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Original article

Knowledge, attitudes and good practices concerning SARS-CoV-2 infection and vaccines among Italian nursing students: A cross-sectional study

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Abstract. *Background and aim:* During the Covid-19 pandemic, the world implemented strategies to contain and prevent the transmission of SARS-CoV-2. Nurses played a key role in informing and educating the population on correct health management and the fight against SARS-CoV-2 infection. This study aims to analyse Italian nursing students' knowledge, attitudes and good practices concerning SARS-CoV-2 infection and vaccines. *Methods:* A cross-sectional study was conducted. A convenience sample of nursing students from a nursing-degree programme of University of Rome Tor Vergata was considered. The Knowledge, Attitudes and Good Practices concerning SARS-CoV-2 among Nursing Students (KAGP-COV-Ns) questionnaire was used. *Results:* A convenience sample of 303 nursing students enrolled in a three-year degree program was considered. Of the participants, 74.6% were female, with a mean age of 23.86 years (standard deviation 5.41). The participants demonstrated good knowledge of the SARS-CoV-2 virus, its risk factors, and associated symptoms. However, they exhibited inadequate knowledge regarding the incubation time of SARS-CoV-2, the gold-standard test, and treatment options. In our study, first- and third-year students differed in terms of knowledge and good practices, with the latter performing better on the questionnaire. Overall, participants displayed positive attitudes towards SARS-CoV-2 infection but showed a lower positive attitude towards providing information to citizens and becoming nurse vaccinators. *Conclusions:* Our study revealed that a subset of students exhibited vaccine hesitancy. A deeper understanding of this phenomenon would be very valuable for planning future strategies to promote adherence to preventive practices related to Covid-19 or other pandemics. (www.actabiomedica.it)

Key words: knowledge, attitude, good practice, nursing student, Covid-19

Introduction

During the Covid-19 pandemic, the world implemented numerous strategies to contain and prevent the transmission of SARS-CoV-2. The United States Centers for Disease Control and Prevention reiterated that everyone should protect themselves and others to prevent the spread of the virus through adequate hand hygiene, distancing, the use of masks, appropriate coughing and sneezing behaviour, isolation and the decontamination of surfaces (1, 2). Since the success of preventive measures is mainly based on people's adherence to them (3), great attention must be paid to nurses and future nurses, who have a key role in informing and educating the population on correct health management and the fight against SARS-CoV-2 infection.

Therefore, to provide correct information to citizens, nurses and future nurses must possess the necessary knowledge, attitudes, and practices to prevent SARS-CoV-2 infection (4). To meet this goal, universities have made great efforts to allow education in general and nursing instruction in particular to continue despite Covid-19-related restrictions (5).

Still, we know little about the knowledge, perceptions, and preventive practices of nursing students, who will be the healthcare workers of the future. Some studies have been conducted on this topic among health professionals (6, 7) and nursing students (8-17); however, the data on the latter are contradictory (15). For example, some researchers found that nursing students have good knowledge and practice (8, 9), while others found the opposite (10, 13, 17). Albaqawi et al. (9) discovered that most students performed preventive behaviours except for the following two: "Washing hands with soap and water for at least 20 s after blowing my nose, coughing or sneezing" and "Daily cleaning and disinfecting frequently touched surfaces." Ramdzan et al. (16) revealed that only one in three students had positive attitudes towards Covid-19. Provenzano et al. (15) found that a poor knowledge score was associated with poor practice, which means that students should have good knowledge to strengthen preventive practices (18). Given the above-mentioned findings, we decided it was important to investigate the knowledge, attitudes and good practices concerning SARS-CoV-2 infection and vaccines of Italian students at the Tor Vergata University of Rome.

Patients and method

Study design

A cross-sectional study was conducted from 24 July to 29 September 2021 and from 11 February to 8 April 2022. We used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for reporting observational studies (19).

Sample

A convenience sample of nursing students from the Tor Vergata University of Rome, in central Italy with 21 NDP (Nursing Degree Programme) sites (central and peripheral) was examined. The sample consisted of students who agreed to participate in the study from all three years of the programme, including those who were completing the degree with a delay (i.e., after the normal duration of three years).

Enrolment procedures

The programme director sent an email about the study to all the students. During a virtual meeting, a researcher explained the study's objectives to the students, the importance of obtaining informed consent, and the lack of personal consequences from participation. The anonymous nature of data collection was also discussed to assure students that their personal information could not be traced. The students were informed that the programme's director could not access the data, which would be analysed by researchers with no links to the degree. The researcher engaged with the students regarding the initial section of the questionnaire, which sought their informed consent. When this was provided, the students were allowed to complete the survey, which was sent by the researcher via a dedicated link to Google Forms. Reminder emails were sent to the students every 15 days to encourage them to participate.

Ethical issues

The research protocol was approved by the Internal Review Board of the Tor Vergata University of Rome (19/01/2021, number of the protocol 1/2021). The study was conducted according to the ethical principles of the Helsinki Declaration. All the participants were informed about the objectives and method of the study, and they were asked to provide written informed consent for it. Participation was voluntary, and the students could withdraw or refuse to participate at any time; they were also assured of the confidentiality of their responses.

Instrument

The questionnaire included an initial section that requested the participants' consent. By providing

consent, the student could continue with the completion of the survey. The first substantive part of the questionnaire collected sociodemographic data (gender, age and nationality) as well as information regarding which year of the degree the students were enrolled in (first, second, third or delayed) and the programme's site (central or peripheral). The second part of the questionnaire consisted of the Knowledge, Attitudes and Good Practices concerning SARS-CoV-2 and vaccines among Nursing Students (KAGP-COV-Ns) questionnaire.

This instrument was adapted from the questionnaire about knowledge, attitude, and practice of Provenzano et al. (15). Three experts in the cross-cultural adaptation of instruments and nursing education (GB, RM and VZ) constructed the items. They maintained the three dimensions of knowledge, attitudes, and good practices, but they developed new items related to the Italian context for every dimension. The experts produced 40 items. The knowledge section comprised 29 items; the attitudes section included 6 items, and the good practices section consisted of 5 items. During the second step of item revision, experts eliminated items 13, 26, and 34 due to redundancy with others. Consequently, the total number of items was reduced to 37. The knowledge section comprised 28 items, the attitudes section included 5 items, and the good practices section comprised 4 items. A five-point Likert scale was used to measure attitudes, ranging from *strongly disagree* (1) to *strongly agree* (5). Knowledge and good practices were considered together because they entailed assessing clinical knowledge about SARS-CoV-2 infection and good practices. In these two sections the items were considered as dichotomous responses (correct = 1, incorrect = 0) but also as continuous variables using a five-point Likert scale (from strongly disagree = |2|, disagree = |1|, undecided = 0, agree = |1|, strongly agree = |2|). In this scale, the correct answer was computed as 2 or 1 and the incorrect answer as -2 or -1, corresponding to the absolute value of the five-point Likert scale. The undecided response (= 0) was considered as incorrect answer. Additionally, correct and incorrect answers were given a value of 1 and 0 in the dichotomous evaluation respectively.

The score of the attitudes dimension could range from 0 (poor attitudes) to 25 (positive attitudes); the score of the knowledge and good practices dimensions (28 and 4 items respectively) could range from -64 (poor knowledge and practices) to + 64 (good knowledge and practices) when was considered as continuous variables. We piloted the KAGP-COV-Ns questionnaire in a group of 10 students to verify the clarity of the questions. We tested, in our sample, reliability on attitudes dimension that show a Cronbach's alpha of 0.66, that was considered adequate (20).

Data analysis

All statistical analyses were performed with SPSS Statistics version 22.0 (IBM Corp.). Continuous variables were presented as mean, standard deviation [SD] and range or, when appropriated, as median and Interquartile range (Q1-Q3). Categorical variables were presented as absolute frequency and percentage (%). First, we considered the correct-response rate of the students in the knowledge and good practices dimensions. A correct answer rate of 70%–100% indicated good knowledge and practices, while a rate below 70% signalled poor knowledge and practices. This approach stemmed from the level of proficiency required to pass in the public competitions, which is 70%. The knowledge and good practices sections were coded as dichotomous responses (*correct* = 1, *incorrect* = 0) but were also treated as continuous variables using a five points Likert scale (from strongly disagree = |2|, disagree = |1|, undecided = 0, agree = |1|, strongly agree |2|) in which the correct answer was computed 2 or 1 and incorrect answer -2 or – 1 accordingly with the absolute value of the five point Likert scale. The undecided response (= 0) was considered as incorrect answer. Additionally, correct and incorrect answers were given a value of 1 and 0 in the dichotomous evaluation respectively.

The attitudes section was analysed as continuous variable [from *strongly disagree* (1) to *strongly agree* (5)]. A high score meant good knowledge and practices as well as positive attitudes concerning SARS-CoV-2 infection and vaccines. To test differences in continuous variables, a t-test was applied when appropriate. To test differences among categorical variables with more than two classes, a one-way analysis of variance (ANOVA) model was applied. All the

required assumptions for the ANOVA model and the t-test were evaluated. A Bonferroni correction to the *p value* was performed for pairwise comparisons. Normal distribution was evaluated visually by the Normal Q-Q plot. To test differences in variables violating one-way analysis of variance (ANOVA) model and the t-test assumptions we performed the Wilcoxon-Mann-Whitney test. A *p value* of < 0.05 was considered statistically significant.

Results

Sample

The enrolled process was made by voluntary chosen and 303 of them given their consent to the questionnaire. The characteristics of the final sample are shown in Table 1. The mean age was 23.86 (SD 5.41), with a range of 18–42 years; 74.6% were female, and 90.1% were of Italian nationality; 39.6% attended the first, 10.2% the second, and 31.0% the third year of the programme. 19.1% were outside the prescribed time (delayed graduation); 58.4% were from the central site of the university, and 54.8% had previous work experience.

Table 1. Characteristics of the sample (N = 303)

	Mean (SD, range)
Age	23.86 (5.41, 18–42)
	% (n)
Gender *Female* *Male*	74.6 (226) 25.4 (77)
Nationality *Italian* *Other*	90.1 (273) 9.9 (30)
Year of attendance *First* *Second* *Third* *Delayed*	39.6 (120) 10.2 (31) 31.0 (94) 19.1 (58)
Site *Central* *Peripherical*	58.4 (177) 41.6 (126)
Previous work experience *Yes* *No*	54.8 (166) 45.2 (137)

The KAGP-COV-Ns questionnaire

The students' correct and incorrect responses in the knowledge and good practices dimensions are shown in Table 2.

The students showed a good level of knowledge regarding items n. 1 – 4, n. 8, n. 10, n. 11a, n. 14–18, n. 20, n. 21, n. 28 – 30, and n. 37, while they exhibited low knowledge concerning items n. 5, n. 6, n. 7, n. 9, n. 11b, n. 11c, n. 11d, n. 12, n. 19, and n. 31.

Regarding good practices, all the participants had good response rates, with a range of correct answers of 90.8%–97.7%.

The students' replies in the attitudes dimension are presented in Table 3.

All items show a satisfactory response rate, except in two items (n. 32: "I am in favour of SARS-CoV-2 vaccination for health professionals", and n. 33: "If someone were to ask me for advice on getting vaccinated against SARS-CoV-2, I would recommend it without reservations") where the students expressed a partial or incomplete attitude towards SARS-CoV-2 vaccination. In item n. 32 ("I am in favor of SARS-CoV-2 vaccination for health professionals"), a total of 5 students responded negatively, namely, *strongly disagree* (0.7%), *disagree* (1%), and 19 students responded *undecided* (6.2%). Similarly, in item n. 33 ("If someone were to ask me for advice on getting vaccinated against SARS-CoV-2, I would recommend it without reservations"), a total of 10 students indicated *strongly disagree* (1.3%), *disagree* (2.0%), and 19 students responded *undecided* (6.3%).

34 students reported a not coherent (*strongly agree/agree and strongly disagree/disagree)* or unclear position (*strongly disagree/disagree and undecided,* or *strongly agree/agree and undecided*) in item n. 32 and n. 33; we labeled them as *"students with a vaccine hesitancy attitude position*" as defined by MacDonald (21). Only 1 student reported a negative response (strongly disagree/disagree) in both items n. 32 and n. 33; we labeled him as *"students with an anti-vax position* as defined by MacDonald (21).

Concerning item n. 35 ("I feel ready to correctly inform the citizenry as per my professional role") and

Table 2. Knowledge and Good Practices among Nursing Students (N = 303)

Knowledge	Incorrect Answer % (n)	Correct Answer % (n)
1. Is SARS-CoV-2 infection caused by a beta-coronavirus?	26.1 (79)	73.9 (224)
2. Does SARS-CoV-2 infection cause an acute respiratory disease?	5.3 (16)	94.7 (287)
3. Are the typical symptoms of SARS-CoV-2 infection fever, cough and air hunger (dyspnoea)?	2.6 (8)	97.4 (295)
4. Is SARS-CoV-2 infection more serious among people with comorbidities, such as diabetes, cancer and other chronic diseases?	9.2 (28)	90.8 (275)
5. Is the incubation time of SARS-CoV-2 between 14 and 28 days?	69.3 (210)	**30.7 (93)**
6. Is polymerase chain reaction the gold-standard test for the diagnosis of SARS-CoV-2?	41.9 (127)	**58.1 (176)**
7. Does a SARS-CoV-2 antigen swab test produce many false negatives?	77.2 (234)	**22.8 (69)**
8. Should special attention (e.g., quarantine measures and molecular testing) be paid to people who have specific symptoms after being in areas with outbreaks of Covid-19 variants (e.g., the delta variant)?	5.9 (18)	94.1 (285)
9. Are antibiotics the gold-standard treatment for SARS-CoV-2 infection?	63.4 (192)	**36.6 (111)**
10. Can SARS-CoV-2 infection be deadly?	4.9 (15)	95.1 (288)
11a. Is the Pfizer vaccine made with mRNA technology?	13.2 (40)	86.8 (263)
11b. Is the AstraZeneca vaccine made with harmless adenovirus viral-vector technology?	52.5 (159)	**47.5 (144)**
11c. Is the Moderna vaccine made with mRNA technology?	30.4 (92)	**69.6 (211)**
11d. Is the Johnson & Johnson vaccine made with synthetic adenovirus viral-vector technology?	50.2 (152)	**49.8 (151)**
12. Which of the techniques listed below is considered innovative for producing SARS-CoV-2 vaccines because it has never been tried before?	56.1 (170)	**43.9 (133)**
14. Are mRNA-based SARS-CoV-2 vaccines dangerous because they modify a person's genetic code?	27.7 (81)	73.3 (222)
15. Does vaccine immunity against SARS-CoV-2 last only a few weeks?	26.4 (80)	73.6 (223)
16. What is the site for the inoculation of the vaccine against SARS-CoV-2?	2.3 (7)	97.7 (296)
17. Are the SARS-CoV-2 vaccines unsafe because they were prepared too quickly compared to other vaccines?	27.2 (84)	72.3 (219)
18. Can people vaccinated against SARS-CoV-2 transmit the virus?	20.5 (62)	79.5 (241)
19. After completing the SARS-CoV-2 vaccination series, should a serological test be performed to evaluate the person's immunological response?	91.7 (278)	**8.3 (25)**
20. Can anyone who has contracted SARS-CoV-2 get vaccinated?	22.1 (67)	77.9 (236)
21. If I have been in close contact with a SARS-CoV-2-positive person, must I undergo a 10-day quarantine and then a molecular/antigenic test?	15.5 (47)	84.5 (256)
28. Should SARS-CoV-2 carrier patients always remain in isolation during the quarantine period?	18.2 (55)	81.8 (248)
29. Is a vaccinated person fully protected from the risk of developing SARS-CoV-2 infection?	20.1 (61)	79.9 (242)
30. In Italy, at the current state of vaccination coverage against SARS-CoV-2 with a second dose (July 2021), is it possible to avoid wearing personal protective equipment (PPE)? Is it possible to meet relatives and friends if they are not vaccinated?	27.7 (84)	72.3 (219)

Table 2 (*Continued*)

31. Once herd immunity to SARS-CoV-2 has been achieved, as per the guidelines of the Higher Institute of Health (ISS), will it be possible to avoid PPE and meet friends and relatives freely?	37 (112)	**63 (191)**
37. Does someone who has completed the vaccination series but who has a positive molecular swab still need to comply with containment measures?	9.6 (29)	90.4 (274)
Good Practices	**Incorrect Answer % (n)**	**Correct Answer % (n)**
22. Does washing hands with soap and water for at least 30 seconds help prevent the transmission of the SARS-CoV-2 virus?	9.2 (28)	90.8 (275)
23. Does covering the nose and mouth when coughing and sneezing help prevent SARS-CoV-2 infection?	4 (13)	96 (290)
24. Does avoiding touching the eyes, nose and mouth as much as possible help prevent SARS-CoV-2 infection?	2.3 (7)	97.7 (296)
25. Does a mask worn in closed environments and during gatherings help prevent SARS-CoV-2 infection?	4.3 (13)	95.7 (290)

Note. The bold items had a correct-response rate below 70% and demonstrated low knowledge.

Table 3. Attitudes among Nursing Students (N = 303)

Attitudes	**Strongly Disagree % (n)**	**Disagree % (n)**	**Undecided % (n)**	**Agree % (n)**	**Strongly Agree % (n)**
27. Information concerning SARS-CoV-2 should be disseminated only by official and accredited institutes, such as the ISS, the Ministry of Health and regional departments.	0 (0)	1.3 (4)	4.3 (13)	11.9 (36)	82.5 (250)
32. I am in favour of SARS-CoV-2 vaccination for health professionals.	0.7 (2)	1.0 (3)	6.2 (19)	8.9 (27)	83.2 (252)
33. If someone were to ask me for advice on getting vaccinated against SARS-CoV-2, I would recommend it without reservations.	1.3 (4)	2.0 (6)	6.3 (19)	27.4 (83)	63.0 (191)
35. I feel ready to correctly inform the citizenry as per my professional role.	1.7 (5)	3.6 (11)	9.6 (29)	29 (88)	56.1 (170)
36. I am ready to serve as a nurse vaccinator once registered.	0.3 (1)	0.7 (2)	5 (15)	10.9 (33)	83.1 (252)

item n. 36 ("I am ready to serve as a nurse vaccinator once registered"), we observed a relatively low response rate regarding the duties outlined in Italian law for the professional profile in question. Of the surveyed students, 1.7% (5/298) *strongly disagreed*, 3.6% (11/298) *disagreed* and 9.6% (29/298) were *undecided* concerning their readiness to inform citizens (item n. 35). Similarly, 0.3% (1/298) *strongly disagreed*, 0.7% (2/298) *disagreed* and 5% (15/298) were *undecided* about their readiness to be nurse vaccinators (item n. 36).

Differences in the KAGP-COV-Ns questionnaire

The first verification of the assumptions underlying the t-test and the ANOVA test required the elimination of five outliers (1.6%) from an initial sample of 303 students that had response values excessively distant from what was expected. The final statistical analysis was performed on a sample of 298 participants. About Knowledge and Good practice score, Q-Q plot showed that was reasonable assume a normal distribution.

We evaluated the sum of the scores of the knowledge and good practices dimensions. The participants reported an overall mean score of 34.32 (± 10.08, range 7–56) as well as mean scores of 32.25 (± 10.66, range 7–54) in the first year, 34.67 (± 9.16, range 8–48) in the second year and 37.22 (± 10.03, range 9–56) in the third year of the programme. The mean score for the delayed students was 33.53 (± 8.4, range 12–51). There were statistical differences between the students of the first and third years of the programme ($F [3, 299] = 6.294$, $p = 0.001$). There were statistical differences between the central and peripheral sites of the university ($p = 0.025$). The participants studying at the central site had a mean score of 35.42 (± 10.49, range 7–56), while those at the peripheral sites had a mean score of 32.77 (± 9.30, range 8–53). There were no statistically significant differences in relation to gender, age, nationality, region of residence and work experience.

The visual Q-Q plot inspection showed that distributions deviate from that Normal, so we performed the Wilcoxon-Mann-Whitney test. The students with a vaccine hesitancy attitude position had a lower score in knowledge (median = 20, Q1-Q3 13-27.2) than that of the other participants (median= 29, Q1-Q3 22-35; Mann-Whitney test $p < 0.001$) as well as in good practices (median=5.5, Q1-Q3 3.7-8 vs median=8, Q1-Q3 7-8; Wilcoxon-Mann-Whitney test $p < 0.001$).

Discussion

This study aimed to analyse nursing students' knowledge, attitudes and good practices concerning SARS-CoV-2 infection and vaccines. To achieve this aim, we developed the KAGP-COV-Ns questionnaire. The findings indicate that the participants exhibited from low to good knowledge and good practices, with statistical differences between first- and third-year students and between those studying at the central and peripheral sites of the programme. The participants' adherence to our study varied depending on the year of the programme, with the highest adherence observed in the first and third years. We hypothesise that the students in these years engaged more in their academic activities. This increased engagement might be attributed to the fact that lessons, during the period of data collection, took place in the first and third years; in contrast, the second year included the degree's internship, which they were unable to carry out due to the anti-Covid-19 measures.

The participants possessed good knowledge of the SARS-CoV-2 virus (correct answer: 73.9%) as well as the risk factors (correct answer: 90.8%) and symptoms (correct answer: 97.4%) of the infection it causes. Similar results were reported by Aksu et al. (8) (virus 97.7%, risk factors 97.7% and symptoms 97%) and Albaqawi et al. (9) (risk factors 71.6% and symptoms 91.6%). However, the participants showed inadequate knowledge of the incubation time of SARS-CoV-2 (correct answer: 30.7%), the gold-standard test (correct answer: 58.1%) and the treatment options (correct answer: 36.6%). Kahari et al. (13) obtained similar results. Our findings could be related to the period of data collection (July–September 2021 and February–April 2022), when considerable information was derived from theoretical lessons but also from social media, which conveyed some misconceptions about vulnerability and prevention as well as the causes of Covid-19, protective equipment and the disease's management (22).

In this regard, we should note that the World Health Organization declared Covid-19 an infodemic at the Munich Security Conference in February 2020 (23). An infodemic involves over-information, including fake or misleading information in digital and physical environments during a disease outbreak. This phenomenon is amplified by the internet and the widespread use of social media. During the Covid-19 pandemic, TikTok saw a 38% increase in users, while Facebook and Twitter reported almost an 8% rise in users (24, 25).

The participants demonstrated good practices in relation to handwashing behaviour (90.8%) and the use of masks (96%), as was found by Aksu et al. (8) (96.1% handwashing and 96.7% mask use). In contrast, in the study by Albaqawi et al. (9), students had low adherence to handwashing (39%); also, Alshdefat et al. (10) found that only 47.9% of students used masks outside their homes. In our study, first- and third-year students differed in terms of knowledge and good practices. The latter performed better on the questionnaire. This is understandable because the

third-year students possessed more clinical knowledge and had undergone more hours of clinical placement than the first-year ones. Other differences were found between the central and peripheral sites of the programme. The participants studying at the central site performed better. These results could be related to the distribution of students among the different locations. Usually, the students who obtain higher scores in the programme's pre-entry test choose to be assigned to the central site; according to the university's rules, their higher scores guarantee that their choice is respected, unlike for those who achieve lower scores. We think that the students who perform better in the pre-entry test have more knowledge; hence, they did better also in the knowledge dimension of our study. In fact, a low score in pre-entry test is a predictor of academic failure (26).

The participants generally displayed positive attitudes towards SARS-CoV-2 infection. However, two issues emerged: a lack of perceived readiness concerning the nursing role (items n. 35 and n. 36) and a lack of acceptance of vaccination for both citizens and health professionals (items n. 32 and n. 33). The students had a low positive attitude towards providing information to citizens (item n. 35) and becoming nurse vaccinators (item n. 36). This finding is understandable when we consider that the participants were still learning and did not yet see themselves as highly qualified professionals. At the end of the three years of the programme, these students will have attended numerous hours of clinical placement (1,800 in total). Under the guidance of their mentors, they will develop strong clinical skills.

The second issue was that approximately 1.7% (n = 2 strongly disagree, n = 3 disagree) of the participants were not in favour of SARS-CoV-2 vaccination for health professionals and that 3.3% (n = 4 strongly disagree, n = 6 disagree) would not recommend it to the wider population. Several studies (10-13, 15, 16) examined nursing students' attitudes towards Covid-19, but they focused on patient care and governments' management of the pandemic. None of them analysed nursing students' perceptions of SARS-CoV-2 vaccination.

Our study revealed that some students hesitated to recommend SARS-CoV-2 vaccines for both health professionals and laypeople. Vaccine hesitancy and refusal among the wider population and health professionals are well-known phenomena in Italy (27). A study (28) showed that 4.9% of the general population had not received any doses of the vaccine. Among Italian nurses, 2.3% were opposed to the SARS-CoV-2 vaccine, and 6.2% were undecided (29). These data in our study reported 1.7% (strongly disagree/disagree) of students not in favour of vaccination for health professional and 3.3% (strongly disagree/disagree) not in favour for recommending vaccination without reservations. The main reasons for vaccine hesitancy have been shown to be a lack of information about the vaccine, concerns about its safety and fear of adverse events (30). Yilmaz et al. (31) found that nursing students had moderate levels of Covid-19-vaccine literacy and that those who had received the vaccine had higher levels of such literacy. In our study, the participants with vaccine-hesitant (11.7%, 34/298) achieved lower scores in the knowledge and good practices dimension compared to the rest of the sample. Based on this evidence, an intensive vaccine-literacy campaign could help Italian nurses and future nurses to reduce misconceptions about the safety of Covid-19 vaccines and build trust in them, ultimately leading to improved adherence to vaccination and better public-health outcomes (32). Furthermore, a deeper understanding of nursing students' attitudes towards these vaccines would be helpful.

This study aimed to assess nursing students' knowledge, attitudes and good practices concerning SARS-CoV-2 infection and vaccines. The collected data can be valuable in several ways. It can help identify areas where nursing students may have knowledge gaps or need further education or training regarding SARS-CoV-2 infection. Understanding their knowledge, attitudes and good practices is crucial for improving educational approaches, enhancing infection-control measures, and ensuring the safety of both students and patients.

This study has some limitations, including its small sample (in relation to the total national sample of nursing students), self-reported data (33) and specific context. Another limitation is the allocation of continuous scores in knowledge and in good practice sections; it could be considered an arbitrarily decision.

However, we decided to give two points of view to the readers about the students' knowledge in SARS-CoV-2 disease and about the good practice to prevent infection with the percentage of correct and incorrect answers but also a continuous score of overall knowledge and good practice. Therefore, the external validity of this study is circumscribed. Furthermore, a curriculum study should be conducted on SARS-CoV-2 infection to ensure that students possess the necessary knowledge and practices to prevent its spread (8). Additionally, attention should be given to digital literacy skills, as students need the ability to identify, evaluate, and manage information used in the learning process (34).

Conclusions

The participants in this study displayed a range of knowledge levels and good practices, with statistical differences observed between first- and third-year students and between those studying at the central and peripheral sites of the programme. Expanding the scope of this research to include other healthcare students, such as doctors, educators and nurses' aides, could produce interesting insights. Assessing these students' knowledge, attitudes and good practices concerning SARS-CoV-2 infection and vaccines could provide a more complete understanding of the preparedness and response to the virus across various healthcare professions. Furthermore, analysing the knowledge required in emergency situations such as floods, earthquakes and tsunamis could lead to fascinating outcomes. This assessment could shed light on citizen engagement and the efficacy of safety procedures when handling such emergencies.

Our study showed that some participants were vaccine hesitant. Regarding attitudes towards the SARS-CoV-2 vaccine, achieving a deeper comprehension of this phenomenon would be very valuable for planning future strategies to promote adherence to preventive practices in similar situations. By investigating the reasons behind vaccine hesitancy in specific groups, such as nursing students and health professionals, as well as in the general population, policymakers and healthcare authorities can develop targeted interventions to address concerns, provide accurate information and promote vaccine acceptance. This understanding can help shape effective communication campaigns, educational programmes, and policies to encourage greater uptake of vaccines and ensure public-health protection in similar situations in the future.

Ethics Committee: Internal Review Board of the Tor Vergata University of Rome (January 2021).

Conflict of Interest: The authors have no commercial associations (consultancies, stock ownership, equity interest, patent/licensing arrangement, etc.) that might create a conflict of interest in connection to the submitted article.

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