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Coronavirus disease 2019 pandemic promotes the sense of professional identity among nurses

*Zhuyue Li, PhD, Qiantao Zuo, MD, Jingxia Cheng, MD, Yu Zhou, MD, Yingying Li, MD, Longling Zhu, MD, Xiaolian Jiang, PhD**

West China School of Nursing/West China Hospital, Sichuan University, Chengdu, China

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ABSTRACT

Background: Under the COVID-19 pandemic, nurses are the mainstay in the fight against the pandemic.
Purpose: To evaluate potential impact of the pandemic on nurses' professional identity.
Method: Self-report questionnaires were distributed online. Data collected were compared with available norms. Multivariate logistic regression analyses were employed to calculate the OR of frontline vs. nonfrontline nurses.
Findings: The mean of the total score of the scale was 121.12 out of 150. Both the total score and scores on the five dimensions were significantly higher than norms. Frontline nurses had a significantly higher professional identity than non-frontline nurses (total score: odds ratio [OR], 1.19; professional identity evaluation: OR, 1.27; professional social support: OR, 1.18; professional social proficiency: OR, 1.33; and dealing with professional frustration: OR, 1.19). The most frequently mentioned tags were *Hope, Frontline, Protection, Outbreak, Work, Situation*.
Discussion: COVID-19 outbreak was associated with an enhancement in the professional identity of nurses.

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Introduction

Since the current outbreak of coronavirus disease (COVID-19) was first reported from Wuhan, Hubei, China on 31 December 2019, more than 80,000 people have been confirmed with infection in China and the virus has now been classified as a worldwide pandemic by the WHO (World Health Organization, 2020). According to the report of the National Health Committee of China, the nurses supporting Hubei reached 28,600 nationwide by March, 2020 (28,600 nurses support Hubei, 2020). In connection with the COVID-19 outbreak, nurses were portrayed by the media as heroic, warm-hearted, and having a strong sense of professional morality (The light of life, 2020). Of the patients with COVID-19 hospitalized at 552 sites until January 29, 2020, the proportion of health

*Corresponding author: Xiaolian Jiang, West China School of Nursing / West China Hospital, Sichuan University, Guoxue Xiang 37, Chengdu, China, 610041.
E-mail address: jiang_xiaolian@126.com (X. Jiang).

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workers who were infected had reached 3.5% (Guan, Ni & Hu, 2020).

The professional identity of nurses is usually defined as including both personal and professional development and involves the internalization of values and perspectives. Professional identity, or how a nurse views himself or herself in their role as a nurse, affects every aspect of practice. It is the key to providing high-quality care (Langendyk et al., 2015, Andrews, Burr & Bushy, 2011), mediating job dissatisfaction and burnout (Cao, Chen, Tian & Diao, 2016), and improving clinical performance (Bjorkstrom, Athlin & Johansson, 2008, Anderson, Birks & Adamson, 2020) and job retention (Cowin, Johnson, Craven & Marsh, 2008). Previous studies have reported that the professional identity of nurses may be affected by an emergency event or special workplace settings (Goddard, de Vries, McIntosh & Theodosius, 2019, Heung et al., 2005). Heung et al., (2005) interviewed 10 nursing students and found that the severe acute respiratory syndrome crisis affirmed their professional identity. However, there has been a lack of research on the professional identity of nurses during emergency events or in special workplace settings under normal conditions. The professional identity of nurses is determined by many factors such as public image, work environment, work values, education, and culture (Cowin, Johnson, Craven & Marsh, 2008). It is important to understand any changes in the professional identity of nurses during the COVID-19 outbreak as portrayals of them in the media have changed and health care demands have increased.

We hypothesize that in the context of the COVID-19 pandemic, the professional identity of nurses could be affected by changes in the social and working environments, and the outbreak could be a positive factor contributing to affirmation of nurses' professional identity. In this study, we collected both quantitative and qualitative data for a comprehensive analysis and we compared the professional identity of nurses during the COVID-19 outbreak with normative data published in a previous study (Ling, 2009). Further, we also compared the professional identity of frontline and nonfrontline nurses during the pandemic. We aimed to (a) assess the level of professional identity of nurses during the COVID-19 outbreak; (b) compare professional identity in various groups; and (c) investigate nurses' views and feelings during the outbreak and how the outbreak might affect the professional identity of nurses.

Methods

Study Design and Measures

This study used a cross-sectional survey that collected both quantitative and qualitative data from nurses working in the COVID-19 pandemic. To examine the professional identity of nurses in the pandemic situation, we utilized the Professional Identity Scale for Nurses (Ling, Yu-fang & Xiao-hong, 2011). This scale was developed based on local data, has good reliability and validity (Cronbach's α = 0.0938, χ^2/df = 1.85), and is suitable for Chinese nurses. The scale consists of five dimensions and 30 items: (a) professional identity evaluation, nine items, views on importance or value of nursing, feelings and beliefs on nursing profession, and person-post matching; (b) professional social support, six items, the recognition and support from patients, medical and nursing colleagues, managers, and important others like their families; (c) professional social proficiency, six items, the interpersonal communication and cooperation capability for adapting to professional working environment; (d) dealing with professional frustration, six items, the cognitive style and action mode adopted while encountering professional stress and frustrations; and (e) professional self-reflection, three items, the self-exploration, self-correction and critical judgment in work, a process of in-depth understanding of self and occupation. Each item was scored 1 to 5, and the possible score for the total scale and the dimensions of professional identity evaluation, professional social support, professional social proficiency, dealing with professional frustration, and professional self-reflection are 30-150, 9-45, 6-30, 6-30, 6-30, and 3-15, respectively. Ling, (2009) established a professional identity norm based on their survey among clinical nurses recruited from different levels hospitals in Shanghai through stratified cluster sampling. According to their criteria, we defined a high-professional identity group (total score $\geq$120) and a low-professional identity group (total score $<$120); a high-score group (dimension score $\geq$34) and low-score group (dimension score $<$34) for professional identity evaluation; a high-score group (dimension score $\geq$22) and low-score group (dimension score $<$22) for professional social support, professional social proficiency, and dealing with professional frustration; and a high-score group (dimension score $\geq$11) and low score group (dimension score $<$11) for professional self-reflection. The whole questionnaire comprised the Professional Identity Scale for Nurses, demographic and occupational information including gender, age, marital status, education level, years of nursing experience, department (ward), professional title, position, and work on the frontline of COVID-19 or not. We defined frontline nurses as those directly working on COVID-19 prevention and treatment, including screening for suspected cases in fever clinic and taking care of people under medical observation and the confirmed cases in the hospital or mobile cabin hospital. At the end of the questionnaire, two open-ended questions were set to capture richer information on the feelings and views of nurses under the pandemic: (a) "As a nurse, how do you feel when witnessing the pandemic situation of COVID-19?" (Q1) and (b) "As a nurse, how do you feel if you participate in the frontline work?" (Q2)

Data Collection

First, we uploaded the questionnaire to Wenjuanxing (https://www.wjx.cn/), an online questionnaire system, and Wenjuanxing created a link for it. Then, we posted the questionnaire link on WeChat (https://weixin.qq.com/), a Chinese social media platform. Any nurse interested in the survey could open the link and fill in the questionnaire. The completion of the survey was considered consent to participate. Finally, we exported all the completed questionnaires using Wenjuanxing.

Statistical Analysis

Means with standard deviations (*SD*) or medians with quantiles were used to describe age and length of nursing career after testing for skewness and kurtosis. Frequency distributions were used to describe categorical variables. Scores for professional identity and its five dimensions (professional identity evaluation, professional social support, professional social proficiency, dealing with professional frustration, and professional self-reflection) were described by means with *SD*, and compared with the results of Liu (Ling, 2009). Scores on the five dimensions were also compared between frontline nurses and nonfrontline nurses in the present study using the Kruskal-Wallis test. Univariate and multivariate logistic regression models were used to evaluate the odds ratio (OR) with 95% confidence intervals (CI) of frontline nurses compared with non-frontline nurses. Those variables that were significant ($p < .05$) in univariate logistic regressions were included in multivariate models.

All *p*-values were calculated as two-tailed and all statistical tests used a significance level of .05. All statistical analyses were conducted with SPSS 25.0.

Content Analysis

To analyse data collected from two open-ended questions, a conventional content analysis was carried out. Three investigators first deconstructed the text, highlighted the words that captured key points; and then, translated them into codes and classified the codes to consolidate themes. Any disagreements were resolved by discussion. We also import original text to NVivo 11.0 to create word clouds based on the frequency of words or phrases.

Ethics Approval

This study has been approved by the Biomedical Ethics Review Committee of the relevant hospital for this study.

Findings

Description of Sample Characteristics

We collected a total of 5,570 responses during February 2020. Table 1 shows the characteristics of participants. The results of the skewness and kurtosis tests indicated that age and length of nursing career had positively skewed distributions. The median age of participants was 30 years (quantiles: 25% = 26; 75% = 34) and the median length of nursing career was 8 years (quantiles: 25% = 5; 75% = 13). The most common education level of participants was an undergraduate degree (56.6%) and a substantial majority of them (92.4%) were clinical nurses providing direct patient care. 2,057 (36.9%) nurses reported working in frontline positions. The age of frontline nurses and their years of working experience were higher than the nonfrontline nurses. Regarding to professional title, the Chinese government has set five titles for nurses: nurse, senior nurse, supervisor nurse, deputy chief nurse, and chief nurse. “Nurse” and “Senior nurse” belong to the junior title, “Supervisor nurse” is the intermediate title, and “Deputy chief nurse” and “Chief nurse” are the senior title. In this study, the intermediate title nurse accounted for a higher proportion of frontline workers. More head nurses and directors of nursing are in the frontline.

Professional Identity

The mean professional identity score in our study was 121.12 (*SD* = 22.77). Mean scores on the five dimensions of professional identity evaluation, professional social support, professional social proficiency, dealing with professional frustration, and professional self-reflection were 34.57, 25.22, 23.74, 25.12, and 12.48, respectively. The means on the five dimensions were all at a high level. Interestingly, compared with the results of the study by Liu (Ling, 2009), our results demonstrated a higher score for both the total scale and the scores on every dimension (Table 2). The largest difference in any item mean was in the dimension of profession identity evaluation (this study: 4.5; Liu: 2.88).

Frontline vs. Nonfrontline Nurses During COVID-19

Figure 1 compares the scores on the five dimensions between the frontline group and the nonfrontline group. The means on each dimension for the frontline group are all significantly higher than those for the nonfrontline group (professional identity evaluation: frontline, 35.11, nonfrontline, 34.25; professional social support: frontline, 25.45, nonfrontline, 25.08; professional social proficiency: frontline, 24.24, nonfrontline, 23.45; dealing with professional frustration: frontline, 25.44, frontline, 24.93; professional self-reflection: frontline, 12.55, non-frontline, 12.44). These differences between groups were all significant

Table 1 – Characteristics of Sample in the Groups.

Characteristics	Total (n = 5,570)	Frontline (n = 2,057)	Nonfrontline (n = 3,513)
Age, years (median (quantiles))	30 (26, 34)	30 (26, 36)	29 (26, 33)
Nursing experience, years (median (quantiles))	8 (5, 13)	9 (5, 15)	7 (4, 11)
Department or ward			
Surgical	1,138 (20.4)	307 (14.9)	831 (23.6)
Internal medicine	1,119 (20.1)	298 (14.5)	821 (23.4)
Other*	1,074 (19.3)	365 (17.7)	709 (20.2)
Obstetrics, gynecology and pediatrics	754 (13.5)	252 (12.3)	502 (14.3)
Emergency and ICU	558 (10.0)	323 (15.7)	235 (6.7)
Nonclinical†	428 (7.7)	233 (11.3)	195 (5.6)
Outbreak related‡	245 (4.4)	143 (7.0)	102 (2.9)
Community and rehabilitation	209 (3.8)	121 (5.9)	88 (2.4)
NA	45 (0.8)	15 (0.7)	30 (0.9)
Gender (%)			
Male	146 (2.6)	77 (3.7)	69 (2.0)
Female	5,424 (97.4)	1,980 (96.3)	3,444 (98.0)
Marital status (%)			
Unmarried	1,702 (30.6)	582 (28.3)	1,120 (31.9)
Married	3,699 (66.4)	1,396 (67.9)	2,303 (65.6)
Divorced	156 (2.8)	70 (3.4)	86 (2.4)
Widowed	13 (0.2)	9 (0.4)	4 (0.1)
Education level (%)			
Secondary nursing school	157 (2.8)	64 (3.1)	93 (2.6)
Junior college	2,207 (39.6)	861 (41.9)	1,346 (38.3)
Undergraduate	3,151 (56.6)	1,116 (54.3)	2,035 (57.9)
Graduate and above	55 (1.0)	16 (0.8)	39 (1.1)
Job type (%)			
Clinical	5,144 (92.4)	1,847 (89.8)	3,297 (93.9)
Administrative	113 (2.0)	72 (3.5)	41 (1.2)
Logistics	35 (0.6)	10 (0.5)	25 (0.7)
Other§	278 (5.0)	128 (6.2)	150 (4.3)
Job title (%)			
Nurse	1,671 (30.0)	585 (28.4)	1,086 (30.9)
Senior nurse	2,603 (46.8)	923 (44.9)	1,680 (47.8)
Supervisor nurse	1,066 (19.1)	431 (21.0)	635 (18.1)
Deputy chief nurse	206 (3.7)	105 (5.1)	101 (2.9)
Chief nurse	24 (0.4)	13 (0.6)	11 (0.3)
Position (%)			
Staff nurse	5,086 (91.3)	1,783 (86.7)	3,303 (94.0)
Head Nurse	419 (7.5)	220 (10.7)	199 (5.7)
Director of Nursing	65 (1.2)	54 (2.6)	11 (0.3)

* Other department or ward including dentistry, oncology, traditional Chinese medicine, otolaryngology, ophthalmology, psychiatry, anesthesia operating room, and dermatology.
† Nonclinical department or ward including nursing department, laboratory imaging and other medical technology departments, disinfection supply room, and physical examination center.
‡ Outbreak related department or ward including respiratory department, infection department, and fever isolation ward.
§ Other job type including nurses in physical examination center, hospital auxiliary examination department etc.

and the p-values of Kruskal-Wallis tests were all below .001.

The results of univariate and multivariate logistic regression analyses for the total score on professional identity and the scores on the five dimensions are presented in Table 3. The details of logistic regressions for the total score on professional identity and the five dimensions are provided in Supplementary Table 1. After multifactor adjustment, frontline nurses were 1.19 times more likely to have a higher score on professional identity than were nonfrontline nurses. Compared with nonfrontline nurses, frontline nurses had a significantly higher OR on all dimensions except professional self-reflection (professional identity evaluation: OR, 1.27, $p < .001$; professional social support: OR, 1.18, $p = .02$; professional social proficiency: OR, 1.33, $p < .001$; and dealing with professional frustration: OR, 1.19, $p = .01$).

Content Analysis

A total of 2,838 nurses provided information on the open-ended questions, with 3,016 and 2,790 points of view respectively for question 1 and 2. Figure 2

Table 2 – Comparison Between This Study and Liu et al. (Ling, 2009)

	This Study(mean (SD))		Liu (1)(mean (SD))
N	5,570		524
Total score	121.12 (22.77)		96.83 (14.99)
Professional identity evaluation	34.57* (8.19)	4.5† (1.09)	2.88† (0.66)
Professional social support	25.22* (4.65)	4.20† (1.00)	3.58† (0.53)
Professional social skills	23.74* (4.84)	3.96† (0.98)	3.12† (0.53)
Dealing with professional frustration	25.12* (4.77)	4.19† (0.89)	3.42† (0.57)
Professional self-reflection	12.48* (2.50)	4.16† (0.91)	3.37† (0.65)

* Mean and standard deviation of the dimension.
† Mean and standard deviation of the item of the dimension.

displays the results of the word cloud. We translated the original word cloud from Chinese into English and the original Chinese version is provided in Supplementary Figure 1. Words mostly mentioned in the original text were Hope, Frontline, Protection, Outbreak, Work, and Situation. Major themes derived from the text included Sense of professional and social responsibility, Sense of professional value and fulfilment, Enhanced psychological/spiritual qualities, and Reflection on life, world, self. The frequency distributions of the themes and their related codes are reported in Table 4.

Sense of Professional and Social Responsibility

Many nurses expressed a strong sense of responsibility. They believed that they are obliged to provide care because patients and society urgently need help. They would like to try their best to take care of the patients and stick to post, even they know their work is risky. They stated that *"We have the responsibility to work at the front line, to fulfil our duty, to alleviate the suffering of patients, to fight against the virus." "This is the responsibility and mission of a professional nurse and the value of my existence." "Want to go frontline", "Be ready to go frontline at any time"* were frequently reported by the nonfronline nurses. Out of a sense of responsibility for human health, many nurses also put froward suggestions for nursing care under COVID-19. They emphasized the importance of personal protection, public education, and quality ensurerance. Representative statements include: *"The situation is serious, we must strictly do self-protection and public education." "The virus spread fast, and the pandemic has brought huge pressure to the society, hope the pandemic will end soon."*

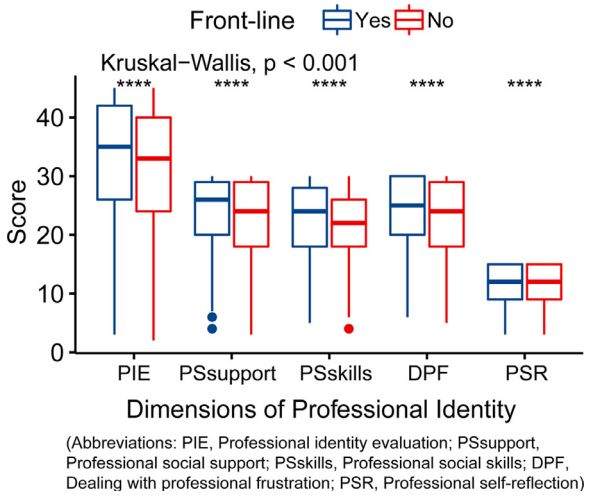

Figure 1 – Scores on the five dimensions for frontline nurses and nonfrontline nurses.

Sense of Professional Value and Fulfilment

Most nurses considered the work of antipandemic is meaningful and the role of nurses is irreplaceable, which promoted their feelings of achievement and recognition of nursing value. Representative quotations include: *"Nurses play a significantly important role in this battle, we are the hope for mankind."* One front-line nurse wrote that *"The pandemic is so severe, those critical patients are in too much pain and helpless. In my career, I have never realized how much people are in need of us and how important nursing is."* Other representative statements are: *"Nurses are great. The 24-hour care of COVID-19 patients is accompanied by many nurses who risk their lives." "We provide a wide range of care from basic daily living care, psychological support, to high-tech care for those undergoing mechanic ventilations and ECMO. Nurses are an indispensable part of the anti-pandemic team, their role is irreplaceable," "We are named by the public as the white angel heading for danger, we deserve it."*

Reflection on Life, World, and Self

COVID-19 crisis provoked nurses' reflection and reconstruction about their views on life, world, and self. They repeatedly stated that *"Life is precious but fragile, we must cherish life." "Worldwide environmental deterioration is the primary cause of epidemics, it is the bounden duty of everyone to revere nature and protect the environment."* The experience of working under an extreme stress of healthcare system makes nurses realize their potential and growth needs. They stated that *"The frontline work offers an opportunity to make use of my potential. Only through experience can we grow", "Because of not meeting the requirement, I am so regret that I was not selected to the front line. I need to keep learning and make an effort to improve my professional capabilities".*

Table 3 – Univariate and Multivariate Logistics Regressions of Professional Identity for Frontline Nurses.

	Mean (SD)	Univariate Regression		Multivariate Regression*	
		OR (95% CI)	*p*	OR (95% CI)	*p*
Professional identity					
Nonfrontline	120.14 (22.56)	Reference		Reference	
Frontline	122.79 (23.05)	1.21 (1.08, 1.35)	.001	1.19 (1.06, 1.33)	.003
Professional identity evaluation					
Nonfrontline	34.25 (8.10)	Reference		Reference	
Frontline	35.11 (8.31)	1.30 (1.16,1.45)	<.001	1.27 (1.14, 1.42)	<.001
Professional social support					
Nonfrontline	25.08 (4.61)	Reference		Reference	
Frontline	25.45 (4.71)	1.22 (1.06, 1.40)	.006	1.18 (1.03, 1.36)	.02
Professional social skills					
Nonfrontline	23.45 (4.79)	Reference		Reference	
Frontline	24.24 (4.89)	1.38 (1.23, 1.56)	<.001	1.33 (1.18, 1.51)	<.001
Dealing with professional frustration					
Nonfrontline	24.93 (4.76)	Reference		Reference	
Frontline	25.44 (4.77)	1.22 (1.07, 1.40)	.003	1.19 (1.04, 1.36)	.01
Professional self-reflection					
Nonfrontline	12.44 (2.50)	Reference		Reference	
Frontline	12.55 (2.51)	1.08 (0.95, 1.23)	.25	1.06 (0.93, 1.21)	.39

* The multivariate regression of professional identity adjusted by sex, marital status, education level, job title and position. The multivariate regression of professional identity evaluation adjusted by marital status, job title and position. The multivariate regression of professional social support adjusted by age, sex, marital status, job type, job title, position. The multivariate regression of professional social skills adjusted by age, marital status, duration of nursing, job type, job title, position. The multivariate regression of dealing with professional frustration adjusted by age, marital status, job type, position. The multivariate regression of professional self-reflection adjusted by job type, job title, position.

Enhanced Psychological/Spiritual Qualities

Encountering COVID-19, many nurses reported that they were full of confidence and firm belief, and they united optimistically. They stated *"Though everyone felt anxious, as a nurse, I must be brave to overcome any difficulties," "Disaster is inevitable, but as long as we work together, we can succeed," "The virus is horrible, but we would never give up," "Persistence is success,"* Besides, they thought they should fight the pandemic positively, quotations like *"As a nurse, we should actively participate and face it."*

Inhibiting Factors of Professional Identity

Some nurses expressed dissatisfaction with the status of nurses, which includes low income and low social status but a heavy workload and high professional risk. *"Nurses are paid low wages, and many hospitals were short of protective equipment. Now it seems I have to sacrifice myself and family, this is not what I want... If the status of nursing could be changed, I was willing to work at the front line...", "...However, our social and economic status is relatively low... in primary hospitals, nurses have to do everything...".*

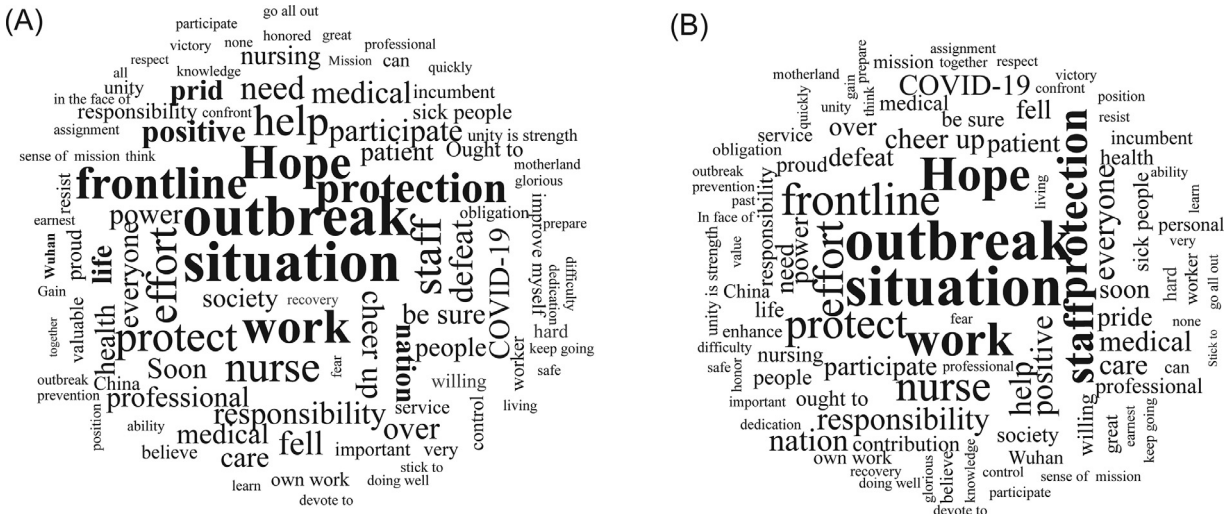

Figure 2 – (A) The word cloud of the question *As a nurse, how do you feel when witnessing the pandemic situation of COVID-19?* (B) The word cloud of the question *As a nurse, how do you feel if you participate in the frontline work?*

Table 4 – Themes and Codes Emerging From Content Analysis of Nurses' Feelings Under Outbreak Situation of COVID-19.

Themes	Codes	Q1(N = 3,006) Frequency (%)	Q2(N = 2,765) Frequency (%)	Total(N = 5,771) Frequency (%)
Sense of professional and social responsibility		**1,398 (46.5)**	**1,304 (47.2)**	**2,702 (46.8)**
	Try my best	163 (5.4)	405 (14.6)	568 (9.8)
	Be responsible to patients	243 (8.1)	280 (10.1)	523 (9.1)
	Suggestions for nursing care (attach importance of personal protection and public education, ensure nursing quality)	255 (8.5)	228 (8.2)	483 (8.4)
	Dedicate myself	265 (8.8)	154 (5.6)	419 (7.3)
	Sense of mission for humans	218 (7.3)	107 (3.9)	325 (5.6)
	Stick to post	86 (2.9)	66 (2.4)	152 (2.6)
	Hope to participate in frontline work	114 (3.8)	/	114 (2.0)
	Be responsible to society	47 (1.6)	32 (1.2)	79 (1.4)
	Unconditionally obey work arrangement	12 (0.4)	32 (1.2)	44 (0.8)
Sense of professional value and fulfilment		**498 (16.6)**	**676 (24.4)**	**1,174 (20.3)**
	Full of pride and honor	270 (9.0)	445 (16.1)	715 (12.4)
	Being valued/needed	129 (4.3)	99 (3.6)	228 (4.0)
	Irreplaceable role	99 (3.3)	132 (4.8)	231 (4.0)
Enhanced psychological/ spiritual qualities		**500 (16.6)**	**448 (16.2)**	**948 (16.4)**
	Unity	201 (6.7)	94 (3.4)	295 (5.1)
	Facing positively	106 (3.5)	109 (3.9)	215 (3.7)
	Confidence and firm belief	95 (3.2)	81 (2.9)	176 (3.0)
	Optimistic	64 (2.1)	69 (2.5)	133 (2.3)
	Being brave	22 (0.7)	51 (1.8)	73 (1.3)
	Persistence	12 (0.4)	44 (1.6)	56 (1.0)
Reflection on life, the world, the self		**260 (8.6)**	**82 (3.0)**	**342 (5.9)**
	Reflection on life (life is precious and fragile, cherish life)	111 (3.7)	36 (1.3)	147 (2.5)
	Self-reflection (deficiency, growth needs, and growth space)	86 (2.1)	39 (1.4)	125 (2.2)
	Reflection on the world / environment (revere nature, protect nature)	63 (2.1)	7 (0.3)	70 (1.2)
Others		**350 (11.6)**	**255 (9.2)**	**605 (10.5)**
	Views on COVID-19 pandemic (sudden break, high-risk, wide-spread, extensive influence, desperate state, hope to end soon)	232 (7.7)	117 (4.2)	349 (6.0)
	Inhibiting factors (low income, low social status, be ignored), negative emotional reaction (fear, helplessness), stress, overload	118 (3.9)	138 (5.0)	256 (4.4)

Abbreviation: Q1, "As a nurse, how do you feel when witnessing the pandemic situation of COVID-19?"; Q2, "As a nurse, how do you feel if you participate in the frontline work?".

Discussion

The results of this study show a high level of professional identity among nurses in China during the outbreak of COVID-19. For further confirmation, we compared the results of professional identity to normative data (Ling, 2009) collected with the same research tool and a similar research population but in a different social or work environment. Except for the education level, most characteristics of the normative sample including age, years of nursing experience, working department, position, professional title, marital status, and job type are consisting with the current study. The main education level of their participants was junior college, which accounted for 58.1% of their sample, while our most common education level was an undergraduate degree (56.6%). The difference might be related to the rapid development of Chinese nurse education in the past ten years which has changed the structure of the education level of hospital nurses. Meanwhile, nurses at the undergraduate level might be more likely to be sent to fight an outbreak due to their presumably stronger capabilities. Although higher scores on professional identity are seen among nurses with higher education levels,

previous studies have reported that education level is negatively related to nurses' professional identity (Xiangju et al., 2005, YJ, L, HX & Q, 2018).

The results of our comparison broadly support the conclusion that the outbreak of COVID-19 was associated with enhanced professional identity of nurses. In addition to the original normative study, the Professional Identity Scale for Nurses developed by Liu (Ling, Yu-fang & Xiao-hong, 2011) has been broadly adopted in other studies that included varied participants such as clinical nurses (Xi, Ying, Ziyin & Huiyun, 2019), specialist nurses (Lin et al., 2019), psychiatric nurses (Ping, Yanxing & Xinmei, 2019), and ICU nurses (Qiaofeng, Jinyi & Jingbing, 2016) in China and, with minor fluctuations, the results of these studies are consistent with the norm. Among them, specialist nurses achieved the highest level of professional identity (mean of total score (*SD*): 111.36 (20.15)) (Lin et al., 2019), but this score is still lower than our findings.

The change of social and working environment of nurses could be the underlying mechanisms. Rasmussen et al reviewed contemporary studies and concluded that factors influencing nurses' perceptions of their professional identity were synthesized into three categories: the self (who I am), the role (what I do), and the context (where I do) (Rasmussen, Henderson, Andrew & Conroy, 2018). This shows that the perception of oneself and outside world is essential for professional identity. In Japan, which is a patriarchal and highly masculinized country, the professional identity of female doctors was profoundly affected by gender stereotypes and that a study reported a considerable gap between married female doctors and those who were unmarried (Matsui, Sato, Kato & Nishigori, 2019). Further, two previous studies suggest that the professional identity of nurses in special practice areas, such as police custody and prisons, is poorly developed due to the sensitive work environment (Goddard, de Vries, McIntosh & Theodosius, 2019, Davidson, 2015).

The COVID-19 pandemic, as a global emergency public health event leading to severe economic and social impacts (Sohrabi, Alsafi & O'Neill, 2020) and huge health care demands, also allows nurses to re-evaluate their professional identity. In our study, nurses reported a strong sense of responsibility and accountability on patients, humankind, and the society. They firmly believe that it is the duty and mission of nurses to save lives. They also expressed a strong sense of professional value and fulfilment. These feelings are helpful to a positive professional identity development (Piil, Kolbœk, Ottmann & Rasmussen, 2012, Seo & Kim, 2017). Meanwhile, COVID-19 crisis enhanced the reconstruction of their view of life and worldview. They are deeply aware of the sincere and fragility of life and further appreciate health-related work. They had come to realize that nursing not only concerns about individual lives, but relates to the survival of all humankind. Some nurses wrote: "*Nursing is a great profession, I didn't understand greatness before, but now I do.*" Such professional reflection is not only about the profession, but also about the self. They were aware of both their values and their own deficiencies and growth needs. Many nurses expressed their regret that they were not qualified for going to the frontline. Also, some frontline nurses perceived a strong need by the patient but felt helpless in saving the lives of those critically ill. These perceptions contribute to a heightened self-awareness and the internalization of professional identity (Ramvi, 2015). Moreover, under the pandemic, the sublimation of spiritual and psychological qualities such as unity, being brave, firm, confidence, persistence, altruistic, are not only a strong foundation to face the frustrations and difficulties under health care crisis, but also meet a professional image that the public appreciates, thus, contribute to their positive self-formation and professional identification. It is difficult to compare as there is a lack of study on the professional identity of nurses under public health emergencies. However, during SARS, Heung and her colleagues examined the professional identity of student nurses in Hong Kong. They found that the outbreak enhanced student nurses' professional identity (Heung et al., 2005), and indicated that nursing students gained a sense of moral duty, appreciation for nursing, and self-growth.

Another important novel finding was that nurses at the frontline obtained a higher score on both the total score of professional identity and its five dimensions, and frontline nurses were 1.19 times more likely to report high professional identity than nonfrontline nurses. The reason might be that although positive changes in Sense of professional and social responsibility, Sense of professional value and fulfilment, Enhanced psychological/spiritual qualities, and Reflection on life, world and self were identified in both frontline and nonfrontline nurses, frontline nurses reported significantly more sense of professional value and fulfilment (theme frequency 24.4% vs. 16.6%). As the essence of professional identity is the self-conception of requirements, values and fulfilment, norms concerning a profession (Miller, 2010), it is not difficult to interpret the above finding.

Limitations

This study has some limitations which should be acknowledged. First, we collected self-report data that has inevitable bias, but our large sample size may have reduced it. Second, as a cross-sectional study, we cannot assume a causal relationship between work on the frontline and enhanced professional identity. However, we surveyed a large sample and look forward to providing evidence for future research. Third, the survey was conducted at the ascending stage of the pandemic; a longitudinal study is warranted for ascertaining the long-term impact of the COVID-19 pandemic on nurses' professional identity. Fourth, the word clouds reflect the changes in social and work environment under the pandemic from the

perspective of nurses, but the information provided is limited.

Conclusions

COVID-19 pandemic is not just a time of crisis, but an opportunity for reconstructing the professional identity for nurses. Given the importance of professional identity in determining professional commitment and the quality of care, making sense of the event, incorporating the unique COVID-19 experience into the training for the student nurse and the emergency care reserve nurse and motivation management for those frontline nurses is suggested. Tailored training should be centered on strengthening those promoting influence such as sense of professional responsibility and professional value, reflective thinking on health and life, positive world view and good personal qualities, as well as on avoiding the inhibitors such as negative emotion and stress management. In addition, developing strategies from the policy, management and organizational levels to enhance professional fulfillment and the publicity of the image and role of nurses are indicated to promote professional identification of nurses. .

Supplementary Figure 1.A. The original Chinese version of the word cloud of the question *As a nurse, how do you feel when witnessing the pandemic situation of COVID-19?*

Supplementary Figure 1.B. The original Chinese version of the word cloud of the question *As a nurse, how do you feel if you participate in the frontline work?*

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.outlook.2020.09.006.

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