

Effects of the First Wave of the COVID-19 Pandemic on the Work Readiness of Undergraduate Nursing Students in China: A Mixed-Methods Study

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Background: Newly graduated nurses with strong work readiness are more likely to smoothly transition from school to clinical settings. However, even before the pandemic, this transition from nursing graduate to clinical nurse was often challenging. Therefore, this study aims to investigate the impact of the initial wave of COVID-19 on the work readiness of nursing students.

Methods: A convergent mixed-method design was employed. For the quantitative study, an online cross-sectional survey was conducted among 500 graduating nursing students from four Chinese public higher education institutions. The questionnaire comprises three parts: socio-demographic information, the Chinese version of the Work Readiness Scale for Graduate Nurse, and a questionnaire on the socio-behavioral impact of COVID-19 on the general population. In the qualitative study, a semi-structured interview was carried out with 8 students who took part in the survey. The results from both parts were integrated using the "Pillar Integration Process".

Results: The study identified six key pillars: "Graduating nursing students possess fundamental knowledge, skills, and a preparedness in terms of attitude and psychology"; "Specialist knowledge and skills and soft skills for transition from nursing students to clinical nurses need to be strengthened"; "The most obvious impact of COVID-19 on nursing students are the adoption of preventive measures and the limitations in study and daily life due to household confinement"; "Growth in both personal and professional awareness"; "Negative effects of fear and anxiety"; and "Negative effects of household confinement".

Conclusion: Graduating nursing students require additional preparation in specialized nursing knowledge, skills, and soft skills to make a successful transition from students to clinical nurses. It is important to acknowledge that the impact of COVID-19 on students' work readiness has both positive and negative aspects. Therefore, whether during the pandemic or post-graduation, these students will benefit from increased support from universities and hospitals.

Keywords: work readiness, COVID-19, nursing students, nursing education, mixed methods, pillar integration process

Introduction

Nowadays, the global shortage of nurses presents a significant challenge. Effectively and swiftly transitioning from school to clinical work, as well as retaining nursing staff, has become a crucial concern within academic circles and various medical institutions. However, owing to the highly specialized and high-risk nature of clinical work, the demanding workload, patient complexity, and a general lack of confidence and experience among graduates, the shift from graduate to clinical nurse often proves less seamless than anticipated.^{1,2} Nursing graduates encounter challenges upon entering the workforce, experiencing not only the transition from a school to a professional environment, but also a shift in their social roles. According to the Ulupinar & Aydogan study, 47.7% of newly graduated nurses faced difficulties adjusting to nursing work in their initial year, with 53.5% struggling to adapt to their roles, 42.5% contemplating leaving

the nursing industry, and 50.9% planning to depart from their respective organizations.³ Similarly, in China, 17.2% of newly graduated nurses intend to leave shortly after commencing their careers; this percentage escalated to 59.6%, 74.4%, and 71.8% after four months, eight months, and one year, respectively.⁴

Recent studies have indicated that new graduate nurses with strong work readiness are more likely to navigate the transition from school to the hospital setting with greater ease, and this readiness level serves as an indicator of their potential for future performance and career development.⁵ However, the current state of work readiness among new graduate nurses is not encouraging. Most studies reveal that they tend to lack practical preparation in complex professional domains. Kavanagh et al examined the entry-level competencies and practical readiness of new graduate nurses and discovered that only 23% of them met the entry-level competencies.⁶ In the study by Missen et al, the coordinator for nurse residency programs observed that most nursing graduates are inadequately prepared for clinical practice, primarily showing deficits in clinical skills, communication, and difficulties in transitioning into their roles as nurses.⁷ Hickey suggests that over 50% of preceptors believe that clinical experience during school education does not adequately equip new graduate nurses to adapt to the medical working environment; 63% expressed that recent graduates require more assistance in their roles than initially anticipated.⁸

Moreover, nursing schools have been compelled to suspend traditional classroom teaching due to the COVID-19 outbreak, which has had a definite impact on the academic progress of nursing students. The stance of educational institutions towards online learning and web-based teaching methods, the existing information technology infrastructure, the availability of web-based learning resources, the information literacy of teaching staff, and the reorganization of clinical teaching, will all influence the delivery of instructional content and the achievement of educational outcomes.⁹ Research indicates that nursing students faced elevated levels of stress related to online learning during the COVID-19 pandemic, and teachers noted a negative impact on student academic performance.¹⁰ This is also reflected in clinical practice, where the absence of hands-on experience and skills training heightens student apprehension. Cengiz et al discovered that the primary challenges encountered by nursing students involve adapting to online courses and the lack of hands-on clinical practice for skill development.¹¹ However, research also shows that the challenges brought by the pandemic can serve as an important motivation for learning, enabling students to learn things beyond formal learning outcomes.¹² It cultivates their sense of pride and responsibility as nurses,¹³ and the experience of working in isolation wards can promote psychological growth, enabling junior nurses to develop resilience and confidence in clinical practice to meet future challenges.¹⁴

Pre-pandemic evidence suggests that the work readiness of newly graduated nurses is suboptimal and the transition from nursing graduate to clinical nurse is often not seamless. The more demanding clinical environment resulting from the COVID-19 outbreak, and its multiple impacts on the personal and academic lives of nursing students. It is worth exploring whether this will further exacerbate this situation. However, the majority of existing studies focus on the learning experiences of nursing students during the COVID-19 pandemic and its short-term impact on educational outcomes.^{15–17} Furthermore, the profound impact of COVID-19 on the healthcare system has rendered the clinical care work environment more intricate, thus heightening the demand for well-prepared newly graduated nurses.¹⁸ Therefore, this study aims to investigate the enduring impact of the initial wave of the COVID-19 pandemic on the long-term work readiness index of nursing students. It is anticipated that this research will offer valuable insights for future adjustments in nursing education programs in the event of similar unforeseen public health crises, as well as for the training and management of new nurses in the post-epidemic era.

Specifically, this study sought to answer the following research questions (RQ):

RQ 1: What is the level of work readiness among graduating nursing students who experienced the initial wave of the COVID-19 pandemic? And to what extent has the pandemic impacted the socio-behavioral aspects of these students? (Quantitative)

RQ 2: What is the correlation between the socio-behavioral impact of COVID-19 and the work readiness of nursing students? (Quantitative)

RQ 3: What are the perspectives of graduating nursing students on their own readiness for work and the effects of the COVID-19 pandemic on their life and work readiness? (Qualitative)

RQ 4: How has the first wave of the COVID-19 pandemic impacted nursing students' work readiness? (Mixed methods)

Methods

Study Design

This study employed a convergent mixed methods design (Figure 1). This approach involves collecting both quantitative and qualitative data simultaneously, followed by analysis of these data separately to compare and validate the findings. It is important to note that the results of one component are not contingent on the results of the other.¹⁹ In most of the convergent designs, both quantitative and qualitative data hold equal importance, and their outcomes are typically integrated during the interpretation phase, leading to the development of meta-inferences. This design not only offers a depth of understanding that may not be attainable through purely quantitative methods but also ensures a high degree of agreement between quantitative and qualitative responses, thereby enhancing the study's overall effectiveness.

In the quantitative study component, an online cross-sectional survey was conducted to assess the work readiness status and the socio-behavioral impact of COVID-19 on Chinese graduating nursing students. This was done using the Chinese version of the Work Readiness Scale for graduate nurses (WRS-GN) and a questionnaire on the socio-behavioral impact of COVID-19 on the general population. In the qualitative study component, semi-structured interviews were employed to gather insights from graduating nursing students regarding their perceptions of work readiness and how the COVID-19 pandemic influenced their readiness for the nursing profession.

Participants and Sample

For the quantitative study, nursing students who were on the verge of graduating in 2021 from four Chinese public higher education institutions across 4 provinces—namely Xiangnan University, Huzhou University, Hainan Medical University, and the Guangxi University of Chinese Medicine—were included. The inclusion criteria were as follows: 4-year full-time undergraduate nursing students who had completed the prescribed curriculum and clinical practice as per the arrangements of their respective schools and practice hospitals, thus meeting the graduation criteria. The sample size was determined using the formula for cross-sectional studies ($\alpha = 0.05$, $u_{w/2} = 1.96$).²⁰ Based on prior studies on the work readiness of new graduate nurses,²¹ setting σ at 43 and δ as half the confidence interval (4), the calculated sample size

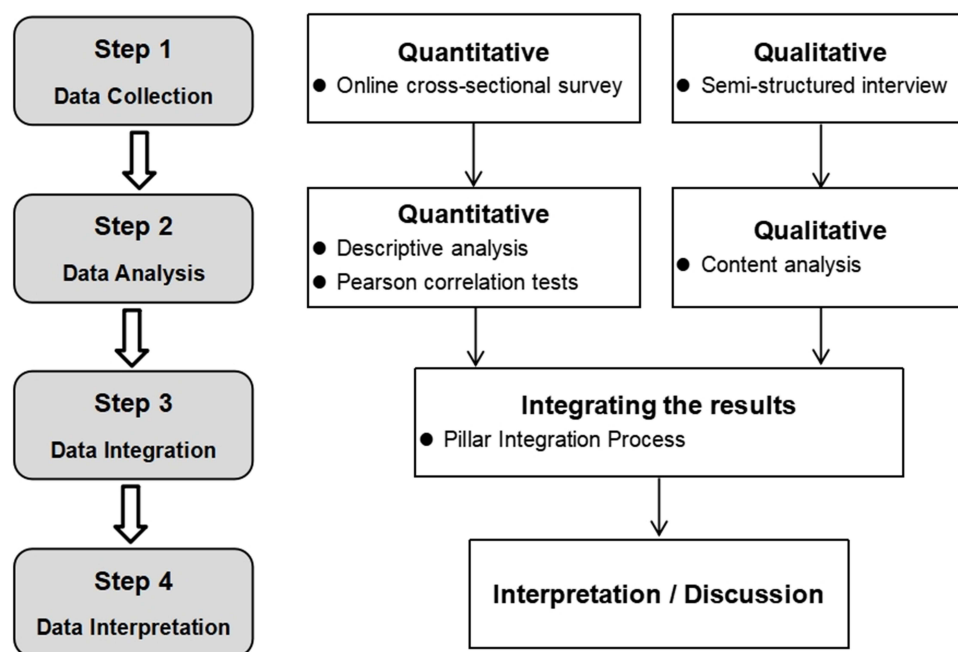


Figure 1 Visual Model for Mixed-Methods Convergent Design Procedures.

was 444. Accounting for a 10% potential sample loss, the actual required sample size was 489. Ultimately, 500 valid questionnaires were collected, meeting the established sample size criteria.

$$N = ((u_{\alpha/2}\sigma)/\delta)^2 = ((1.96 \times 43)/4)^2 \approx 444$$

In the qualitative study, a purposive sampling approach was utilized, focusing on graduating nursing students who had participated in the quantitative study. The sample size for the qualitative research was determined by employing the principle of data saturation, which is reached when no new information is obtained. Ultimately, 8 students were selected for interviews.

Quantitative Data Collection

In the quantitative study, web page links were employed as survey tools through a software called “Wenjuanxing” (www.wjx.cn). The questionnaire consisted of three main sections:

- (1) Socio-demographic data (age, sex, and school location) were collected to provide a descriptive overview of the participants.
- (2) Students’ work readiness was evaluated using the Chinese version of the Work Readiness Scale for Graduate Nurses (WRS-GN). This scale, translated by a Chinese researcher in 2020, was revised from 46 items to 37 items and encompasses five dimensions: work competence (WC), organizational acumen (OA), social intelligence (SI), organizational hierarchy (OH), and personal work characteristics (PWC). The scale demonstrated high reliability and validity, with a Cronbach’s Alpha value of 0.96, making it suitable for assessing the work readiness of nursing graduates in China.²¹ The scoring was done on a 10-point Likert scale, where higher scores indicate a greater level of work readiness.
- (3) The socio-behavioral impact of COVID-19 was assessed using a questionnaire developed by Bandhu Kalanidhi et al in 2021. This questionnaire comprised 33 questions covering various social and behavioral aspects related to COVID-19, including five dimensions: fear and anxiety, household confinement, lifestyle modifications, preventive practices, and coping strategies. The questionnaire demonstrated good internal consistency with a Cronbach’s α of 0.82, using a five-point scale, from 0 to 4, except for the lifestyle modifications items, which ranged from –2 (significantly decreased) to 2 (significantly increased).²² With permission from the original author, the English version of the questionnaire was translated using the Brislin’s Translation Model.²³ Experts suggested that question 33, which was an open question about investigating COVID-19 coping strategies, could be omitted as the main focus of the study was on assessing the impact of COVID-19 on students and its relationship with their work readiness. Additionally, the qualitative research portion addressed the influence of COVID-19 on students. Thus, 32 questions were retained for the questionnaire. The content validity of the Chinese version of this questionnaire in this study was determined to be 0.86, and the Cronbach’s α was calculated to be 0.84.

Qualitative Data Collection

Given that respondents often use WeChat for daily communication, it was chosen as the platform for conducting semi-structured online interviews in the qualitative research phase. Evidence suggests that online interviews can yield results as accurate as face-to-face interviews, making them a viable alternative to face-to-face interviews, and that online interviews can be effective in reducing the impact of the Hawthorne effect.²⁴ Prior to the interviews, the research team members convened to discuss and outline the interviews according to the semi-structured interview guide. Potential subjects were pre-interviewed to refine the interview outline. The final interview guide for students covered the following three areas: (1) What aspects do you feel well-prepared for in your upcoming nursing career? What areas do you feel less prepared for? (2) What changes have occurred in your life during the COVID-19 outbreak? (3) Could you please discuss the impact of COVID-19 on your work readiness?

Appropriate interview times were scheduled with the respondents. Before the interviews, the researchers ensured that respondents carefully read the interview informed consent form and confirmed their willingness to participate. Respondents were given the autonomy to determine the start time of the interview. The interview outline was then

sent to the respondents. They were reminded that they could raise any questions about the content of the interview outline during the interview, and that they would receive a prompt response. During the interview, the interviewees were encouraged to freely express their thoughts and opinions. Probing questions were used to deepen the discussion. Non-verbal cues (such as tone and pauses) and significant statements emphasized by the respondent were recorded. Answers were clarified or repeated when necessary to avoid misinterpretation. Each interview typically lasted between 15–22 minutes. The interview ended after reaching data saturation. Two additional interviews were conducted after data saturation to ensure that no new findings were added during the content analysis process, achieving data saturation using this data collection method.²⁵

Quantitative Data Analyses

All quantitative data were exported to a computer for statistical analysis using SPSS 18.0 statistical software. Descriptive analysis was performed, reporting means with standard deviations or frequencies with percentage distributions. Pearson correlation tests were conducted as appropriate.

Qualitative Data Analyses

Within 24–48 hours of the interview, the researchers transcribed the interview data. Another team member conducted a thorough check. After confirming the transcribed content with the interviewee, the data was imported into NVivo 12 software for management and analysis. Graneheim & Lundman's content analysis²⁶ was employed for qualitative data analysis: (1) Reading the interview text in its entirety multiple times to grasp the overall context; (2) Identifying statements conveying specific meanings in the analysis unit to form meaning units; (3) Further condensing the meaning units to create compressed meaning units; (4) Extracting the compressed sense units to form codes; (5) Comparing the codes extracted from all units of analysis for similarities and differences, grouping codes with common features into sub-categories and categories; (6) Linking all categories to form a theme.

Mixed-Methods Integration

The qualitative and quantitative findings were systematically integrated using the pillar integration process (PIP)²⁷ after independent analysis. This transparent and rigorous technique involves four stages (listing, matching, checking, and pillar building): (1) Listing the most pertinent qualitative and quantitative data in the form of a table/chart/matrix; (2) Matching qualitative data and codes with quantitative data and categories; (3) Cross-checking all data for completeness to ensure appropriate matching; and (4) Comparing and contrasting the results developed from the listing, matching, and checking phases. This allows for the integration of insights identified in both the qualitative and quantitative columns to construct the pillars.

Ethical Approval

The study received approval from the Medical Ethics Committee of Xiangnan University (No. KY-202011007) and the Ethics Review Board of St. Paul University Manila (No. 2021-[129]-[IGS]-[CNA]). Participants provided informed consent prior to data collection, ensuring that appropriate ethical considerations were observed throughout the research process.

Results

Demographic Characteristics of the Participants

A total of 521 online questionnaires were collected. After removing redundant and standard responses, 500 questionnaires were deemed valid and subjected to analysis. The participant pool comprised 57 (11.4%) male students and 443 (88.6%) female students, with a mean age of 22.04 ± 1.07 years (range 17–26). There were 216 students from schools in Guangxi province, 143 from Hunan province, 88 from Zhejiang province, and 53 from Hainan province. Among the 8 students interviewed, 7 were female and 1 was male, aged 20–22 years.

Work Readiness Among the Graduating Nursing Students

The overall level of work readiness among graduating nursing students was high, with a mean score of WRS-GN \pm SD at 7.46 ± 1.04 . The lowest score was noted in the dimension of personal work characteristics, with a mean score \pm SD of 5.00 ± 1.84 . This observation was also reflected in the qualitative findings, which primarily indicated that, through practice, nursing students gained a relatively clear understanding of clinical nursing work. They were able to define their position in the organization, possessed basic knowledge and skills, and were prepared in terms of psychological and work attitude. However, there is still room for improvement in specialized knowledge and skills, as well as soft skills (such as clinical thinking, work organization and coordination, interpersonal relationships and communication, clinical emergency management, and critical thinking) to facilitate a smoother transition from student nurse to the role of a nurse. Two pillars emerge from the combined qualitative and quantitative analysis: graduating nursing students possess fundamental knowledge, skills, and a preparedness in terms of attitude and psychology; specialist knowledge and skills and soft skills for transition from nursing students to clinical nurses need to be strengthened, as depicted in [Table 1](#).

Socio-Behavioral Impact of COVID-19 Among the Graduating Nursing Students

Household confinement and preventive practices were notably prevalent, with mean \pm SD scores of 1.90 ± 0.80 and 1.92 ± 0.53 , respectively. As outlined in [Table 2](#), interviews with students revealed three distinct themes: 1) Significant constraints in learning and daily life. The pandemic resulted in disruptions to large-scale gatherings, face-to-face classes, holidays, family visits, and job-seeking activities. 2) Proactive adherence to effective preventive measures. Confronted with COVID-19, nursing students proactively sought information, sought guidance from teachers, practiced self-protection, and even disseminated protective measures to their families. 3) Diminished apprehension toward COVID-19 due to improved awareness. Initially, students were anxious about the unknowns of COVID-19. However, as awareness grew, prevention and control measures were implemented in China, and students in low-risk areas became less concerned about the COVID-19 pandemic itself. One pillar emerged from the integrated qualitative and quantitative analysis: the most obvious impact of COVID-19 on nursing students are the adoption of preventive measures and the limitations in study and daily life due to household confinement ([Table 2](#)).

Relationship Between Socio-Behavioral Impact of COVID-19 and Work Readiness of the Graduating Nursing Students

A weak but significant positive relationship was observed between lifestyle modifications and work readiness ($r = 0.148$, $P = 0.001$), as well as preventive practices and work readiness ($r = 0.230$, $P < 0.001$). Conversely, there was a weak but significant negative relationship between fear and anxiety and work readiness ($r = -0.101$, $P = 0.024$), coping strategies and work readiness ($r = -0.188$, $P < 0.001$), and household confinement and work readiness ($r = -0.096$, $P = 0.032$). The analysis of interview data from nursing students can be summarized into two key themes: positive adaptation and negative impacts. Positive adaptation encompassed heightened career awareness, increased focus on infection prevention and control, and introspection. Negative impacts included uncertainty, concerns about personal protection, the perceived inferiority of online learning compared to in-person instruction, and a perceived lack of clinical learning opportunities. Three pillars emerged from the combined qualitative and quantitative analysis: growth in both personal and professional awareness; negative effects of fear and anxiety; and negative effects of household confinement, as outlined in [Table 3](#).

Discussion

In this study, a mixed-methods research design was employed to investigate the enduring impact of the learning and living experiences during the COVID-19 pandemic on the work readiness of undergraduate nursing students. Six pillars were identified in the study. Pillars 1 and 2 emphasize the need for more comprehensive preparation in specialized nursing knowledge, skills, and soft skills for graduating nursing students, which is crucial for their transition from students to clinical nurses. The first wave of the COVID-19 pandemic had the most obvious impact on nursing students in terms of adhering to preventive measures and the limitations on learning and daily life due to household confinement (Pillar 3). These impacts on students' work readiness manifests in dual facets. On one hand, the proactive adoption of

Table 1 Joint Display of Quantitative, Qualitative, and Mixed-Methods Meta-Inferences of Work Readiness

Quantitative Data	Quantitative Categories	Pillar	Qualitative Categories	Qualitative Codes
WRS-GN:M=7.46 (SD=1.04) OA:M=8.47 (SD=1.27) OH:M=8.42 (SD=1.23) SI:M=7.03 (SD=1.47) WC:M=7.20 (SD=1.38) PWC:M=5.00 (SD=1.84) Scale: 1 = Completely disagree, 10 = completely agree	The general level of work readiness of graduating nursing students is high; Lack of preparation in terms of personal work characteristics.	Pillar 1: Graduating nursing students possess fundamental knowledge, skills, and a preparedness in terms of attitude and psychology.	Positive work emotion preparation	“I would say that I am mentally prepared and then physically prepared. After all, I've been working so many night shifts and practicing for so long that I'm probably starting to get used to this job”. (P2). “I think I have a certain enthusiasm for this job and a good working mood... and I can continue to learn and make progress in this job, and strive to be a qualified nurse”. (P3). “Psychological preparation is very good, I'm confident in myself”. (P7).
			Basic professional knowledge and skills	“I think there are some aspects that I have prepared well, such as knowledge reserve and basic skills. I think it might be the experience of four years in college, and it might be that after going through the clinical placement stage, this aspect has a certain foundation. It's just that this aspect is a bit more confident”. (P1). “...Relatively well-prepared is the knowledge, I recently read professional books”. (P4).
		Pillar 2: Specialist knowledge and skills and soft skills for transition from nursing students to clinical nurses need to be strengthened.	Specialist knowledge and skills need to be strengthened	“I still need to strengthen my theoretical knowledge, because I'm busy with the clinic every day, getting tired when I get home ... I might pay more attention to some of these skills in the clinic, and practice these skills every day”. (P2). “In different departments, different specialized knowledge also needs to be mastered in the work; then there are some specialized operations... the operation of some medical devices is also needs to be learned”. (P3).
			Soft skill preparation for transition from nursing students to clinical nurses is inadequate	“In clinical work, there may be other relationships that are different from what I had in school, such as relationships with colleagues, relationships with leaders, and concerns that I couldn't handle these relationships, and concerns that I couldn't handle relationships with patients, patients' families... or an unmanageable clinical emergency”. (P1). “And the organization aspect, because when you first start working, you have to learn to do things on your own, so maybe you're just not organized”. (P3). “If there is insufficient preparation, then it is clinical thinking... For example, I'm more mechanical, and I did it all according to the book. That kind of clinical response ability is still lacking a little bit”. (P5).

Table 2 Joint Display of Quantitative, Qualitative, and Mixed-Methods Meta-Inferences of Socio-Behavioral Impact of COVID-19

Quantitative Data	Quantitative Categories	Pillar	Qualitative Categories	Qualitative Codes
Fear and anxiety: M=1.44 (SD=0.62) Household confinement: M=1.90 (SD=0.80) Lifestyle modification: M=0.01 (SD=0.38) Preventive practices: M=1.92 (SD=0.53) Coping strategies: M=1.25 (SD=1.04) TOTAL: M=1.49 (SD=0.41)	Household confinement and preventive practices were relatively obvious. Fear and anxiety, coping strategies, and lifestyle modification have less of an impact.	Pillar 3: The most obvious impact of COVID-19 on nursing students are the adoption of preventive measures and the limitations in study and daily life due to household confinement.	Significant constraints in learning and daily life	“There is a lot of talk about reducing these large gatherings, so we spend a lot of time at home and less time with family and friends... and we can’t travel during the holidays”. (P1). “The main feeling is that people don’t go out either. They live at home and their social interactions are limited. Some theoretical courses are taught online, and there are clinical practices in hospitals that have been delayed, and there is one department where clinical practice is done online”. (P3).
			Proactive adherence to effective preventive measures	“I will look up some information related to COVID-19 pandemic on the internet, see some reports and so on... Let me know what can spread COVID-19, and talk to my teacher if I’m doing the right thing”. (P1). “Face masks have become a necessity for daily life. Hand hygiene needs constant attention. Disinfectants such as alcohol should be prepared at home. All kinds of pandemic prevention and control should be checked in and registered”. (P4). “And then we worry that our families don’t know the basics of protection, so we’re going to spread the word”. (P5).
			Diminished apprehension toward COVID-19 due to improved awareness	“The concern about the fear of an outbreak may be that we are in a low-risk area, so we haven’t felt like we were in a very dangerous environment for so long”. (P2). “I think as long as we take good protective measures, we’ll be less worried. Also, if we’re in the inpatient department, the outpatient department will usually do the nucleic acid test and only come here to be hospitalized after we get the results. It’ll be safer”. (P3).

Table 3 Joint Display of Quantitative, Qualitative, and Mixed-Methods Meta-Inferences of the Relationship Between Socio-Behavioral Impact of COVID-19 and Work Readiness

Quantitative Data	Quantitative Categories	Pillar	Qualitative Categories	Qualitative Codes
Fear and anxiety and work readiness ($r = -0.101$, $P = 0.024$); Household confinement and work readiness ($r = -0.096$, $P = 0.032$); Lifestyle modification and work readiness ($r = 0.148$, $P = 0.001$); Preventive practices and work readiness ($r = 0.230$, $P < 0.001$); Coping strategies and work readiness ($r = -0.188$, $P < 0.001$)	There was a significant weak positive relationship between lifestyle modification and work readiness, preventive practices and work readiness.	Pillar 4: Growth in both personal and professional awareness.	Positive adaptation	Heightened career awareness "I started to understand this profession better...Now I feel that this major is very good... The pandemic makes me feel like it's really a responsibility to do medicine, to study nursing". (P5). "Just seeing them (the frontline health workers) on TV like that, I felt so good, I thought I could be one of them...I feel proud to be a nurse". (P7). Increased focus on infection prevention and control "The positive impact is to pay attention to personal protection, because this year everyone is talking about, whether it's schools or hospitals, emphasizing personal protection, paying attention to infection control and so on". (P2). "It is also a kind of training for us, that is to say, encountering such an epidemic, has strengthened our knowledge of COVID-19 and epidemic prevention". (P4). Introspection "(Because of the pandemic) you're isolated at home doing nothing, but you also feel this sense of urgency, that time is running out, and you think about what to do, and the kind of thinking just seems to go up a stage". (P7). "Of course in this process, my own ideas are very important, I feel I have to turn the negative impact into a favorable condition". (P5).
	A significant weak negative relationship existed between fear and anxiety and work readiness, coping strategies and work readiness, household confinement, and work readiness.	Pillar 5: Negative effects of fear and anxiety. Pillar 6: Negative effects of household confinement.	Negative impacts	Uncertainty "The negative thing is that the clinical placement has been delayed a lot, and then many things have been delayed a lot. Many things have yet to be decided, including the clinical placement hospital at that time, and the time is also uncertain". (P5). "The main thing is that the clinical placements are put off, and then all the arrangements are put off, and then a lot of things can come together. And then there's the fact that the pandemic has been going on and on, and we don't know if that's going to change. There are unknowns about finding a job, taking a nursing qualification exam, or graduating". (P7). Concerns about personal protection "But the negative side is, as I said earlier, there's some concern that you might not be able to protect yourself properly or that you might get an infection in the clinic". (P1). "In clinical practice, if you don't have the strict kind of protection, like wearing protective clothing. You're always a little worried". (P4). Inferiority of online learning compared to in-person instruction "There are a few courses that have never been to school. They are all conducted online. The teaching of online courses and the students' mastery of knowledge are definitely different from those in school. The learning effect is not achieved". (P7). "The effect of online clinical practical is not as good as their own hands-on in the department, or there is a certain difference". (P3). Clinical learning opportunities are reduced "We may have added a post for pandemic prevention and control. Some assignments in our hospital may not be very reasonable. Sometimes, we may be assigned to this post two days a week. We can only stay there to take temperature and register these things. That will make us lose time with our teachers". (P1). "Because we have to guard the door to prevent and control the pandemic, or take the temperature of the patients and the accompanying people, it affects other kinds of study time". (P6).

preventive measures, introspection prompted by learning and daily life limitations, facilitated the personal and professional growth of nursing students during the pandemic (Pillar 4). On the other hand, the anxiety and fear caused by the COVID-19 pandemic, as well as the limited effectiveness of online learning and reduced clinical learning opportunities due to household confinement, have had a negative impact on the work readiness of nursing students (Pillars 5 and 6).

Our study revealed that graduating nursing students possess a solid foundation in basic knowledge and skills, as well as psychological preparedness and a strong work ethic. However, they are not sufficiently equipped with the specialized knowledge, skills, and soft skills necessary for a seamless transition from nursing students to clinical nurses. When comparing our findings with the studies by Li et al²¹ and Patterson et al²⁸ on the work readiness of new graduate nurses prior to the COVID-19 outbreak, it became evident that, much like their counterparts in China before the COVID-19 pandemic, graduating nursing students in China exhibited lower scores in WC, SI, and OA than their peers in Australia. However, they scored higher in PWC than the new graduate nurses in Australia, encompassing traits such as responsibility, mental resilience, flexibility, and stress management. Nonetheless, the PWC scores of graduating nursing students in China were lower than those of newly graduated nurses prior to the outbreak. In addition to the usual challenges of transitioning into the workforce and the need to develop certain competencies, the post-COVID-19 work environment, characterized by heightened risks to both patients and nurses, coupled with the unpredictability and complexity of job duties, further compounded the inadequate preparation of nursing students for clinical practice. Consequently, students recognized the paramount importance of specialized knowledge and skills, as well as non-technical abilities. A study by Canet-Vélez et al highlighted the significance of experiential learning and vocational training in effectively addressing the demands of complex nursing work within the context of the COVID-19 pandemic.¹⁵ This underscores the need for tailored training programs for new graduate nurses, focusing on honing specialized nursing knowledge and skills, and enhancing their overall competency in practical settings.

During the COVID-19 pandemic, nursing students experienced significant personal and professional growth, which emerged as a positive outcome of the crisis. The participants in this study were directly impacted by COVID-19 and underwent clinical practice while in home isolation, engaging in home-based online learning, and adapting to the normalized management of the epidemic. Throughout this period, our country's understanding of COVID-19 pneumonia evolved from initial insufficiency to gradual control, ultimately culminating in the implementation of the "Dynamic Zero-Clearance" strategy.²⁹ Remarkably, the majority of nursing professionals' efforts in preventing and controlling this pandemic embody the noble ethos of "Protecting life and saving lives", which further amplified the heightened social regard for nursing workers.³⁰ Inspired by these exemplar actions and the presence of role models, nursing students experienced a general enhancement in their sense of professional identity and value. They also developed a profound appreciation for the responsibilities and missions of healthcare personnel. A study by Heilferty, Phillips & Mathios demonstrated that, post-COVID-19 outbreak, a majority of nursing students expressed admiration for nurses who selflessly cared for patients, often leaving their own families at risk.¹⁷ When combined with Yang et al's early-stage pandemic research,³¹ it is evident that the pandemic's impact on the professional attitudes of nursing students is both positive and enduring. By contrast, despite the disruptions caused by COVID-19 in their studies and personal lives, nursing students exhibited a proactive approach, reflecting a form of post-traumatic growth, a testament to their resilience. Yıldız's work illustrated that nursing students underwent positive transformations in their self-perception, interpersonal relationships, and overall outlook on life during the COVID-19 pandemic.³² Xia, He & Qian also observed, one year after COVID-19, that college students experienced a moderate level of post-traumatic growth, primarily evident in their enhanced appreciation for life and a shift in their overall outlook.³³ This amalgamation of personal and professional growth stands to greatly assist nursing students in their transition from academic settings to clinical practice.

The negative effects of fear and anxiety on students' work readiness may be attributed to the uncertainty and self-protection concerns brought about by the pandemic. The uncertainties associated with COVID-19 encompass the unpredictability of the outbreak, alterations in learning schedules, prolonged periods of uncertainty regarding the future. These experiences not only induce feelings of insecurity and evoke emotional responses,³⁴ but also give rise to mental health issues such as anxiety, stress, and depression. Cognitively, this leads to a diminishment of an individual's sense of control and predictability in their environment.³⁵ In a study by Ulenaers et al, nursing students expressed challenges in adapting to the dynamic environment and rapidly changing clinical recommendations and guidelines. This highlights the

importance of creating a trusting and supportive environment and enhancing student resilience.³⁶ Additionally, even though students' awareness of infection prevention and control has been heightened, their concerns about self-protection persist in practical work. This is not only due to the high infectivity and concealment of COVID-19 but is also tied to the mastery of knowledge and skills in infection control, as well as accessibility to personal protective equipment. A survey of medical and nursing students revealed that only 8.9% of students correctly answered questions regarding measures to prevent the spread of hospital-acquired infections among patients, and only 18.6% had received training on COVID-19 organized by health service institutions or their universities.³⁷ For nursing students, additional training is needed for the proper wearing and removal of protective materials. Moreover, some internship sites face a shortage of personal protective equipment, which has emerged as a significant stressor impacting the clinical practice of nursing students.³⁶ Therefore, during the COVID-19 outbreak, schools and practice hospitals should establish a sense of control and provide a stable educational structure for students. This includes timely dissemination of information about changes, as well as regular provision of psychological care and support, particularly during clinical internships. Ensuring that students have sufficient personal protective materials and opportunities for targeted knowledge and skills training in infection prevention and control is also crucial.

The negative effect of household confinement on students' work readiness is potentially linked to the limited effectiveness of online teaching and its impact on learning opportunities. From interview data with students, it's evident that nursing students perceive the effectiveness of online learning, whether for theoretical coursework or clinical practice, as subpar. This could be attributed to students' limited willingness to engage in online learning, viewing it as a temporary measure to continue learning under specific circumstances. Other factors include students' limited experience with online learning, inadequate opportunities for teacher-student interaction and supervision, inadequate curriculum design, and the unsuitability of online platforms for clinical practice and skills acquisition.^{38,39} Reports suggest that both students and teachers experienced "Zoom fatigue" during the COVID-19 pandemic, a condition of fatigue or burnout due to excessive use of videoconferencing, which likely contributed to overall dissatisfaction with online teaching.⁴⁰ Consequently, Terzi et al recommended experimenting with different teaching methods to foster a positive attitude among nursing students towards distance education.⁴¹ Furthermore, the uneven allocation of time for participating in epidemic prevention and control efforts can affect the availability of time for nursing students' specialized practice. Simultaneously, due to the heightened workload and increased sense of insecurity due to the pandemic, nurses' support and supervision of nursing students' studies may be diminished. A cross-sectional survey of medical students has indicated a concerning decline in the proportion of students who believe that university programs achieved their primary objectives during and after the pandemic, compared to pre-pandemic levels.⁴² Consequently, universities and practice hospitals should enhance online teaching resources, bolster teachers' proficiency in online teaching, and prioritize clinical practice training and guidance for students. This will enable a seamless transition from face-to-face teaching to online instruction in the event of a similar public health crisis.

Limitations of the Study

Four universities were selected for the study, excluding schools in Wuhan, Hubei Province - The area most severely affected by COVID-19 in China in 2020. This exclusion was due to the differing extents of impact from the pandemic, which may have influenced the study results. Additionally, while both school nursing educators and hospital nursing administrators play a role in evaluating the work readiness of nursing students, this study focused solely on the self-assessment of graduating nursing students. Future research could benefit from considering the perspectives of multiple stakeholders to comprehensively explore the work readiness of nursing graduates in the post-COVID-19 era.

Conclusions

Even though the acute phase of the COVID-19 pandemic has subsided, it is crucial not to underestimate its enduring effects on nursing students. This study revealed that the altruistic dedication of medical professionals and post-traumatic growth of students during the COVID-19 pandemic significantly bolstered students' recognition and confidence in the field of nursing. This insight can be valuable material for shaping the education of nursing students' professional values. The negative impacts of uncertainty, self-protection concerns, and suboptimal online learning on students' work readiness persist, both during the pandemic and in the post-graduation phase. These students require continued support

from universities and hospitals, including the establishment of a sense of control and community, rational integration of online theory and clinical practice, provision of support and learning opportunities for epidemic prevention and control during in-person internships, and targeted on-the-job training. Hence, it is imperative for nursing schools and practice hospitals to glean lessons from this experience and ready themselves for potential future emergencies. Post-entry training in hospitals should be tailored to counteract the negative effects of the pandemic on nursing graduates, with ongoing attention directed toward the clinical adaptation of newly graduated nurses.

Abbreviations

COVID-19, Coronavirus disease 2019; WRS-GN, Work Readiness Scale for graduate nurses; WC, Work competence; OA, Organizational acumen; SI, Social intelligence; OH, Organizational hierarchy; PWC, Personal work characteristics; SD, Standard deviation.

Ethics Approval and Informed Consent

The study was approved by the Medical Ethics Committee of Xiangnan University (No. KY-202011007) and the Ethics Review Board of St. Paul University, Manila (NO.2021-[129]-[IGS]-[CNA]). All research procedures in this study were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study, and the participant informed consent included publication of anonymized responses.

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Disclosure

The authors declare that they have no conflicts of interest in this work.

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