

Research Article

## Infection Control Behavior Factors to Prevent COVID-19 among Nursing Students: Cross-Sectional Online Survey

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### Abstract

**Background:** Coronavirus illness (COVID-19) reached the level of a significant public health emergency in 2019, with an estimated worldwide death toll of more than 1,00,000 people 2019. Coronavirus illness (COVID-19). This survey was conducted to identify the factors influencing COVID-19 practice among undergraduate nursing students at the University of Nizwa, Sultanate of Oman. **Methods:** A quantitative cross-sectional online survey of sixty-four undergraduate nursing students chosen from the school of Nursing at the University of Nizwa in Sultanate of Oman took part from July 30 to August 5, 2021. **Results:** Participants' average age was  $22.27 \pm 1.04$ , and the male-to-female ratio was 31.8% (n=64). Nursing students had adequate knowledge ( $13.67 \pm 3.46$ ), a positive attitude ( $48.14 \pm 12.29$ ), and good practices ( $32.6 \pm 6.12$ ), according to the results of a survey. Female students, compared to males (0.006,  $p < 0.05$ ), were more likely to follow better practices. Significant positive associations were found between age (0.025,  $p < 0.05$ ), gender (0.006,  $P < 0.05$ ), living areas (0.031,  $p < 0.05$ ), grade (0.000,  $p < 0.05$ ), Clinical practice experienced (0.016,  $p < 0.05$ ) and practice on COVID -19. **Conclusions:** The study findings exhibited the essential elements that affected COVID-19 precautionary practices, knowledge, and a positive attitude, which were the most critical variables to consider. Male students and students who reside in rural regions should be targeted for further health education, and efforts should be made to ensure these groups have access to reliable and effective online tools to assist them. *ASEAN Journal of Psychiatry, Vol. 23(5) May, 2022; 1-18.*

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### Introduction

In December 2019, a new ailment known as Corona Virus Disease 19 was discovered in China, and it has a high proclivity to transfer from one individual to another [1]. COVID 19 is a member of the coronavirus family that is accountable for the severe acute respiratory syndrome in humans and other

animals [2]. One or more of the following signs and symptoms may occur lung pneumonia; shortness of breath; cough; fever; congestion or runny nose; body ache; sore throat; loss of taste or smell; diarrhea; and vomiting (CDC,2020). Furthermore, COVID-19 can alter a wide range of physiological systems. COVID-19 has spread around the world, resulting in a large number of deaths and a large number of respiratory illness infections [3]. Compared to SARS 2002 and MERS 2012, where the death rate was 5%, the COVID 19 death rose

from 2% to 4%. Since SARS and MERS are both members of the same viral family, they have similarities with COVID 19 [4]. In addition to respiratory droplets and secretions, COVID-19 is spread indirectly through contaminated surfaces. There is a two-week incubation period for the virus to infect, and it is possible to become ill. Because of the rapid spread of COVID-19, individuals are advised to take measures as suggested by the World Health Organization, such as wearing a face mask, washing hands often, and cleansing hands with hand rub, among other things. The WHO recommends people with COVID 19 signs and symptoms stay at home (WHO., 2020) remain at home.

There are 41,570,883 million confirmed cases and 1,13,4940 fatalities globally up till October 23, 2020, according to the World Health Organization (WHO,2020). On February 24, 2020, the first instance of a COVID 19 positive case in Oman occurred, and the patient was from Iran [5]. Since the beginning, 1,11,837 cases of COVID 19 have been diagnosed in Oman, causing 1147 fatalities (Ministry of Health (MOH), 2020). In Oman, like in other nations, the imposed lockdown was in early 2020 to stem the spread of the disease. But the number of people who have been infected continues to climb. Despite official warnings, the public continues to meet for social occasions such as weddings and birthday parties, with little consideration for the risk of viral transmission.

Consequently, in response to an increase in the number of hospitalized patients in Oman, health organizations invited nursing students willing to assist the medical team by volunteering their time and skills. Globally, the shortage in the workforce in all healthcare settings has encouraged nursing students to come to the force to deliver services [6]. Moreover, healthcare students worldwide manned volunteer ships, visiting communities to bring awareness and educate about COVID-19 [7]. With such novel approaches taken to enhance any institutional contribution to the healthcare workforce, it is incumbent on the organizations to ensure that changes are effective and do not cause harm. Student nurses are the pillars and backbone of healthcare services and collaborate with healthcare workers in managing any pandemic situation. Also, they contribute to health service care provision during their nursing education, in their capacity as “learners” where they work under direct supervision [8]. The outcomes of this study will be beneficial in several perspectives, including boosting understanding of COVID-19 transmission, uptake of

prevention strategies, and identifying enhancing skills gaps and lapses in preventative behavior, particularly among nursing students.

This research will aid in identifying the aspects of the variables that impact COVID-19 knowledge, attitude, and preventative practice among nursing students. The result will help construct a comprehensive education program for infectious illness prevention and control in the management of emergencies [9]. To our knowledge, no papers have examined the variables that influence COVID-19 practice among nursing students in the Sultanate of Oman. In addition to contributing to the literature and research on COVID 19 KAP Knowledge, attitude, practice among nursing students and related issues in the nursing profession, the findings of this study will serve as a resource for future researchers who wish to investigate the matter in greater depth. The research focuses on student nurses across different levels of their studies to survey their KAP towards COVID-19. Thus the current project has two aims: (1) to explore the current level of knowledge, attitude, and practice of Oman School of Nursing students, University of Nizwa, and (2) to identify the relationship among nursing students' demographic attributes, knowledge, attitude, and practices [10].

## **Methods**

### *Study Design*

The study adopted a cross-sectional online survey design with a quantitative approach, conducted among undergraduate nursing students of the University of Nizwa, with independent and dependent variables measured simultaneously.

### *Population and setting*

Undergraduate nursing students across all program levels, at the school of nursing, the University of Nizwa in Sultanate of Oman.

## **Sample Size and Sampling Procedures**

The sample size was computed by reviewing previous similar studies with the power analysis based on a few assumptions: the proportion of adequate knowledge above 75%, level of confidence 95%, precision rate 5%, and 10% sample size was increased to overcome non-response [11,12]. The volunteers from undergraduate nursing students of the nursing courses responded to our survey

questionnaire. They also had to 'click on the link' to access the online questionnaire and provide their replies to qualify. After deleting 13 students who had submitted incorrect questionnaires and 23 students who refused to participate, a total of 64 samples were utilized in the study. The calculated sample size was finally 64 undergraduate nursing students of the University of Nizwa from different levels of nursing courses [13].

#### *Inclusion/exclusion criteria*

Being unwilling to participate, having experienced indications and symptoms of COVID-19, have not received two doses of vaccinations, and having been involved in caring for family members with COVID-19 were all grounds for exclusion from the study [14]. Initially, one-hundred undergraduate nursing students were eligible for participation in the online survey based on inclusion and exclusion criteria.

#### *Data collection tool/ instrument*

The primary independent variables were students' demographic data age, gender, grade, living location, source of information about COVID-19, and their training experience [15,16]. The data collection tool for the survey was developed based on the study's aims and related to KAP theoretical model components of health prevention strategies.

The survey was divided into four major sections: demographics, knowledge of COVID-19 (diagnosis,

treatment, and preventative measures), attitude, and practice. In the knowledge domain, there were three components on this scale: information concerning COVID-19 (3 items); symptomatology (3 items); transmission (6 items); diagnosis (4 items); and therapy (three items) (3 items). There were three options for each item on the list true, false, and I do not know. Accurate answers received one point, while false and I don't know responses received zero points for their responses. The total score varied from 0 to 19, with 0 indicating the lowest possible score and 19 representing the most probable score. The students with scores of 13 and above are considered to have adequate knowledge [17]. Students score of 6-12 are believed to have moderate knowledge, and those below six are deemed to have inadequate knowledge.

The attitude tool had 13 items of evaluation, with a five-point Likert scale ranging from strongly agree

(five scores) to strongly disagree (one score). The total scores of attitude were from 1 to 65. Based on the participant's score, a cut of score of 33 and above was deemed to be a positive attitude, while a score less than 33 was interpreted as negative attitude. The practice scale had eight evaluation items; each ranged from always (score 5) to never (score 1). The total score varied from 1-40. The interpreted score of greater than 20 was accepted to be good practice, while a score of less than 20 was interpreted as bad practice.

The STROBE (strengthening of Reporting of Observational Studies in Epidemiology) statement was used to prepare the paper, and it was consistently implemented throughout the writing process [18]. Because of the COVID-19 situation, it was possible to access the technologies to create a link to an online survey that was then electronically mailed to participants. The initial pilot study was performed with ten nursing students excluded from the main study to examine the validity of the questionnaire and the practicability of conducting the survey. The tool has been shown to have high dependability with high test-retest reliability [19,20]. Pearson's coefficient analyzed the internal correlation to test the reliability of the survey tool (Cronbach's alpha value of 0.75, 0.83, and 0.84, respectively, for KAP).

#### **Ethical Consideration**

The research committee of the College of Pharmacy and Nursing School, University of Nizwa, Sultanate of Oman, approved the proposal (Ethical Committee Approval identification No: UON/AA-006/FORM-GUI/V2/2017, dated 4/4/2021). The present study was accomplished in compliance with the Declaration of Helsinki-ethical norms for research involving human subjects issued by the World Medical Association [21]. Before responding to the survey, the participants were informed, and their consent was received. Students were given the freedom to opt-out of the study without detriment to their relationship with the School of Nursing.

#### *Statistical analyses*

IBM SPSS version 26.0 (Chicago, IL, USA) was used for all statistical analyses. Data were verified to have normal distribution before examination using the Kolmogorov-Smirnov test. The distribution of continuous variables was described by means and standard deviations [22]. Frequencies and

percentages characterized the distribution of categorical variables. The association among variables was explored using a Pearson correlation test. Multinomial logistic regression was used to analyze the correlation between precautionary practice and the main variables.  $P < 0.05$  was considered statistically significant for all statistical

analyses.

**Results**

*Demographic characteristics*

Participant’s demographic details indicate that the mean age was 22.27(SD:1.04). The detailed results are captured in Table 1.

**Table 1. Participant’s demographic details indicate that the mean age**

<b>Variable</b>	<b>f</b>	<b>Percentage</b>	<b>Mean</b>	<b>SD</b>
Age in years			22.27	1.043
18-20	15	23.4		
21-23	30	46.9		
24-26	6	9.4		
>27	13	20.3		
Sex				
a. Male	11	17.2		
b. Female	53	82.8		
Living areas				
City	37	57.8		
Countryside	27	42.2		
Grade				
First-year	1	1.6		
Second-year	21	32.8		
Third-year	18	28.1		
Fourth-year	6	9.4		
Fifth-year	18	28.1		
<b>Clinical practice experienced</b>				
Yes	59	92.2		
No	5	7.8		
Sources of information				
Newspapers/magazines	9	14.1		
School network platform	19	29.7		
Television	1	1.6		
Classmates/friends/family	3	4.7		
Social media	32	50		

**Knowledge Level of COVID-19**

Different evaluation items of students’ knowledge have been depicted in Table 2&3. As described in

table 2, most of the students, 54 (84.4%), had adequate knowledge of COVID-19. The mean score on the level of knowledge about COVID-19 was 13.67 of 19 total scores, and the standard deviation

was 3.46. The participants represented students from

different levels of the nursing courses from the first to fifth year [23]. A59(92.2%) have prior clinical experience, while five participants (7.8%) have no previous clinical experience. Of sixty-four participants, 32 participants (50%) used social media as a primary source of information about COVID-19.

**Table 2. Distribution of level of knowledge on COVID-19 (N=64)**

Items number	Items	True		False		I do not know	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
1	COVID-19 is a coronavirus-related respiratory infectious illness.	59	92.2	3	4.7	2	3.1
2	The first human infection with COVID-19 was reported in Wuhan, China, in 2019.	60	93.8	1	1.6	3	4.7
3	Coronavirus can be fatal.	54	84	5	7.8	5	7.8
4	Ultraviolet light, heat sensitivity, 56°C for 30 min, ether, 75% alcohol, chlorine disinfectant, acetic acid, and chloroform inactivate the virus.	14	21.9	14	21.9	36	56.3
5	The main symptoms are fever, dry cough, and fatigue. Other symptoms are a stuffy nose, runny nose, sore throat, myalgia, and diarrhea.	61	95.3	3	4.7	0	0
6	Severe symptoms are dyspnea and hypoxemia, acute respiratory distress syndrome, multi-organ dysfunction, and septic shock.	58	90.6	3	4.7	3	4.7
7	Respiratory droplets are from sneezing and coughing.	60	93.8	3	4.7	1	1.6
8	Close contact with the patient.	49	76.6	10	15.6	5	7.8
9	Contact with virus-contaminated objects.	45	70.3	9	14.1	10	15.6
10	Aerosol.	26	40.6	12	18.8	26	40.6
11	COVID-19 infection was believed to originate in bats.	46	71.9	8	12.5	10	15.6
12	Antibiotics can help treatment.	30	46.9	28	43.8	6	9.4
13	Antiviral can help with treatment.	49	76.6	9	14.1	6	9.4
14	Rehabilitated plasma helps treatment.	38	59.4	6	9.4	20	31.3
15	Vaccines to prevent new coronavirus infections are available.	53	82.8	6	9.4	5	7.8
16	The population is generally susceptible to infection.	57	89.1	5	7.8	2	3.1
17	Real-time reverse transcription-polymerase chain reaction can help to diagnose COVID-19.	28	43.8	3	4.7	33	51.6

18	Viral next-generation sequencing can help to diagnose COVID-19	35	54.7	3	4.7	26	40.6
19	The incubation period of coronavirus is from 1 to 14 days	52	81.3	6	9.4	6	9.4

**Table 3. Mean and standard deviation of knowledge of COVID-19 (N=64)**

Knowledge	f	%	Mean	SD
Adequate	54	84.4		
Moderate	7	10.9	14	3.46
Inadequate	3	4.7		

**Attitude Toward Covid-19**

The distribution of participants' responses to different evaluation items, as shown in table 4&5,

revealed the scores ranged from 1 to 65, with a mean score of 48.14 and a standard deviation of 12.29. The majority of the nursing students, 56(87.5%), showed a positive attitude [24].

**Table 4. Distribution of attitude toward COVID-19**

Items. NO	Items	Strongly disagree		Partly disagree		Neutral		Partly agree		Strongly agree	
		f	%	f	%	f	%	f	%	f	%
1	Promoting guidelines or programs for the care of new coronavirus infections can prevent the spread of disease	10	15.6	4	6.3	9	14.1	21	32.8	20	31.3
2	Agree to wear a mask when going outside	10	15.6	1	1.6	7	10.9	1	1.6	45	70.3
3	Agree to close management of communities	8	12.5	3	4.7	17	26.6	20	31.3	16	25
4	Agree to delay the resumption of work	4	6.3	12	19	17	26.6	17	26.6	14	21.9
5	Agree to delayed school attendance	8	12.5	12	19	4	6.3	23	35.9	17	26.6
6	Agree with the transportation department to take passenger registration and take a temperature	12	18.8	2	3.1	6	9.4	17	26.6	27	42.2
7	Agree to carry out a clinical internship in hospitals receiving COVID-19 patients	16	25	2	3.1	19	29.7	10	15.6	17	26.5
8	Agree to receive the newly developed vaccine	9	14.1	5	7.8	9	14.1	13	20.3	28	43.8
9	COVID-19 suspects should be isolated	5	7.8	3	4.7	6	9.4	11	17.2	39	60.9
10	COVID-19 patients should be isolated	6	9.4	4	6.3	6	9.4	4	6.3	44	68.8
11	Cares of COVID-19 patients should be isolated for 14 days.	6	9.4	5	7.8	10	15.6	8	12.5	35	54.7
12	There are immigrants who, while segregated, actively inform themselves of their travel history.	7	10.9	1	1.6	27	42.2	15	23.4	14	21.9

13	COVID-19 discharged patients should continue to be isolated at home for 14 days, wear masks, reduce close contact with family members, and share meals	7	10.9	4	6.3	11	17.2	17	26.6	25	39.1
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**Table 5: Mean and standard deviation for attitude on COVID-19 (N=64)**

Attitude	<i>f</i>	%	Mean	SD
Positive	56	87.5		
Negative	8	12.5	48.14	12.29

Tables 6&7 reveal the distribution of participants' responses in different evaluation items, and the mean practice score for COVID-19 was 32.6, with an SD of 6.2. The overall score ranged from one to 40. If the score is above 20 points, the student has an

excellent preventive practice; however, if it is less than 20 points, the student has a negative attitude [25,26]. The majority of the students, 60(93.8%), had good precautionary practice toward COVID-19.

**Table 6. Distribution of Participant's Practice toward COVID-19**

Items number	Items	Never		Seldom		Sometime		Often		Always	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
1	Clean your hands with an alcohol-based hand sanitizer	2	3.1	0	0	11	17.2	16	25	35	54.7
2	Cover your mouth and nose when you cough or sneeze	1	1.6	1	1.6	6	9.4	8	12.5	48	75
3	Clean and disinfect items that can be easily touched with hands (i.e., door handles and surfaces)	2	3.1	4	6.3	19	29.7	11	17.2	28	43.8
4	Avoid touching eyes, nose, and mouth	3	4.7	0	0	16	25	16	25	29	45.3

5	Reduce unnecessary outings (meetings, dining, shopping, sports activities)	2	3.1	2	3.1	21	32.8	15	23.4	24	37.5
6	Avoid close contact with people when they are sick	6	9.4	2	3.1	3	4.7	12	18.8	41	64.1
7	Wear masks, gloves, goggles, etc. in the crowded areas	2	3.1	5	7.8	12	18.8	14	21.9	31	48.4
8	Avoid using public transportation	6	9.4	3	4.7	21	32.8	15	23.4	19	29.7

**Table 7. Mean and standard deviation for precautionary practice toward COVID-19 (N=64)**

precautionary practice	<i>f</i>	%	Mean
Good	60	93.8	32.6
Poor	4	6.2	

**Association between demographic data and level of knowledge, attitude, and practice of COVID-19**

The information illustrated in Tables 8, 9, and 10 shows a significant association of KAP with demographic characteristics [27,28]. Table 8 depicts a statistical association found with the variable gender in terms of their knowledge with the chi-square value of 21.27,  $p < 0.05$ , and grade with the chi-square value of 69.21,  $p < 0.05$ . Regarding attitude Table 9, there was a statistically significant association only with three variables: age, clinical practice, and source of information [29]. There is a significant positive association between attitude

towards nursing students and age with the chi-square value of 122.83,  $p < 0.05$ ; clinical practice experienced with the chi-square value of 46.64,  $p < 0.05$ ; and sources of information with the chi-square value of 148.72,  $p < 0.05$ . In terms of practice, Table 10 shows there is a significant association between precautionary practice toward COVID-19 among nursing students and age with the chi-square value of 76.16,  $p < 0.05$ ; year grade with the chi-square value of 148.06  $p < 0.05$ ; clinical practice experienced with the chi-square value of 33.22,  $p < 0.05$ ; gender with the chi-square value of 36.57;  $p < 0.05$ , and the living area with the chi-square value of 30.67,  $p < 0.05$ .

**Table 8. Demographic Data and Participants' level of knowledge (N=64)**



Variable	N	Adequate	Moderate
	-64	( %)	( %)
<b>Age in years</b>			
18-20	15	13 (86.7)	00 (0)
21-23	30	25 (83.3)	04 (13.3)
24-26	6	05 (83.3)	01 (16.6)
>27	13	11 (84.6)	02 (15.4)
<b>Gender</b>			
Male	11	08 (72.7)	00 (0)
Female	53	46 (86.8)	07 (13.2)
<b>Living area</b>			
city	37	31 (83.8)	03 (8.1)
countryside	27	23 (85.2)	04 (14.8)
<b>Grade</b>			
First-year	1	01 (100)	00 (0)
Second-year	21	19 (90.5)	00 (0)
Third-year	18	15 (83.3)	03 (16.7)
Fourth-year	6	05 (83.3)	01 (16.7)
Fifth-year	18	14 (77.8)	03 (16.7)
<b>Clinical experience</b>			
<b>Yes</b>	59	49 (83.1)	07 (11.9)
<b>No</b>	5	05 (100)	00 (0)
<b>Sources of information</b>			
Newspapers/magazine	9	08 (88.9)	01 (11.1)
School network platform	19	15 (78.9)	04 (21.1)
Television	1	01 (100)	00 (0)
Classmates/friends/family	3	03 (100)	00 (0)
Social media	32	27 (84.4)	02 (6.3)

Legend:  $p < 0.05^*$  –significant;  $p > 0.05$ - non significant (NS).

**Table 9. Association between demographic data and Attitude toward COVID-19 (N=64)**

Variable	N	Positive (%)	Negative (%)
<b>Age</b>			
18-20	15	11 (73.3)	4 (26.7)
21-23	30	29 (96.7)	1 (3.3)
24-26	6	05 (83.3)	1 (16.7)
>27	13	11 (84.6)	2 (15.4)
<b>Gender</b>			
Male	11	10 (90.9)	1 (9.1)
Female	53	46 (86.8)	7 (13.2)
<b>Living area</b>			
city	37	34 (91.9)	3 (8.1)
countryside	27	22 (81.5)	5 (18.5)
<b>Grade</b>			
First-year	1	1 (100)	0 (0)
Second-year	21	18 (85.7)	3 (14.3)
Third-year	18	16 (88.9)	2 (11.1)
Fifth-year	18	15 (83.3)	3 (16.7)
<b>Clinical experience</b>			
Yes	59	54 (91.5)	5 (8.5)
No	5	2 (40)	3 (60)
<b>Sources of information</b>			
Newspapers/magazines	9	09 (100)	00 (0)
School network platform	19	18 (94.7)	01 (5.3)
Television	1	01 (100)	00 (0)
Classmates/friends/family	3	03 (100)	00 (0)

Legend:  $p < 0.05$ \* –significant;  $p > 0.05$ - non significant (NS).

**Table 10. Association between demographic variables and practice on COVID-19 (N=64)**

Variable	N	Good (%)	Poor (%)
<b>Age</b>			
18-20	15	13 (86.7)	02 (13.3)
21-23	30	29 (96.7)	01 (3.3)
24-26	6	05 (83.3)	01 (16.7)
>27	13	13 (100)	00 (0)

<b>Gender</b>			
Male	11	9 (81.8)	02 (18.2)
Female	53	51 (96.2)	02 (3.8)
<b>Living area</b>			
city	37	34 (91.9)	03 (8.1)
countryside	27	26 (96.3)	01 (3.7)
<b>Grade</b>			
First-year	1	01 (100)	00 (0)
Second-year	21	19 (90.5)	02 (9.5)
Fourth-year	6	06 (100)	00 (0)
Fifth-year	18	17 (94.4)	01 (5.6)
<b>Clinical experience</b>			
Yes	59	55 (93.2)	04 (6.8)
No	5	05 (100)	00 (0)
<b>Sources of information</b>			
School network platform	19	18 (94.7)	01 (5.3)
Television	1	01 (100)	00 (0)
Classmates/friends/family	3	03 (100)	00 (0)

Legend:  $p < 0.05^*$  –significant;  $p > 0.05$ - non significant (NS).

### Nursing Students’ Knowledge, attitude, and practice toward COVID-19

Pearson’s correlation matrix for the main study dependent variables is shown in Table 11. The result of .086,  $p > 0.01$ , suggests a modest positive relationship between knowledge and attitude, i.e.,

the adequacy of students' knowledge correlated with a favorable positive attitude. Given the correlation between knowledge and practice, a score of 0.48,  $p < 0.01$ , implies a moderate positive relationship between these variables [30]. The coefficient of 0.46,  $p < 0.01$ , indicates a correlation between attitude and preventive practice.

**Table 11. Pearson’s correlation matrix for the main study dependent variables**

Variables	1	2	3
Knowledge	1	0.086	0.486**
Attitude	0.086	1	0.468**
Precautionary practice	0.486**	0.468**	1

Legend: \*\* significant  $p < 0.01$  level (2-tailed).

**Multinomial logistic regression analysis of the factors affecting precautionary practice toward**

COVID-19 among the nursing students

Table 12 presents the results of the correlations of the student characteristics and knowledge, attitude,

and preventive practice [31,32]. Fourth-grade students with clinical experience, adequate knowledge, and a positive attitude were the significant predictors of the appropriate approach toward COVID-19.

Table 12 Multiple Logistic Regression: Precautionary practice towards COVID-19 among nursing students

IVariable	Precautionary practice toward COVID-19												
	N	Never			Seldom			Sometime			Often		
		OR	95 % CI	P	OR	95 % CI	P	OR	95 % CI	P	OR	95 % CI	P
Age	64	0.28	1.02 – 1.54	0.62	0.56	0.83-1.31	0.14	0.21	0.07-0.21	0.46	0.65	0.01-0.32	0.37
<b>Gender</b>													
Female	53	0.15	0.68-0.96	0.51	0.11	0.34-0.54	0.45	0.28	0.17-0.45	0.67	0.73	1.43-2.12	0.53
Male	11	<b>Ref</b>											
<b>Living area</b>													
City	37	0.51	0.28-0.72	0.43	0.34	0.69-0.91	0.28	0.61	0.23-0.91	0.31	0.47	0.19-0.82	0.65
Countryside	27	<b>Ref</b>											
<b>Grade</b>													
First-year	1	0.71	1.43-1.92	0.76	0.28	0.31-0.79	0.64	0.56	0.41-0.86	0.34	0.59	0.81-1.58	0.76
Second year	21	0.65	0.51-0.81	0.43	0.34	0.36-0.64	0.32	0.48	0.15-0.67	0.81	0.43	0.79-1.23	0.61
Third year	18	0.71	0.04-0.12	0.87	0.45	0.14-0.46	0.23	0.75	0.47-0.81	0.78	0.61	0.56-1.56	0.49
Fourth-year	6	<b>1.07</b>	0.61-0.81	<b>0.000***</b>	<b>1.6</b>	1.01-1.78	<b>0.000***</b>	<b>1.1</b>	0.34-0.61	<b>0.000***</b>	<b>1.2</b>	0.15-0.89	<b>0.03*</b>
Fifth-year		<b>Ref</b>											
<b>Clinical experience</b>													
Yes	59	<b>1.24</b>	0.89-1.23	<b>0.04*</b>	<b>1.1</b>	0.26-0.81	<b>0.03*</b>	<b>1.1</b>	0.13-0.81	<b>0.002*</b>	<b>1.2</b>	0.88-1.61	<b>0.001**</b>
No	5	<b>Ref</b>											
<b>Sources of information</b>													
Newspapers/magazines	9	0.2	1.32-1.76	0.6	0.17	0.91-1.37	0.7	0.14	0.7-1.20	0.076	0.19	0.12-0.87	0.067
School network platform	19	0.39	0.78-1.26	0.44	0.47	0.44-0.61	0.11	0.28	0.6-1.21	0.15	0.23	0.21-0.68	0.082
Television	1	0.26	0.61-	0.12	0.8	0.31-	0.27	0.45	0.54-	0.51	0.63	0.34-	0.1

			1.04		1	0.94			71			1.20	
Classmates/friends/family	3	0.57	0.18-0.51	0.51	0.17	0.12-0.67	0.82	0.18	0.44-0.71	0.43	0.51	0.44-0.91	0.23
Social media	32												
<b>Knowledge</b>													
Adequate	54	<b>1.35</b>	0.13-0.68	<b>0.02*</b>	<b>1.2</b>	0.23-0.67	<b>0.003**</b>	<b>1.3</b>	0.21-0.61	<b>0.0001***</b>	<b>1.3</b>	0.28-0.89	<b>0.0001***</b>
Moderate	7	0.98	0.37-0.61	0.12	0.16	0.41-0.81	0.71	0.27	0.21-0.89	0.15	0.18	0.4-1.21	0.36
<b>Attitude</b>													
Positive	56	<b>1.45</b>	0.13-0.56	<b>0.000***</b>	<b>1.2</b>	0.41-0.71	<b>0.002**</b>	<b>1.1</b>	0.56-0.72	<b>0.001*</b>	<b>1.2</b>	0.34-0.81	<b>0.006*</b>
Negative	8												

\*  $P < 0.05$ , \*\*  $P < 0.01$ - Significant \*\*\*  $P < 0.001$ - Highly significant

### Discussion

Worldwide, nursing students have been volunteers and a promising workforce backbone for any healthcare organization; hence a clear understanding of their KAP of COVID-19 is mandatory. No studies have been published to explore the KAP of COVID-19 among nursing students to the researchers' knowledge. This project will generate a road map to address the gaps in preparing nursing students to practice safe and effective strategies. The present study looked at the KAP of COVID-19 among undergraduate nursing students at the University of Nizwa, Sultanate of Oman. Our results identified that many nursing students of the University of Nizwa have proficient knowledge of COVID-19 and possess a favorable attitude and practice. Our findings are consistent with the KAP study by Adam M et al., 2021. Developing knowledge habits will be important in cultivating the correct and desirable attitude and practice. Nursing students can disseminate knowledge to the community to provide accurate awareness and education about infection prevention. This study's significant findings illustrated that the majority of the nursing students have adequate knowledge in terms of different evaluation items of infection control practices.

The cross-sectional online survey assessed KAP regarding COVID-19 among nursing students at different course levels in their undergraduate programs. Undergraduate nursing students at the University of Nizwa have adequate knowledge (84.4%), a positive attitude (87.5%), and good practice (93.8%). Even though appropriate knowledge enhances a good attitude and practice, a study in Pakistan did not report a significant level of expertise (33%) Salman et al. 2020. However,

another survey among medical students in Pakistan documented that 80% of them had adequate knowledge of COVID-19 prevention strategies.

Interestingly, most of the students had scored a more significant percentage, 48.14 out of 65 possible points. Simultaneously, most of the students agreed that COVID-19 recovered patients should remain isolated at home for 14 days, wearing masks, limiting close contact with family members during infection, and splitting their meals (56(87.5%)). In addition, only 17 (2.5%) agreed to continue their clinical internship training in a hospital during such a pandemic situation. This is most likely due to nursing students' concerns about their ability to care for infected patients and about fear of transmission of infection. In contrast, in South Africa, it was revealed that most students were willing to volunteer to care for infected patients.

Almost slightly less than half of the participants, 28(43.8%), agreed about the benefits of receiving COVID-19 vaccination. In a study in the United States, 83.6% were interested in being vaccinated because they were more knowledgeable about the benefits of vaccination. In another study, 26% of those who took part reported not receiving the vaccine (COCONEL Group, 2020). Hence, these diverse findings from different regions suggest extensive focus is required on re-visiting knowledge and awareness of the benefits of vaccination.

In this study, nursing students' COVID-19 preventive practice demonstrates that they effectively practiced using appropriate knowledge. Students have scored 32.6 out of 40 points in the current research for knowledge, with an SD of 6.12. In this survey, 48.4% strongly believed and followed wearing

masks, gloves, and goggles. However, in previous research, only half of the participants were eager to use face masks. The discrepancy may stem from the rapid exhaustion of wearing masks following the Covid outbreak.

To learn about COVID-19, nursing students at the University of Nizwa used social media as their primary source of information (50 %), followed by the school network platform (29.7%), which was similar to a study conducted among Chinese nursing students by Yuan et al. (2020). Based on the findings, students rely on online sources (such as social media), and the government and nursing schools are working to improve the reliability and usability of these sources. According to the findings of this study, students had only minimal awareness of COVID-19 therapy. Surprisingly, only 17.2% of nursing students at the University of Nizwa knew that a COVID-19 vaccination was available, compared to Pakistan's 33%. 56.3% of the participants were unaware that antibiotics were ineffective against COVID-19. Because the quality of information on social media is poor, educators and the government should produce open-access publications on COVID-19, which experts reviewed to help students understand it better. In this study, students have substantially less knowledge about COVID-19 therapy. In addition, a study in China reported knowledge awareness was 20.9% (Yuan et al., 2020). As a result, open-access journals on COVID-19 could be made available to aid students in better understanding COVID-19 because the quality of the facts available on social media is poor.

Regarding sentiments, 57.9% of participants strongly disapprove, slightly disagree, or are ambivalent about clinical internships with COVID-19 patients. It demonstrates nursing students' concerns about being unprepared to care for Covid-19 patients. A similar report was performed among intern nursing students in Saudi Arabia. Only 64.1 percent of individuals consented to get vaccinated, compared to 21.9 percent who declined and 14.1 percent who stated they were ambivalent, comparable to China's 59.91 percent. According to the data, vaccination concern is on the rise among students, and governments should work on how to deliver more vaccine information. Regarding precautionary measures, 70.3% of the participants utilized masks, gloves, and goggles. The demographic data about living areas was discovered to play a vital function in preventing behavior. The government must expand educational opportunities for students in rural areas to prevent the spread of

disease. This study showed that students in remote locations employed fewer preventative measures. To prevent the spread of the disease, the government must expand educational opportunities for students in rural areas.

In the face of the health threat of COVID-19, the correlation between students' knowledge, attitudes, and practice reveals that adequate information and positive attitudes influence their actions. Although health literacy can help people acquire and apply online health information to adopt a positive attitude and engage in health-promoting activities, accredited knowledge is required to develop informed, correct positive attitudes and promote health- strategies. As a result, nursing students need to receive further training in emergency disease management. Experts are still working on expanding health education strategies and substituting the curriculum with courses like epidemiology and new developing diseases. Even though our study tried to minimize the shortcomings, this study has a few limitations. A bias of recall can influence online self-reported survey information. Misrepresentation of actual perception could occur as the data was collected during a pandemic. Further studies are recommended to implement the tool after exploratory factor analysis as the current study had adopted the researcher developed online survey tool.

## **Conclusion**

In conclusion, our findings suggest knowledge is the fundamental requirement for any health education activity and should be focused on to underpin good practice and attitude. Gaining awareness about any pandemic illness would increase the likelihood of preventing infection and bring awareness to policymakers. The study findings could support educational institutions in developing students' knowledge by organizing several education programs to promote higher levels of knowledge and attitudes toward emerging new health challenges.

## **Declaration of Competing Interest**

The authors declare that we do not have known competition for financial interest or personal profit that could have appeared to impact the task of this paper. We wish to thank all nursing students of the University of Nizwa, Sultanate of Oman, who contributed to this research to explore the reality of KAP during the pandemic situation.

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