240 (24.7)
• Friends	434 (44.6)	**539 (55.4)**
• Healthcare workers	**891 (91.6)**	82 (8.4)
• Lecturers	**487 (50.1)**	486 (49.9)
• Political leaders	159 (16.3)	**814 (83.7)**
• Religious leaders	232 (23.8)	**741 (76.2)**
• Traditional healers	127 (13.1)	**846 (86.9)**
• Other	70 (7.2)	**903 (92.8)**
I would prefer that vaccinations are done:		
• At school	**500 (51.4)**	473 (48.6)
• At the workplace	434 (44.6)	**539 (55.4)**
• During a vaccination campaign	**565 (58.1)**	408 (41.9)
• At a healthcare worker's office	**794 (81.6)**	179 (18.4)
• My healthcare centre, such as a clinic	**904 (92.9)**	69 (7.1)
• At a pharmacy	**869 (89.3)**	104 (10.7)
• Other	40 (4.1)	**933 (95.9)**

ipants preferred to receive vaccination information at a hospital. Both vaccine-hesitant (84.9%, n=202) and non-hesitant (96.6%, n=710) participants preferred to receive vaccination information from a pharmacy.

Only 26.8% (n=15) of Atheists wanted to receive vaccination information from family. Family was the preferred source of information for Catholics (80.0%, n=28). Most vaccine-hesitant (54.6%, n=130) and non-hesitant (74.3%, n=546) participants preferred to receive vaccination information from the government. The government was the least preferred source of vaccination information for participants on the Campus 2 (63.6%, n=400) and the most preferred choice for participants on the Campus 1 (83.7%, n=169). Most vaccine-hesitant (87.8%, n=209) and non-hesitant (98.2%, n=722) participants preferred to receive vaccination information from a healthcare worker. Only 8.9% (n=5) of Atheists, followed by 10.7% (n=83) Christians and 7.6% (n=48) of participants on the Campus 2 preferred to receive vaccination information from traditional healers. These healers were the preferred choice for participants who indicated their religion as Traditional African (40.5%, n=15) and participants on the Campus 1 (22.8%, n=46).

Most vaccine-hesitant participants did not prefer to have vaccinations done at school (62.2%, n=148). Most non-hesitant participants preferred to have vaccinations done at school (55.8%, n=410). Most vaccine-hesitant participants did not prefer to have vaccinations done during a vaccination campaign (56.3%, n=134). Most non-hesitant participants preferred to have vaccinations done during a vaccination campaign (62.7%, n=461). Most vaccine-hesitant participants (68.5%, n=163) and non-hesitant participants (85.9%, n=631) preferred to have vaccinations done at a healthcare worker's office. Most vaccine-hesitant participants (82.8%, n=197) and non-hesitant participants (96.2%, n=707) preferred to have vaccinations done at their healthcare centres. Most vaccine-hesitant participants (76.5%, n=182) and non-hesitant participants (93.5%, n=687) preferred to have vaccinations

Table 9: Cross tabulations of vaccine-hesitant and non-hesitant participants and certaindemographical characteristicswith associations with practical significance

Question	n (%) Vaccine-hesitant Participants	Non-hesitant Participants	Cramer's V effect size	p*
Age at last birthday:			0.15**	0.002
18	10 (14.7)	58 (85.3)		
19	36 (21.2)	134 (78.8)		
20	42 (19.8)	170 (80.2)		
21	45 (23.3)	148 (76.7)		
22	39 (26.5)	108 (73.5)		
23	32 (30.5)	73 (69.5)		
24	15 (27.3)	40 (72.7)		
25	21 (48.8)	22 (51.2)		
26	7 (30.4)	16 (69.6)		
Mother language:			0.16**	0.001
Afrikaans	71 (17.8)	328 (82.2)		
English	27 (22.7)	92 (77.3)		
Northern Sotho	11 (23.9)	35 (76.1)		
Sotho	23 (32.4)	48 (67.6)		
Setswana	51 (28.5)	128 (71.5)		
Tsonga	10 (34.5)	19 (65.5)		
Xhosa	15 (35.7)	27 (64.3)		
Zulu	24 (38.7)	38 (61.3)		
Other (includes Ndebele, Other, Swazi and Venda)	15 (21.7)	54 (78.3)		

*p-value is that of Pearson'schi-square test**practical significance of association is leaning towards beingpractically visible

done at pharmacies.

4. DISCUSSION

Of the 1016 participants in this study, 24.3% (n=247) were vaccine hesitant to vaccinations (in general). This results are similar to the quarter of French students who were vaccine hesitant in January 2021 (Tavolacci *et al.*, 2021:9), and the 22.5% of dental students globally who were vaccine hesitant (Riad, Abdulqader *et al* 2021:12).

In this current SVHQ study, healthcare workers played an important role with regards to information about vaccinations and in making the choice to be vaccinated. Other studies had similar results. Most parents trusted the advice that family paediatricians gave them, according to a study by Coniglio *et al.* in Sicily in 2008 (2011:5). Riad, Pokorná *et al.* found in 2021 that 62.4% of Czech university students trusted healthcare providers for vaccine safety information (2021:11). Contrary to this, however, there was a distrust of doctors in Romania (ECDC, 2015:13). Tavolacci *et al.* found that general practitioners did not play

Table 10: Cross tabulations of vaccine-hesitant and non-hesitant participantsand certain demographical characteristics with associations without practical significance

Question	n (%) Vaccine-hesitant Participants	Non-hesitant Participants	Cramer's V effect size	p*
Campus:			0.13	‹0.0001
Campus 1	66 (30.8)	148 (69.2)		
Campus 2	131 (20.2)	516 (79.8)		
Campus 3	50 (32.3)	105 (67.7)		
Gender: * (2 participants chose the 'Other' option)			0.002	0.945
Female	151 (24.4)	467 (75.6)		
Male	96 (24.2)	300 (75.8)		
Highest academic year registered for in 2020			0.08	0.142
First Year	34 (22.1)	120 (77.9)		
Second Year	54 (20.7)	207 (79.3)		
Third Year	70 (27.9)	181 (72.1)		
Fourth, fifth and sixth year	33 (29.2)	80 (70.8)		
Religion:			0.13	0.003
Atheism	7 (12.1)	51 (87.9)		
Catholicism	13 (35.1)	24 (64.9)		
Christianity	190 (23.5)	620 (76.5)		
Traditional African	17 (43.6)	22 (56.4)		
Other (includes Hinduism, Islam, Judaism and Other)	20 (27.8)	52 (72.2)		
Faculty:			0.11	0.112
Economic and Management Sciences	70 (27.9)	181 (72.1)		
Education	50 (30.7)	113 (69.3)		
Engineering	5 (13.5)	32 (86.5)		
Health Sciences	32 (21.1)	120 (78.9)		
Humanities	26 (19.3)	109 (80.7)		
Law	17 (26.6)	47 (73.4)		
Natural and Agricultural Sciences	44 (22.6)	151 (77.4)		
Other (includes Theology and Other)	3 (15.8)	16 (84.2)		

*p-value is that of Pearson's chi-square test

Table 11: Cross tabulations with practicallysignificant associations with regards to participants' preferences, certaindemographic questions (Religion, Campus, Faculty) and category of participant(hesitant or not-hesitant)

Participants' preferences	**Practically significant association**	**-waardes**
Sources trusted for information regarding vaccines	Family and religion *	0.22
	Government and H or NH participant *	0.28
	Healthcare workers and H or NH participant *	0.26
	Radio and campus **	0.30
	Radio and faculty *	0.15
	Scientific literature and H or NH participant *	0.17
	Television and campus *	0.29
	Traditional healer and religion *	0.27
	Traditional healer and campus *	0.21
Sources influencing the choice to be vaccinated	Celebrities and campus *	0.18
	Family members and religion *	0.25
	Healthcare worker and category of participant **	0.30
	Religious leaders and campus *	0.17
	Traditional healer and religion *	0.19
	Traditional healer and campus *	0.23
Places preferred to receive vaccination information	Clinic and category participant *	0.18
	Healthcare worker's office and category of participant *	0.16
	Hospital and category participant *	0.21
	At a pharmacy and category participant *	0.21
Sources to receive vaccination information from	Family and religion *	0.18
	Government and category participant *	0.18
	Government and campus *	0.18
	Healthcare worker and category participant *	0.22
	Traditional healer and religion *	0.18
	Traditional healer and campus *	0.19
Places to receive vaccinations,	At school and category participant *	0.16
	During a vaccination campaign and category participant *	0.17
	At a healthcare worker's office and category participant *	0.19
	At my healthcare centre, such as a clinic and category participant *	0.23
	At a pharmacy and category participant *	0.24

* Association is leaning towards being practically visible
** Association is practically visible

a big role in shifting opinions of those university students in France who were vaccine hesitant or refusing vaccines (2021:10).

Social media is not a trustworthy information source regarding vaccines in this current SVHQ study. Tavolacci *et al.* found that social networks did not play a big role in negatively influencing university students in France with regard to their choice to be vaccinated (2021:10). Riad, Pokorná *et al.* found in 2021 that 81.3% of Czech university students were not influenced by mass media or social networks when it came to making decisions about Covid-19 vaccination (2021:10). In 2015, university students in London did not receive vaccine-related health information on social media (Landowska *et al.*, 2017:5). However, patients' vaccination decision- making in Romania is influenced by social media (ECDC, 2015:14). Riad, Abdulqader *et al.* found that in 2021 media and social media informing decisions related to vaccines among dental students globally might lead to vaccine acceptance decreasing (2021:12). In one region in Italy (Emilia-Romagna region) in 2021, it was found that using social media can be one of the causes of Covid-19 vaccine hesitancy, with the opposite being true for institutional websites (Reno *et al.*, 2021: 719).

Only age and mother language had practically visible associations with vaccine hesitancy. When it comes to receiving the vaccine for seasonal influenza for students from California State University, Northridge, in the Los Angeles San Fernando Valley in 2014, gender and race/ethnicity was not statistically significant (Benjamin & Bahr, 2016:3). Year of study for undergraduates was, however, statistically significant (Benjamin & Bahr, 2016:3).

This SVHQ study indicated that information should be given by healthcare workers and the government. Tam *et al.* found that vaccine-hesitant college students would consider the authoritative advice of the college (2021). The results of this SVHQ study indicated that information originating from scientific literature is preferred. Healthcare workers were indicated as an influence on the choice of SVHQ participants to be vaccinated. In Croatia many healthcare workers felt they had to influence patients with regard to vaccination (ECDC; 2015:20). Many Romanian doctors felt that they had to try to influence the decisions that patients make with regard to vaccination (ECDC; 2015:20).

For participants who are non-hesitant, vaccinations can also be provided at schools and during a vaccination campaign.

Religious frameworks might be mobilised to underscore vaccine opposition (Kasstan, 2021). For this study population, it seems that participants of most religions, especially Catholics and participants who indicated their religion as Traditional African, prefer their families as sources of information regarding vaccination. Family will also impact the choice to be vaccinated or not of Catholics, Traditional Africans and Christians. It seems also that for Orthodox Jewish parents, religion is not the primary consideration when vaccination decisions are being made, but rather issues like safety (Kasstan, 2021). Vaccines are perceived as dangerous and not effective by parents and caregivers who are members of the Apostolic Church (who were identified as having hesitancy towards vaccines) in Zimbabwe (Machekanyanga *et al.*, 2017:1689).

Family do not influence the choice of Atheists to be vaccinated or not and should not give information to Atheists about vaccination. None of the religious groups indicated that they would like information from traditional healers on vaccination and traditional healers would also not influence their vaccination choice.

Participants could attend a university of South Africa on one of its three previously mentioned campuses. There were practically significant differences among the campuses. This emphasises the notion that vaccination campaigns should be target specific (Tam *et al.*, 2021).

Participants on the Campus 1 should receive vaccination information from the radio, the television, and the government.

Participants on the Campus 3 should receive vaccination information from the radio and the government. This information should not be received from the television.

Participants on the Campus 2 should receive

vaccination information from the government. This information should not be received from the radio, or the television.

For participants on all three campuses, celebrities, religious leaders, and traditional healers do not have an influence on their vaccination decisions and they do not want to receive information from traditional healers. A study undertaken in 2012, among Warao Amerindian caregivers in the Orinoco Delta, Venezuela, found that the majority of these caregivers paid visits to traditional healers and were Christians, but these factors did not play a big role in vaccine decision making (Burghouts *et al.*, 2017:11).

With regards to faculties, only the radio should be used as a source of vaccine information for participants from the Education and the Humanities faculties.

5. Limitations

Even though this study was planned before the existence of Covid-19, the SVHQ reached the study population a couple of months after Covid-19 was declared a pandemic by the WHO. Thus, even though the questionnaire was meant to explore vaccine hesitancy with regard to vaccines in general, it seemed that some university students had a Covid-19 vaccine in mind when they answered the questionnaire. The start of Covid-19 affected the duration of the collection and processing of the results. Only a small percentage of the entire university student population took part in the SVHQ study. The findings of the SVHQ study might be less precise than they would have been if there had been more participants. The number of questions to measure each factor were limited, in order to prevent the questionnaire from becoming too long. The results and findings of the SVHQ study may thus not be as thorough and precise as they could have been.

The data were collected by means of a self-report survey, meaning some additional information was not investigated that might be helpful to understand and give more depth to the results obtained. This study might provide current results for influences on hesitancy, but vaccine hesitancy has the nature to change. The results are also not generalisable to other populations.

A convenience sample was used; therefore, the results might depict a biased perception of general vaccine hesitancy, for we do not know the possible differences between the university students who answered the questionnaire and those who did not.

6. Conclusion

General vaccine hesitancy is prevalent among students at this South African university and should be addressed for this population. Information from scientific literature is important. The way healthcare workers treat patients and communication with them, is important and should be enhanced. Healthcare workers and the government should provide information on vaccination. Furthermore, information should be provided at pharmacies; clinics; healthcare workers' offices; and hospitals, and not at the workplace. Vaccinations should be provided at healthcare centres; healthcare workers' offices; hospitals; and pharmacies. Vaccinations can be provided at schools and during vaccination campaigns for not vaccine-hesitant individuals. Take into consideration that family plays an important role when it comes to vaccination decisions.

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