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Mental workload of frontline nurses aiding in the COVID-19 pandemic: A latent profile analysis

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Abstract

Aims: To investigate the mental workload level of nurses aiding the most affected area during the Coronavirus disease 2019 (COVID-19) pandemic and explore the subtypes of nurses regarding their mental workload.

Design: Cross-sectional study.

Methods: A sample of 446 frontline nurses participated from March 8 to 19, 2020. A latent profile analysis was performed to identify clusters based on the six subscales of the Chinese version of the *National Aeronautics and Space Administration Task Load Index*. The differences among the classes and the variables including sociodemographic characteristics, psychological capital and coping style were explored.

Results: The level of mental workload indicates that the nurses had high self-evaluations of their performance while under extremely intensive task loads. The following three latent subtypes were identified: 'low workload & low self-evaluation' (8.6%); 'medium workload & medium self-evaluation' (35.3%) and 'high workload & high self-evaluation' (56.1%) (*Classes 1*, *2*, and *3*, respectively). Nurses with shared accommodations, fewer years of practice, junior professional titles, lower incomes, nonmanagement working positions, lower psychological capital levels and negative coping styles had a higher likelihood of belonging to *Class 1*. In contrast, senior nurses with higher psychological capital and positive coping styles were more likely to belong to *Classes 2* and *3*.

Conclusion: The characteristics of the 'low workload & low self-evaluation' subtype suggest that attention should be paid to the work pressure and psychological well-being of junior nurses. Further research on regular training program of public health emergency especially for novices is needed. Personnel management during public health events should be focused on the allocation between novice and senior frontline nurses.

Impact: This study addresses the level of mental workload of frontline nurses who aid in the most severe area of the COVID-19 pandemic in China and delineates the characteristics of the subtypes of these nurses.

KEYWORDS
coping style, COVID-19, cross-sectional study, latent profile analysis, mental workload, nurses, psychological capital

Yawei Shan and Jing Shang contributed equally to this work and considered as the Co-first authors.

1 | INTRODUCTION

The ongoing outbreak of novel pneumonia caused by the Coronavirus disease 2019 (COVID-19) has raised considerable concerns globally, as it is associated with high infection rates and fatal outcomes (Zhu et al., 2020). Although a rapid response and timely detection were implemented globally, large-scale infection and death have been reported (World Health Organization, 2020a). In mainland China, the Chinese government announced its highest-level commitment to respond to the pandemic and prevent its further spread (World Health Organization, 2020b). As the highest peak occurred on February 12, 2020. with 30,042 existing conformed cases (National Health Commission of the People's Republic of China, 2020a), more than 42,000 health care professionals (HCPs) were sent to Wuhan by February 29, 2020, which is the most affected area in China (National Health Commission of the People's Republic of China, 2020b). With the ever-increasing number of infected cases, HCPs on the frontline might be under both physical and psychological pressure (Lai et al., 2020).

Among these HCPs, nurses aiding in the COVID-19 pandemic account for 68% (28,600) and have been considered the major workforce in pandemic control (National Health Commission of the People's Republic of China, 2020b). As reported in many public health pandemics, such as the SARS-CoV, MERS-CoV (Park et al., 2018) and 2009 influenza A (H1NI) (Nap et al., 2008) pandemics, the high workload of nurses on the frontline is a major concern for efficient health care, patient safety, and the physical and mental health of nurses (World Health Organization, 2019). As COVID-19 appears to be 10 times more contagious than SARS-CoV and MERS-CoV (Ahn et al., 2020), this might increase the workload burden of frontline nurses. However, given the different types of workloads (Holden et al., 2011), not all workloads result in compromised performance (McKendrick et al., 2019). Therefore, apart from the task load, a particularly interesting construct related to state of mind, namely, mental workload (MWL), warrants considerable attention (Sumwalt et al., 2019). However, little is known about the level of MWL among nurses aiding in Wuhan. Whether there exist different MWL clusters in nurses and how to identify these clusters are worthwhile to explore. The main study objective is to investigate the level of MWL among nurses in Wuhan during the COVID-19 pandemic, and to explore the subtypes of MWL among these nurses. The specific objective is to identify the characteristics of subtypes.

1.1 | Background

Mental workload is a multidimensional and multifaceted concept that explains the relationship between the nature of a task and the characteristics of the worker. This subjective factor can be defined as the amount of thinking, level of cognitive demand or thought processing effort required by the worker to meet the physical, temporal and environmental demands of the defined task (Young et al., 2015). It is a more comprehensive variable than the simple quantity of tasks for predicting nurses' mental health and work performance, especially in some complex and dynamic situations (Byrne, 2013). The assessment and management of MWL was recommended by the *European Pact for Mental Health and Welfare* to promote physical and mental well-being (Scheftlein, 2011). Because of the urgency of managing the variety of human factors that influence the mental health of HCPs and that thus compromise pandemic control (Carayon, 2011), researchers should examine the topic of MWL in frontline nurses, especially in pandemic regions (Ticharwa et al., 2019). While drawing insights from previous studies that have provided a solid foundation for the present study, the researchers seek to go a step further to identify the different subtypes of MWL among nurses in the most affected area in China and investigate the characteristics of the different subtypes to, in turn, improve the mental health of frontline nurses. In this way, two technical issues should be addressed, namely, the use of a feasible statistical methodology for MWL grouping and the identification of the major characteristics of each subtype.

With respect to the statistical methodology, previous studies on nurses' MWL were conducted based on a variable-centred analytical approach (Koch et al., 2012). However, the identification of different facets of MWL among pandemic frontline nurses provides an opportunity for policy makers to take measures to prevent negative physical and psychological outcomes of nurses and improve their clinical performance. Latent profile analysis (LPA) is a person-centred statistical method that provides a methodology to group individuals with similar patterns of personal and professional characteristics, traits or behaviours into profiles according to their responses to a set of observed indicators. This statistical analysis method is rather novel in the MWL research among nurses, but it has been shown to be usable and valid for exploring the subtypes of clinical competency (Liu et al., 2017; Oyesanya & Snedden, 2018), work stress (Jenull & Wiedermann, 2015) and job satisfaction (Wang et al., 2017) in HCPs. Therefore, LPA can be employed to identify the patterns of MWL among pandemic frontline nurses.

According to the human-based archetype of MWL proposed by Mohammad-jabad Jafari et al., task demand, resource supply and individual characteristics are the key variables that influence psychophysiological responses and workload modification (Jafari et al., 2019). For all pandemic frontline nurses in China, the task demands of nursing care and the external resources from the government and designated hospitals for COVID-19 treatment are generally equivalent. Therefore, the personal resources and core individual characteristics associated with the MWL of frontline nurses might be essential for identifying the subtypes. Current studies predominantly address several sociodemographic variables that influence nurses' MWL, including living conditions, financial status (Moloney et al., 2018) and work experience (Hegney et al., 2019; Kallberg et al., 2017). Regarding the internal psychological and behavioural factors that reflect personal resources, psychological capital (PsyCap) and coping style were also a focus of this study, following a previous study (Liling, 2019).

PsyCap is recognized as a personal resource that predicts nurses' mental health and work performance (Boamah & Laschinger, 2015). It is an individual, positive, motivational propensity that accrues through positive psychological characteristics such as self-efficacy, optimism, hope and resilience (Fred Luthans et al., 2007). The development of PsyCap promotes psychological well-being and effective work performance (Fred Luthans & Youssef, 2004). Therefore, exploring the features of PsyCap in relation to different facets of MWL in pandemic frontline nurses could identify target populations for precise intervention. Coping style is another internal factor that reflects personal resources related to MWL; it is defined as the set of cognitive and behavioural strategies used by an individual to manage the internal and external demands of stressful situations (Folkman & Moskowitz, 2004). In contrast with the traditional classification of positive and negative coping, Gou et al. recommended six dimensions of coping, including avoidance or self-accusation, emotional distress alleviation, social support seeking, positive reinterpretation and behavioural disengagement (Gou et al., 2006), which provide more specific information for describing MWL subtypes.

The main hypotheses of this study were as follows: (a) the level of MWL of nurses aiding in Wuhan during the COVID-19 pandemic is high; (b) different subtypes of MWL exist among these nurses; and (c) the sociodemographic characteristics, level of PsyCap and coping style of the subtypes are different among the subgroups. Testing the three hypotheses will increase the understanding of the MWL of nurses aiding in a pandemic and permit more targeted guidance for developing interventions to facilitate the physical and mental well-being of nurses and the quality of care in the COVID-19 pandemic.

2 | THE STUDY

2.1 | Aims

The aim of this study is to investigate the level of MWL among nurses aiding in Wuhan during the COVID-19 pandemic, identify the subtypes of MWL among nurses and explore the characteristics of different MWL clusters in terms of sociodemographic factors, PsyCap and coping style.

2.2 | Design

A cross-sectional self-report study design was conducted.

2.3 | Sample/participants

Frontline nurses were recruited in a tertiary hospital in Wuhan, which was redesigned to provide health care to patients infected with COVID-19. There were 1,120 frontline nurses from 12 provinces at this hospital. Of the 1,120 nurses approached, 477 were interested in this study and completed the questionnaires.

2.4 | Data collection

Data were collected from March 8 to 19, 2020 through an online questionnaire platform called *Wenjuanxing* (www.wjx.cn), on which only a fully completed questionnaire can be uploaded. Initial permission was sought and obtained from various department heads and hospital administrators before the release of the recruiting information and questionnaire. The frontline nurses reported their sociodemographic characteristics, MWL, PsyCap and coping style. We discontinued data collection when the data were not uploaded in 7 days. Participants in this study was entirely voluntary.

2.4.1 | Sociodemographic characteristics

A sociodemographic questionnaire was designed to collect information on characteristics including gender, age, marital status, financial status, education, clinical experience (years of clinical practice and professional title) and practice department.

2.4.2 | Measurement of mental workload

MWL data were obtained using the Chinese version of the National Aeronautics and Space Administration Task Load Index (NASA-TLX) (Hart & Staveland, 1988). The NASA-TLX is a well-validated and widely used measure in human factors and ergonomics that comprises six subscales or dimensions regarding different aspects of workload (mental demands, physical demands, temporal demands, performance, effort and frustration). The Chinese version was translated by Liang et al. (Liang et al., 2019); in this version, the items are rated on a 20-point bipolar scale that ranges from 0 to 100. For five of the six dimensions, i.e., mental demands, physical demands, temporal demands, effort and frustration, a score of 0 indicates the lowest task load; however, the performance dimension is reverse-scored, with 0 indicating the most successful performance of the task and the highest level of satisfaction with one's performance. The Cronbach's α of the total Chinese version of the scale is 0.707 (Liang et al., 2019). In this study, we used the total (mean) MWL score rather than the weighted workload score.

2.4.3 | Measurement of psychological capital

PsyCap was measured using the 24-item Psychological Capital Questionnaire (PCQ-24) developed by Luthans (Luthans et al., 2007), which consists of the four subscales of self-efficacy, hope, optimism and resilience. All items are scored on a 6-point Likert scale where 1 indicates strong disagreement and 6 indicates strong agreement. The Chinese version of the PCQ-24 has been widely used and has shown satisfactory reliability and validity. The current Cronbach's α of the total scale is 0.93 (Pan et al., 2017).

2.4.4 | Measurement of coping style

The Chinese version of the Coping Style for Nurses scale was used to assess the attitudes and behaviours of individuals during stressful events; the scale contains 30 items. All items are scored on a 5-point Likert scale where 0 is 'never' and 4 is 'always'. The scale is composed of six subscales, namely, problem solving, avoidance or self-accusation, emotional distress alleviation, social support seeking, positive reinterpretation, and behavioural disengagement. A high score on a certain subscale reflects a strong propensity to adopt the corresponding coping style. The Cronbach's α of the total scale of the Chinese version is 0.867 (Gou et al., 2006).

2.5 | Ethical considerations

Guided by the 2000 Declaration of Helsinki for ethical standards, the protocol was approved by the Committee on the Ethics of Medical Research of Navy Medical University (no. NMUMREC-2020-GZR-H-S-003). Informed consent was provided to the participants prior to their participation. The survey was anonymous, and confidentiality of the information was assured.

2.6 | Validity and reliability

The psychometric properties of the measurement tools have been described above.

2.7 | Statistical analysis

Exploratory LPA using Mplus Software (version 7.0) was performed to identify clusters based on the six subscales. Data for the six dimensions were entered into the LPA, with one class initially and additional classes added incrementally, until a unique solution could not be determined with maximum likelihood methods. The fit indices were examined. The Akaike information criterion (AIC) (Akaike, 1978), Bayesian information criterion (BIC) and sample-size-adjusted BIC (aBIC) were applied, with the lowest value indicating the best fit (Stanley, 1987). The Lo-Mendell-Rubin (LMR) adjusted likelihood ratio test and bootstrap likelihood ratio test (BLRT) were used to assess the *p*-values in the comparisons between models (Lo et al., 2001). A low *p*-value indicates that the k-class model fits the data better than the k-1-class model. In addition, entropy values, which range from 0 to 1, were used to evaluate the separability of each LPA solution; values closer to 1 represent a better separation of the classes (Ramaswamy et al., 1993). To test the differences between sociodemographic and occupational characteristics and to determine the psychological characteristics of the subtypes based on LPA, SPSS 21.0 was used, and all statistical tests were two-sided ($\alpha = 0.05$). The statistical methods included descriptive statistical calculations (e.g., percentage, minimum, maximum, mean and standard deviation), and Student's *t* test, a one-way ANOVA or a chi-square (χ^2) test were used to compare the variables.

3 | RESULTS

3.1 | Participant characteristics

In total, 477 nurses participated, and after non-frontline nurses (31 nurses) were excluded, the number of valid responses was 446 (93.50%) without any missing data. Overall, 90.81% of the nurses (*n* = 405) were female, and 50% of the participants (*n* = 223) ranged in age from 31–40 years. The sociodemographic characteristics of the participants are shown in Table 1. Among the 446 frontline nurses, the NASA-TLX scores ranged from 20–100, and the mean score was 65.90 (*SD* = 12.71). The PsyCap scores ranged from 57–144 with a mean score of 111.06 (*SD* = 14.07), and the coping style score ranged from 0.33–4 with a mean score of 2.56 (*SD* = 0.73). The minimum, maximum and mean scores and standard deviations for the measurements of MWL, PsyCap, coping style and their dimensions are shown in Table 2.

3.2 | Exploratory latent profile analysis

The best fitting LPA was the three-class model (Table 3), which had the lowest AIC (23,681.549), BIC (23,788.158) and aBIC (23,705.645). The *p*-values of the LMR test (0.0476) and BLRT (<0.001) suggest that this model was statistically significant at the $\alpha = 0.05$ level. Figure 1 shows the subtypes of nurses (*Classes 1*, *2* and *3*), their proportion (8.6%, 35.3%, 56.1%, respectively), and the mean levels of the different dimensions of MWL, which can be distinguished as having relatively low (*Class 1*), medium (*Class 2*) and high (Class 3) MWL levels. The diagrams for *Classes 3* and *2* shared similar patterns for the six dimensions of the NASA-TLX. *Class 3* presented the highest task load and highest self-evaluation of performance (named the 'high workload & high self-evaluation' subtype). However, the mean level of the frustration dimension was the highest in *Class 3* when compared with that of the other classes. *Class 2* demonstrated medium levels of the six workload dimensions (named the 'medium workload & medium self-evaluation' subtype). Notably, *Class 1* had the lowest scores in task load and the lowest level of satisfaction with performance (named the 'low workload & low self-evaluation' subtype).

3.3 | Characteristics of the different classes

Tables 4 and 5 present the differences in MWL according to the sociodemographic and psychological characteristics, respectively, of the three classes. When compared with *Class 1* concerning the sociodemographic characteristics, nurses in *Classes 2* and *3* tend to be those who live with family members and have more years of

TABLE 1 Sociodemographic and occupational characteristics of the nurses

Characteristic	Number (%)
Overall	446 (100.00)
Gender	
Man	41 (9.19)
Woman	405 (90.81)
Age, y	
20–30	196 (43.95)
31–40	223 (50.00)
>40	27 (6.05)
Marital status	
Unmarried	146 (32.74)
Married	289 (64.80)
Other	11 (2.47)
No. of children	
0	170 (38.12)
1	210 (47.09)
>1	66 (14.80)
Living status	
With family	296 (66.37)
Alone	102 (22.87)
Shared accommodations	48 (10.76)
Years of clinical practice	
0–5	105 (23.54)
6–10	174 (39.01)
11–15	74 (16.59)
16–20	70 (15.70)
>20	23 (5.16)
Educational level	
<Undergraduate	46 (10.31)
≥Undergraduate	400 (89.69)
Professional title	
Junior	297 (66.59)
Intermediate	138 (30.94)
Senior	11 (2.47)
Personal income, thousand/y (RMB)	
<110	120 (26.91)
110–150	185 (41.48)
160–200	104 (23.32)
>200	37 (8.30)
Practice department	
General unit	137 (30.72)
Intensive care unit	267 (59.87)
Others	42 (9.42)
Working position	
Management	57 (12.78)
Nonmanagement	389 (87.22)
Aiding experience	
No	408 (91.48)
Yes	38 (8.52)

clinical practice, intermediate or senior professional titles, higher incomes and management positions during frontline aid work. Concerning the differences in the PsyCap among the groups, *Class 3* showed the highest level of PsyCap and more positive coping styles.

4 | DISCUSSION

4.1 | Key findings

To our knowledge, this is the first study to explore clusters of frontline nurses with MWL in the COVID-19 pandemic. The investigation showed a medium level of MWL with a relatively higher performance and lower frustration compared with other studies. LPA identified three different classes based on the model accuracy indices and regarding reflection on the content. The three classes can be separated from one another by a relatively low, medium and high MWL level, and the nurses with a high MWL represented more than half of the total sample. *Class 3*, accounted for the majority of sample, had the highest task load but the best self-evaluated performance, which could be the important workforce in health care in public health emergency. *Class 1* had the lowest task load level but the worst self-reported performance, which indicates a major concern that should be focused on.

4.2 | Mental workload of frontline nurses

In this study, the total mean MWL score was 65.90 (*SD* 12.71), which indicates a medium level of MWL. The classes divided by the LPA showed that the total mean MWL score in *Class 3* (which accounted for 56.96% of the total sample) was 73.59 (*SD* 8.86), which suggests a much lower level of MWL than the MWL reported not only in a study conducted by Habibi et al. (Habibi et al., 2015) with nurses in Iran (77.7 ± 12.6) but also in a study by Sönmez et al. (Sönmez et al., 2017) with nurses in Turkey (80.48 ± 11.76) and in a study conducted by Liang et al. (Liang et al., 2019) with nurses in China (80.91 ± 5.95). Regarding the objective workload, during the data collection period, the number of existing confirmed patients in Wuhan was 12,358–16,627, which included 3,793–4,735 cases of severe illness (National Health Commission of the People's Republic of China, 2020a). The routine care for pandemic control was developed in March and included a time arrangement of 4–6 h per work day and 2 days off per week. During the workhour, one nurse would take care of two to three patients, which was consistent with the

TABLE 2 Mean mental workload, psychological capital and coping strategy scores (n = 446)

Variables	Dimensions	Minimum	Maximum	Mean	*SD*
MWL	Mental demands	10	100	71.30	22.64
	Physical demands	10	100	87.19	17.69
	Temporal demands	0	100	74.66	21.58
	Performance	0	100	35.47	30.50
	Effort	10	100	84.46	17.99
	Frustration	0	100	42.34	28.23
	Total	20	100	65.90	12.71
PsyCap	Self-efficacy	10	36	28.37	4.45
	Hope	11	36	28.55	4.29
	Optimism	15	36	27.84	3.94
	Resilience	13	36	26.30	3.72
	Total	57	144	111.06	14.07
Coping style	Problem solving	0.86	4	2.87	0.63
	Avoidance or self-accusation	0	4	1.31	0.69
	Emotional distress alleviation	0.6	4	2.42	0.68
	Social support seeking	1	4	2.51	0.67
	Positive reinterpretation	1	4	2.97	0.71
	Behavioural disengagement	0.33	4	2.59	0.73

Abbreviations: MWL, Mental Workload; PsyCap, Psychological Capital.

TABLE 3 Latent profile analysis models and fit indices

Model	k	AIC	BIC	aBIC	Entropy	LMR *p*-value	BLRT *p*-value
1	12	24,303.351	24,352.555	24,314.472	–	–	–
2	19	23,862.948	23,940.854	23,880.556	0.818	0.019	<0.001
3	26	23,681.549	23,788.158	23,705.645	0.815	0.0476	<0.001
4	33	23,532.397	23,667.708	23,562.980	0.868	0.7015	<0.001

Abbreviations: aBIC, Sample-size-adjusted Bayesian Information Criterion; AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; BLRT, Bootstrap Likelihood Ratio Test; LMR, Lo-Mendell-Rubin Adjusted Likelihood Ratio Test.

data reported in recent study (Wu, Wang, et al., 2020). However, the objective workload might be increased because personal protective equipment may increase the difficulty of care. Although the challenges of potential infection and high work stress due to the influx of suspected and confirmed cases of COVID-19 might seem sufficiently severe to increase the MWL of frontline nurses (Chen et al., 2020), the survey showed a different result.

However, as the graphs in the three-class model show, the scores for the dimensions of performance and frustration in this study were much lower than the other dimension scores in each subgroup, which contributed to the overall lower MWL than that reported in previous studies (Liang et al., 2019; Sönmez et al., 2017). The possible reason for the high self-evaluation of performance under an extremely intensive task load might be that the frontline nurses in this study were quite competent and confident in the task of nursing, which is supported by the finding from Wu et al. that HCPs were relatively well-informed about the professional knowledge related to the COVID-19 pandemic in March (Wu, Zhang, et al., 2020). Another possible reason might be that the sense of honour and responsibility (domains of self-affirmation) in frontline nurses motivated them to succeed. Research provides extensive evidence on the positive effects of self-affirmation on personal achievements and performance outcomes (Sönmez et al., 2017).

4.3 | Sociodemographic characteristics of the different classes

Regarding the significant differences in the sociodemographic characteristics among the classes, *Class 1* (overall mean MWL score of 44.03 ± 8.18, performance mean score of 47.57 ± 24.71) was

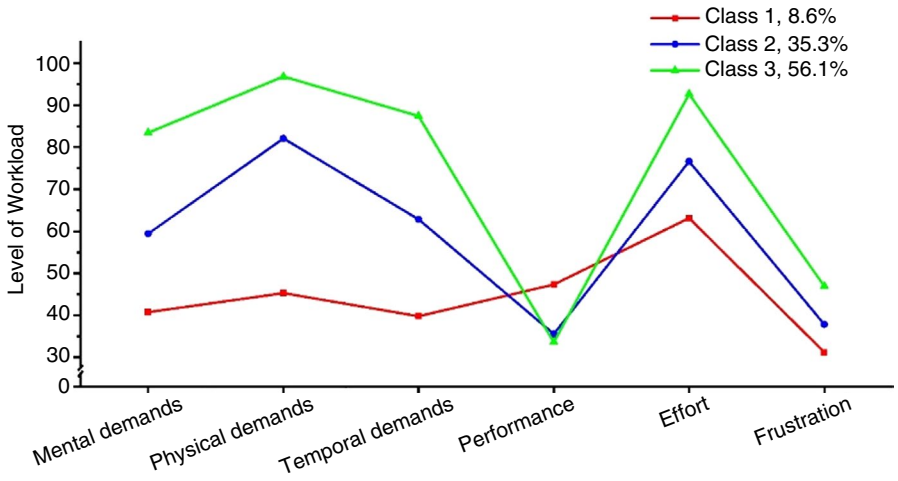

FIGURE 1 The latent profiles of the NASA-TLX dimensions

referred to as the 'low workload & low self-evaluation' subtype, as these individuals tended to have shared accommodations, fewer years of practice, junior professional titles, lower incomes and non-management working positions. The majority of nurses with these characteristics represents novices in the nursing profession with a lower economic status. Usually, the main work for novices would be less challenging or completed under the guidance of senior nurses to reduce novices' burnout and errors that result from a heavy workload (Ceballos-Vásquez et al., 2015). Therefore, among the three classes, *Class 1* had the lowest mean MWL score in this study. However, the mean self-reported work performance score was the highest for this class, which indicates that these nurses were the least successful in their performance or the least satisfied with their performance. One of the reasons might be that they were less experienced or inadequately prepared before aiding in the COVID-19 pandemic, which identifies the importance of training before participating in aid work (Mohamadi et al., 2019). Another possible reason is that they may not have met their own lofty expectations for pandemic control performance. However, their level of frustration was low (30.541 ± 21.660). It can be speculated that the physical and psychological stress during COVID-19 aid work may not result in job burnout; however, job burnout in frontline nursing has been reported in other countries (Rajkumar, 2020).

According to the diagrams for *Classes 2* and *3* of the LPA model, both classes showed a similar pattern for the six dimensions of the NASA-TLX. *Class 3* showed the lowest score in the performance dimension and the highest task load, i.e., the 'high workload & high self-evaluation' subtype (overall mean MWL score of 73.586 ± 8.860, performance mean score of 33.780 ± 32.796). *Class 2* showed a medium level for all MWL dimensions, i.e., the 'medium workload & medium self-evaluation' subtype (overall mean MWL score of 58.538 ± 7.440, performance mean score of 35.355 ± 27.161). The majority of nurses in the two classes shared the characteristics of living with family members and having more years of clinical practice, intermediate or senior professional titles, higher incomes and management positions during frontline aid work, which shows that these individuals were senior professionals who generally took on more challenging frontline tasks. Notably, 71.65% of the nurses in *Class 3* were living with family members before aiding on the frontline, who could be a good source of support; a previous study on the factors associated with MWL and work performance has reported that social support is one of the essential protective factors of work performance (Young et al., 2015).

4.4 | Psychological factors of the different classes

Concerning the differences in the PsyCap among the groups, *Class 3* showed the highest level of PsyCap, which confirms the association between MWL and PsyCap, especially in the domains of self-efficacy, hope and optimism. Previous studies have found that nurses are willing to provide care during a pandemic because of their commitment as HCPs (Wong et al., 2008). Willingness and motivation can positively influence nurses' self-efficacy and ability to work to provide aid during a pandemic (McMullan et al., 2016). In this study, the frontline nurses were all volunteers; apart from professional responsibility and personal dedication, government policies on extra compensation and special recognition might have been positive motivators, which has also been reported in other epidemics (Khalid et al., 2016; Simonds & Sokol, 2009). Moreover, a previous study has also reported that a positive attitude towards success (optimism and hope) can ease the stress of HCPs and improve their work performance (Khalid et al., 2016), which may explain the relationship between PsyCap and MWL in this study. However, the domain of resilience did not show significant differences among the groups in this study, and the reason for this might be determined by the characteristics of resilience. Resilience is defined as a positive coping and adaptation mechanism in the face of significant risk, conflict, failure, or even positive change and progress (Luthans, 2002); it is recognized as a state-like variable more than a trait-like construct. Therefore, it might take time to adapt to intensive frontline care and 'bounce back' from adverse events. Consequently, significant differences in resilience were not observed among the groups at the time of this study.

Given the differences in the MWL and coping styles among the three classes, the results show significant differences in the domains of problem solving, emotional distress alleviation and positive reinterpretation

TABLE 4 Comparison of the mental workload of the classes by sociodemographic variable

Characteristics	Class 1 (*n* = 37)	Class 2 (*n* = 155)	Class 3 (*n* = 254)	χ^2	*p*-value
Gender					
Man	2 (5.41%)	17 (10.97%)	22 (8.66%)	5.746	0.057
Woman	35 (94.59%)	138 (89.03%)	232 (91.34%)		
Age, y					
20–30	22 (59.46%)	75 (48.39%)	99 (38.98%)	5.571	0.160
31–40	26 (70.27%)	69 (44.52%)	141 (55.51%)		
>40	6 (16.22%)	11 (7.10%)	14 (5.51%)		
Marital status					
Unmarried	14 (37.84%)	63 (40.65%)	69 (27.17%)	8.494	0.075
Married	22 (59.46%)	89 (57.42%)	178 (70.08%)		
Other	1 (2.70%)	3 (1.94%)	7 (2.76%)		
No. of children					
0	16 (43.24%)	68 (43.87%)	86 (33.86%)	1.981	0.289
1	15 (40.54%)	68 (43.87%)	127 (50.00%)		
>1	6 (16.22%)	19 (12.26%)	41 (16.14%)		
Living status					
With family	22 (59.46%)	91 (58.71%)	182 (71.65%)	19.046	<0.001**
Alone	3 (8.11%)	44 (28.39%)	52 (20.47%)		
Shared accommodations	9 (24.32%)	20 (12.90%)	19 (7.48%)		
Years of clinical practice					
0–5	15 (40.54%)	44 (28.39%)	46 (18.11%)	67.511	<0.001**
6–10	12 (32.43%)	63 (40.65%)	99 (38.98%)		
11–15	5 (13.51%)	18 (11.61%)	153 (20.16%)		
16–20	3 (8.11%)	22 (14.19%)	45 (17.72%)		
>20	2 (5.41%)	8 (5.16%)	13 (5.12%)		
Educational level					
<Undergraduate	5 (13.51%)	19 (12.26%)	22 (8.66%)	1.793	0.408
≥Undergraduate	32 (86.49%)	136 (87.74%)	232 (91.34%)		
Professional title					
Junior	28 (75.68%)	112 (72.26%)	157 (61.81%)	9.466	0.050
Intermediate	9 (24.32%)	42 (27.10%)	87 (34.25%)		
Senior	0 (0.00%)	1 (0.65%)	10 (3.94%)		
Income, thousand/y (RMB)					
<100	16 (43.24%)	46 (29.68%)	58 (22.83%)	23.670	<0.001**
101–150	12 (32.43%)	78 (50.32%)	95 (37.40%)		
151–200	8 (21.62%)	21 (13.55%)	74 (29.13%)		
>200	1 (2.70%)	10 (6.45%)	26 (10.24%)		
Practice department					
General unit	14 (37.84%)	48 (30.97%)	75 (29.53%)	5.108	0.276
Intensive care unit	22 (59.46%)	96 (61.94%)	149 (58.66%)		
Others	1 (2.70%)	11 (7.10%)	30 (11.81%)		
Working position					
Management	1 (2.70%)	18 (11.61%)	76 (29.92%)	20.611	<0.001**
Nonmanagement	36 (97.30%)	137 (88.39%)	216 (85.04%)		
Aiding experience					
No	34 (91.89%)	141 (90.97%)	233 (91.73%)	0.081	0.960
Yes	3 (8.11%)	14 (9.03%)	21 (8.27%)		

*$p < .05$, **$p < .01$.

TABLE 5 Comparison of the different classes by mental workload, psychological capital and coping strategy

		Class 1 (n = 37)		Class 2 (n = 155)		Class 3 (n = 254)			
Variables	**Dimensions**	**Mean**	***SD***	**Mean**	***SD***	**Mean**	***SD***	***F***	***p*-value**
MWL	Mental demands	40.68	20.66	58.58	18.83	83.52	15.46	165.98	<0.001**
	Physical demands	44.60	13.71	81.10	12.80	97.11	6.08	524.47	<0.001**
	Temporal demands	38.38	19.15	61.71	15.13	87.85	12.54	298.38	<0.001**
	Performance	47.57	24.71	35.36	27.16	33.78	32.80	3.337	<0.05*
	Effort	62.43	23.91	76.19	18.16	92.72	10.30	103.43	<0.001**
	Frustration	30.54	21.66	38.29	23.82	46.54	30.68	7.87	<0.001**
	Total	44.03	8.18	58.56	7.44	73.59	8.86	295.62	<0.001**
PsyCap	Self-efficacy	28.24	4.63	27.52	4.64	28.92	4.23	4.87	<0.05*
	Hope	28.70	4.38	27.85	4.32	28.95	4.23	3.20	<0.05*
	Optimism	27.65	3.92	27.27	3.83	28.22	3.99	3.20	<0.05*
	Resilience	25.84	3.17	25.88	3.57	26.61	3.86	2.17	0.115
	Total	110.43	13.96	108.52	14.15	112.70	13.86	4.35	<0.05*
Coping style	Problem solving	2.73	0.59	2.74	0.66	2.97	0.59	8.09	<0.001**
	Avoidance or self-accusation	1.17	0.72	1.28	0.65	1.35	0.71	1.26	0.285
	Emotional distress alleviation	2.25	0.61	2.35	0.69	2.49	0.68	3.35	<0.05*
	Social support seeking	2.46	0.67	2.43	0.65	2.57	0.67	2.36	0.096
	Positive reinterpretation	2.89	0.72	2.85	0.72	3.05	0.69	4.17	<0.05*
	Behavioural disengagement	2.47	0.73	2.60	0.74	2.59	0.73	0.52	0.596

*p < .05, **p < .01.

among the three classes. The efficient resolution of the wide array of problems encountered in pandemic health care is the main factor that helps ease MWL, which is consistent with the findings in our study that the performance dimension score predicted the overall level of MWL. In addition, as reported in previous studies on other epidemics, the anxiety and distress felt by frontline HCPs are common and can result in a compromised quality of care and long-term psychological outcomes of HCPs (Khalid et al., 2016; Lai et al., 2020; Lin et al., 2007). Therefore, efficient and positive coping strategies such as emotional distress alleviation and positive reinterpretation can help decrease MWL. In contrast, coping styles such as avoidance or self-accusation and behavioural disengagement are negative behaviours, and they were observed to be at low levels in the three classes in this study. However, there were no differences in the domain of social support seeking among the three classes, which might be because support (especially in terms of medical supplies) from local hospitals and the government on the frontline was sufficient in March, and mental health and psychosocial support provided by psychologists was accessible.

4.5 | Limitations

This study has several limitations. (a) We employed an online questionnaire platform to recruit participants and collect data. The number of delivered questionnaires and the differences between the participating nurses and the nurses rejecting participation were unclear. The convenience sample may have limited the generalizability of our conclusions. (b) The sample size in this study did not permit conducting a multinomial logistic regression analysis to explore the characteristics of the subgroups, which might have weakened the confidence of the influencing factors among the groups. (c) The use of self-reported measures might have resulted in common-method variance and social desirability bias. In addition, the factors considered to differentiate the three subgroups (living conditions and work experience) were assessed using three single items in the sociodemographic questionnaire, which may not have sufficiently reflected the multiple facets of the factors. Therefore, validated instruments are recommended in future studies.

5 | CONCLUSION

In this survey study, frontline nurses reported high levels of task load but good self-evaluated performance and low frustration. Their profiles differed primarily in professional experience. The current data provide evidence to focus more on the work pressure and psychological well-being of junior nurses. Further research on regular training programs is needed to improve novices' knowledge and skills regarding public health emergency. Research on facilitating the PsyCap level and positive coping styles could be considered, and social support could be enhanced to promote work performance. As for the senior professionals, future practice could involve a major proportion of these nurses for successful frontline aid.

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CONFLICTS OF INTEREST

No conflict of interest has been declared by the authors.

AUTHOR CONTRIBUTIONS

Concept and design: Xuchun Ye, Yawei Shan. Acquisition of the data: Deying Hu, Gendi Lu, Yawei Shan. Analysis and interpretation of the data: Yawei Shan, Jing Shang, Yan Yan. Drafting of the manuscript: Yawei Shan. Critical revision of the manuscript: Xuchun Ye, Deying Hu.

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