



# Disease Prevention Knowledge, Anxiety, and Professional Identity during COVID-19 Pandemic in Nursing Students in Zhengzhou, China

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**Purpose:** This study aimed to evaluate nursing students' understanding of the prevention of COVID-19, as well as their anxiety towards the disease and their perception of their professional identity in the wake of the pandemic, in Zhengzhou, China. **Methods:** A cross-sectional study was designed to investigate 474 nursing students by cluster sampling using a stratified questionnaire from February 15 to March 31, 2020. Multiple linear regression was used to identify the factors affecting professional identity. Binary and multiple logistic regression were used to identify the factors affecting anxiety. **Results:** Responders with a high level of understanding of COVID-19 and frequent use of behavioral strategies for its prevention comprised 93.2% and 30.0% of the cohort, respectively. Professional identity was significantly associated with gender and anxiety ( $p < .050$ ). The prevalence of anxiety among nursing students was 12.4%. Male (odds ratio [OR] = 2.39; 95% confidence interval [CI] = 1.26~4.52), sophomores (OR = 5.30; 95% CI = 1.61~7.45), and infrequent use of prevention measures (OR = 3.49; 95% CI = 1.16~5.19) had a significant effect on anxiety. **Conclusion:** Anxiety during the COVID-19 epidemic gives an adverse effect on the professional identity of nursing in students. Nursing education institutions need to provide psychological counseling services for nursing students, in addition to improving their teaching of COVID-19 prevention strategies.

**Key words:** COVID-19; Anxiety; Students, Nursing; Preventive Health Care; Health Occupations

## INTRODUCTION

Coronavirus disease 2019 (COVID-19) is currently the most severe public health problem facing the international community, which has caused 8.99 million infections and 46.9 thousand deaths worldwide [1]. COVID-19 spreads rapidly through aerosol and droplets around the world, causing widespread panic. This disease poses a substantial threat due to its rapid, extensive, highly infectious nature and the lack of a specific treatment. As a result of the long-term isolation and travel limiting for the prevention and control of this disease, many residents are unable to go to

work or attend school. COVID-19 is becoming a substantial burden to society by affecting people's income and their interpersonal communication [2].

According to reports, the knowledge and practice of health and social work were associated with the professional identity obtained from the claims of psychosocial expertise on health and disease [3]. For nursing students who are about to enter a clinical internship, the large number of healthcare worker infections and the enormous work pressure of the clinical register nurses during the COVID-19 pandemic has caused nursing students to show anxiety and fear about the professional identity of nursing work

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[4]. Furthermore, the lack of infectious disease prevention and nursing training in nursing education institutions also adversely affects the willingness among nursing students to participate in internships in contagious disease departments [5].

The previous studies demonstrated that anxiety and distress among residents were caused by the growing number of confirmed cases during the COVID-19 pandemic, the stigma of the community to which the infected person belongs, and the mandatory isolation measures implemented by the national blockade program [6]. As nursing students, they need to increase their cognitive ability and preventive behaviors to alleviate their anxiety about the disease. Chinese nursing students are taught the concept of universal prevention in infection prevention classes during their undergraduate nursing course, as well as prevention behaviors, such as handwashing and using methods of personal protective equipment. However, for medical professionals and medical students, the COVID-19 pandemic demands people pay more attention to the role of individuals in providing care, the effectiveness and limitations of medical services, and the vulnerability of individuals to the spread of infections and asymptomatic diseases. These challenges can affect the formation of professional identity of medical students [7]. Concerns of the future participation in the treatment and care of high-risk patients, the inadequate knowledge of infectious disease protection tools such as the use of full-face masks and isolation gowns also have an impact on the professional identity of health workers and nursing students [8].

Studies in some Western countries have focused on the knowledge, attitudes, and willingness of medical students to prevent COVID-19. However, only tiny minority literature explores the professional identity of nursing students during the COVID-19 pandemic. Moreover, similar studies are mostly conducted in European and American countries, which is very limited for further research in Asian countries, including China. Therefore, this study aims to evaluate nursing students' understanding of the prevention of COVID-19, as well as their anxiety towards the disease and their perception of their professional identity in the wake of the pandemic, in Zhengzhou, China, to provide fundamental data for the psychological state of nursing students and reference for improving the preventive behavior guidelines for nursing students.

## METHODS

### 1. Study design

This was a cross-sectional study to explore COVID-19 knowledge, anxiety, and professional identity among nursing students in Zhengzhou, China. A cluster sampling method was used to examine a sample of students from all nursing education institutions in Zhengzhou from February 15 to March 31, 2020.

### 2. Setting and samples

According to the survey, the current number of nursing students in Henan Province is 153,713 [9]. The majority of nursing education institutions of Henan Province locate in Zhengzhou, the capital city of this province. According to the proportional allocation of nursing students, we selected the nursing students from Zhengzhou as samples. The inclusion criteria were students participating in the Bachelor of Science in Nursing program and continuing their studies at this stage. Participants had no cognitive impairment or evident language barriers and provided their informed consent to participate in this study. This study excluded nursing students who had a mental illness before the outbreak or who refused to participate in the study. At last, 474 questionnaires were collected and the data analyzed.

### 3. Ethical consideration

This study was approved by the Ethics Committee of Xinxiang Medical University (IRB No. XYLL2020140). All participants were informed that participation in the study was voluntary. Besides, participants were assured that their answers were anonymous.

### 4. Measurements

The data were collected in the form of a structured electronic questionnaire. COVID-19 prevention knowledge was based on the prevention guidelines from the World Health Organization and the Chinese Center for Disease Control and Prevention [10,11]. We conducted a test to evaluate the students' prevention knowledge on COVID-19 and their practice of behavioral strategies to prevent COVID-19 infection with five questions for each of these aspects. For the knowledge on the prevention of COVID-19, the specific items are as follows: (1) COVID-19 is spread by aerosol and droplets transmission; (2) People with asymptomatic infec-

tion of COVID-19 can also become a source of infection; (3) Close contacts of COVID-19 diagnosed persons should be medically isolated for 14 days from the last day of contact with the patient; (4) Maintain at least 1 meter (3 feet) distance between yourself and others in public; (5) Avoid touching eyes, nose and mouth before cleaning the hands. We assigned a score to each entry: 1, correct; 0, incorrect. According to Bloom's taxonomy [12], the knowledge level among participants was divided into three levels, namely low (<3), medium (3~4), and high (>4). The higher the score is, the better the participants know about and prevent COVID-19.

The content of COVID-19 preventive behavior is as follows: (1) wear medical surgical masks or masks that filter non-oily particles greater than or equal to 95% during outbreaks (including: N95, KN95, DS2, FFP2, etc.); (2) clean your hands with an alcohol-based hand rub or wash them with soap and water regularly and thoroughly; (3) cover your mouth and nose with your bent elbow or tissue when you cough or sneeze. Then dispose of the used tissue immediately and wash your hands; (4) stay at least 1 meter (3 feet) distance between yourself and others in public; (5) clean and disinfect frequently touched surfaces daily. This includes tables, doorknobs, light switches, countertops, handles, desks, phones, keyboards, toilets, faucets, and sinks. The options for the application of COVID-19 prevention behavior were as follows: 1, seldom; 2, sometimes; 3, always. A score of less than 9 points was denoted as a low response, 9~12 points as a medium, and over 12 points as high. The higher the score, the better the behavior of the participants. The questionnaires were pilot-tested and the reliability of the measurement was tested with the alpha reliability coefficient. The knowledge level and behavior scales were of acceptable reliability with an alpha coefficient of .82 level and .87 level respectively.

The Self-rating Anxiety Scale (SAS) was used in evaluating the anxiety [13]. The scale was composed of a total of 20 items, including 15 negatively worded statements and 5 positively worded statements. The frequency of symptom occurrence was evaluated on a 4-point Likert scale. The responses were as follows: "1" for a symptom that never occurs or very little; "2" for a symptom that occurs some of the time; "3" for a symptom that occurs often; "4" for a symptom that occurs most or all of the time. The main statistical index of SAS is the total score. The

mental health of the respondents were considered normal when the standard total score was lower than 50, slight anxiety for scores ranging from 50 to 59, moderate anxiety from 60 to 69, and severe anxiety for scores over 70. The Cronbach's  $\alpha$  coefficient of the scale was .93. The SAS is a commonly used scale in clinical psychiatry research, and its measurement accuracy is relatively high [14].

Professional identity was measured by using the Brown Professional Identification Scale [15]. The scale was composed of 10 items in three dimensions of cognition, evaluation, and impact: 3 items in the cognitive dimension (items 1, 4, and 8), 3 items in the evaluation dimension (items 2, 6, and 7), and 4 items in the impact dimension (items 3, 5, 9, and 10). A 5-point Likert scale was used, with "never" given 1 point and "often" given 5 points. The total score of the scale ranged from 10 to 50 points. The higher the score was, the stronger the individual's professional identity. The Cronbach's  $\alpha$  coefficient of the scale was .82.

## 5. Data collection

Due to the travel control policy during the COVID-19 pandemic, we contacted nursing education institutions to inquire about the contact information of students, and invited participants by email or telephone, and distributed electronic questionnaires to students who agreed to participate in this study by email. Participants were asked to answer all the items in the questionnaire, and the collected data was included in the data management software for collation and statistics.

## 6. Data analysis

The data were analyzed with IBM SPSS Statistics 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics was used to summarize the sociodemographic characteristics and the scores and percentages of knowledge, attitudes, and behaviors about prevention COVID-19 were calculated. Multiple linear regression was used to analyze the factors affecting professional identity. Binary logistic regression simulated the factors affecting anxiety.

# RESULTS

## 1. Sociodemographic characteristics

Subjects were mainly woman (84.8%), aged 20~22 years

(58.0%), seniors in college (42.4%), and lived in cities (58.2%). The majority of the respondents were not an only child (85.7%), had no immediate family members working as health workers (77.0%), and were intending to work in a hospital (70.9%) (Table 1).

**Table 1.** Sociodemographic Characteristics ( $N = 474$ )

Sociodemographic variables	n (%)
Gender	
Man	72 (15.2)
Woman	402 (84.8)
Age (yr)	
< 20	59 (12.5)
20~22	275 (58.0)
> 22	140 (29.5)
Grade	
Freshman	66 (13.9)
Sophomore	51 (10.8)
Junior	156 (32.9)
Senior	201 (42.4)
Residence	
Urban	276 (58.2)
Rural	198 (41.8)
Only child	
Yes	68 (14.3)
No	406 (85.7)
Healthcare workers among family members	
Yes	109 (23.0)
No	365 (77.0)
Employment intention	
Hospital	336 (70.9)
Nursing education institution	37 (7.8)
Pharmaceutical companies	13 (2.7)
Attain further education	60 (12.7)
Other industries	28 (5.9)

## 2. COVID-19 knowledge level, behavior level, professional identity, and anxiety scores

The average score for COVID-19 knowledge was  $4.72 \pm 0.78$ ; 442 respondents (93.2%) had a high level of knowledge namely having the better understanding of COVID-19, 16 (3.4%) had a medium level, and 16 (3.4%) had a low level namely having mis-understood the knowledge of COVID-19. The average score for prevention behavior was  $9.12 \pm 2.48$ . 142 respondents (30.0%) had a high level of prevention behavior, namely having high compliance with protective guidelines and protective tools, 122 (25.7%) had a medium level, and 210 (44.3%) had a low level namely having poor compliance with protective guidelines and protective tools. The average score for professional identity was  $38.74 \pm 6.54$ , while the average score for anxiety was  $39.54 \pm 8.70$ , with the prevalence of anxiety in 12.4% of the cohort.

## 3. Multiple linear regression analysis of factors affecting nursing students' professional identity

The factors influencing the professional identity of the respondents are shown in Table 2. For the multivariate linear regression analysis, the total score for professional identity was used as the dependent variable. In contrast, COVID-19 knowledge level, behavior level, and anxiety were used as the independent variables. During the COVID-19 epidemic, gender ( $p = .004$ ) had a significant effect on professional identity, while anxiety ( $p < .001$ ) had a significant influence on professional identity. The results indicate that gender and anxiety accounted for 11.0% of the variation in

**Table 2.** Factors Influencing Professional Identity: Linear Regression Model

( $N = 474$ )

Parameter	$p$ -value	Standardized regression coefficient beta	Non-standardized regression coefficient B	95% Confidence interval
Gender	.004	.13	2.45	0.80, 4.09
Age	.706	-.02	-0.23	-1.41, 0.96
Grade	.666	.03	0.16	-0.56, 0.88
Residence	.617	.02	0.31	-0.90, 1.52
Only child	.884	.01	0.13	-1.59, 1.85
Healthcare workers among family members	.141	-.07	-1.03	-2.39, 0.34
Employment intention	.156	-.06	-0.32	-0.75, 0.12
Knowledge level	.085	.08	0.60	-0.08, 1.29
Behavioral level	.916	.01	0.08	-1.44, 1.60
Anxiety	< .001	-.26	-5.22	-7.03, 3.42

**Table 3.** Factors Influencing Anxiety: Binary Logistic Regression Model (N = 474)

Characteristics	Anxiety (n = 59) n (%)	No anxiety (n = 415) n (%)	OR (95% CI)	p-value
Gender				
Man	16 (22.2)	56 (77.8)	2.39 (1.26~4.52)	.008
Woman	43 (10.7)	359 (89.3)	1	
Grade				
Freshman	4 (6.1)	62 (93.9)	1	
Sophomore	13 (25.5)	38 (74.5)	5.30 (1.61~7.45)	.006
Junior	15 (9.6)	141 (90.4)	1.65 (0.53~5.17)	.391
Senior	27 (13.4)	174 (86.6)	2.41 (0.81~7.15)	.114
Behavioral level of prevention COVID-19				
High	47 (10.6)	395 (89.4)	1	
Medium	1 (6.3)	15 (93.8)	0.56 (0.07~4.34)	.579
Low	11 (68.8)	5 (31.3)	3.49 (1.16~5.19)	< .001

OR = Odds ratio; CI = Confidence interval.

professional identity level (Table 2).

#### 4. Binary logistic regression analysis of factors influencing nursing students' anxiety

The prevalence of anxiety among nursing students was 12.4%. The results of the binary logistic regression analysis showed that male students were more likely to suffer from anxiety disorders than female students (OR: 2.39; 95% CI: 1.26~4.52;  $p = .008$ ). Similarly, nursing students in their sophomore year were more likely to suffer from anxiety than in junior or senior year (OR: 5.30; 95% CI: 1.61~7.45;  $p = .006$ ). Nursing students with low levels of prevention behavior were more likely to experience anxiety than those with high or medium levels (OR: 3.49; 95% CI: 1.16~5.19;  $p < .001$ ) (Table 3).

## DISCUSSION

Since the start of the outbreak, COVID-19 has spread widely due to its high infectivity, increased through population mobility [16], causing panic among the general public. Front-line medical staff caring for infected patients are also facing a great deal of pressure at work, resulting in an increased incidence of anxiety and depression [17]. In response to the national policy, China's Department of Education promptly took measures, such as extending holidays, to ensure that the majority of students remained in their current residence self-isolating. However, since nursing students are a particular group about to enter clinical practice, it

is particularly important that they continue their training and improve their understanding of COVID-19, as well as have their psychological status and professional identity evaluated during this period.

Emerging infectious diseases were forecasted to become significant health problems in the 21st century in previous studies [18]. The rate of COVID-19 infection is faster, and it spreads more widely than ever in the history of modern infectious diseases. As a result, the COVID-19 crisis has triggered a crisis in the nursing profession. Under normal circumstances, as nurses become more knowledgeable and skilled in practice, the retention rate increases, and professional identity is strengthened [19,20]. However, in this study, the results of our data analysis showed that during the COVID-19 pandemic, Chinese nursing students have a better understanding of COVID-19. Still, they have poor compliance with protective guidelines and protective tools. It's similar to Clements's study. The possible reason is the advancement of network communication technology and the rapid dissemination of epidemic information, so it is relatively easy to obtain information about COVID-19. Besides, nursing students gained substantial theoretical understanding during university and had an understanding of measures needed to prevent significant epidemics [21]. However, some students have poor compliance with COVID-19 prevention, especially when going in and out of crowded public places frequently, it will increase the additional risk of infection with COVID-19. The possible reason is that these nursing students have a low ability to perceive the risk of

disease. A similar study in Iran confirmed a significant negative correlation between prevention behavior and risk perception [22]. Therefore, while nursing education institutions are popularizing the COVID-19 prevention knowledge to nursing students, they need to pay attention to students' compliance with prevention knowledge, and also need to explain to students the consequences and dangers caused by improper prevention, so as to improve the attitude and behavior of COVID-19 prevention on nursing students.

It is important to note that the gender of the nursing students was correlated with anxiety levels during the COVID-19 crisis, which was found to affect their professional identity. Indeed, previous studies on the role of gender in professional identity have found that women have a more robust professional identity than men [23]. It is thus reasonable that nursing students are mainly female and that women's professional identity appeared to be stronger than that of men in our results. Personality differences between men and women were also found to result in different emphases when choosing a job, which is consistent with previous studies. Anxiety was also found to impact professional identity. Namely, when facing life-threatening events, nursing students adjusted their emotions and relieved their anxiety, which affected their professional identity concerning the nursing profession. A previous study found that, during the epidemic, acute and life-threatening pressure caused by infectious disease events changed nursing students' professional identity [24].

The results of our survey showed that the prevalence of anxiety was 12.4%, and was higher in the male students. Although there are more European and American studies, female students are more likely to suffer from anxiety [25-27]. However, Jiang et al. [28] indicated that male students have higher levels of anxiety than female students in mainland China. Because in Chinese culture, families and society have higher expectations of males, males are more likely to bear enormous pressure than women due to the more work burdens and family responsibilities. Similarly, it may further exacerbate anxiety due to male students are more prone to take the contrary course. Affleck et al. [29] also mentioned that compared with women, men are underutilizing mental health services and expect more self-identity, self-esteem, and self-worth to be the reasons for men's increased risk of psychological problems. In this study, the possible reason may

males have also been found to be more easily influenced by setbacks and contradictions, such as those experienced during the COVID-19 outbreak, requiring the male nursing students to consider more factors in their professional identity, including career development, economic development, and policy orientation.

It is worth mentioning that the academic grade has a certain impact on anxiety level among nursing students. Previous studies have found that the total SAS score of junior college students is higher than that of senior college students, which may be related to the shorter enrollment time, relatively weak social adaptability, and low socialization level of junior compared to senior college students. Here, students in lower grades were found to be more likely to suffer from anxiety than students in higher grades, which is consistent with the results of previous studies. Therefore, after the pandemic, a greater emphasis should be placed on the mental health counseling services of freshman nursing students, including the establishment of freshman entrance guidance, collective mental health counseling, and psychological counseling. This will help to improve the learning and living environments of freshmen students, thereby improving the mental health level of junior college students.

Low behavior levels influenced anxiety levels during the outbreak. As nursing students mainly study nursing knowledge in the courses, they have little to no relevant clinical experience. If they enter a clinical internship as a nursing beginner, they have insufficient awareness of appropriate protective measures and behaviors, and the rapid spread of epidemics will increase their risk of infection. Therefore, as a result of the seriousness of the COVID-19 outbreak and the high speed of infection transmission, low prevention behavior levels among nursing students will inevitably lead to increasing levels of anxiety [29].

This study is the first report to evaluate the knowledge, anxiety levels, and professional identity of nursing students concerning the current COVID-19 pandemic. Nevertheless, this study has several limitations. First, this study used a cross-sectional study design, which precluded the evaluation of the temporality and causality of the observed relationships. Second, the data were collected from participants' self-reports; thus, recall bias was unavoidable. Third, other predictors of underlying anxiety and professional identity (various types of stress, sleep quality, social support, etc.) were not included in our questionnaire. Further re-

search may use qualitative methods to gain a deeper understanding of the relationship between COVID-19 prevention knowledge and behavior, anxiety, and professional identity among nursing students. Besides, future research can formulate related psychological interventions based on the results of this study to improve the anxiety and professional identity of nursing students.

## CONCLUSION

This cross-sectional study provides preliminary evidence that gender and anxiety in nursing students affected their professional identity, and the academic year and prevention behavior influenced anxiety levels during COVID-19 epidemic. Therefore, we recommend that nursing academic institutions should improve COVID-19 nursing prevention guidelines based on nursing students' deficiencies in anxiety, professional identity, and preventive behavior.

## CONFLICTS OF INTEREST

The authors declared no conflict of interest.

## AUTHOR CONTRIBUTIONS

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