

Analysis of Factors Affecting Psychological Resilience of Emergency Room Nurses Under Public Health Emergencies

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Abstract

Resilience is essential for frontline health workers to cope with the unfavorable situations, especially under public health emergencies. Emergency room (ER) nurses are a special cohort of health professionals that may present moderate level of resilience. This study aimed to identify factors that are correlated with resilience in this special cohort to provide directions for intervention and management. ER nurses that have encountered a public health emergency within 3 months were recruited using purposive sampling and snowball technique for the study. Questionnaires, including Connor-Davidson Resilience Scale (CD-RISC), Zung Self-Rating Depression Scale (SDS), and Maslach Burnout Inventory-Human Services Survey (MBI-HSS) were established, followed by an in-depth interview to identify different clusters of themes. Thirteen ER nurses were recruited, and the average CD-RISC score was 66 ± 21 . Resilience was negatively correlated with SDS index, and positively correlated with personal accomplishment. Five clusters of themes were identified from in-depth interviews, including physical tolerability, psychological tolerability, tenacity of internal drive, institutional implementation, and external adjustment. This study identified factors associated with resilience in ER nurses under public health emergencies, providing useful information for future directions for intervention.

Keywords

resilience, ER nurses, questionnaires, in-depth interview, clusters of themes

What do we already know about this topic?

Emergency room (ER) nurses have been shown to present moderate level of resilience. Maintaining an optimal level of resilience is crucial for frontline health workers, especially under public health emergencies. At present, only a limited number of studies have been carried out to examine factors associated with psychological resilience for ER nurses.

How does your research contribute to the field?

The study identified factors associated with psychological resilience in ER nurses, and provided useful information on the special cohort, where limited number of studies have been carried out to address the issues. In addition, it also added valuable information to make strategies for interventions.

What are your research's implications toward theory, practice, or policy?

The study added novel knowledge to understanding of psychological resilience in ER nurses, and provided potential directions for future interventions.

Introduction

Resilience is an individual's quality and ability to adapt with adverse environment, and maintain physical and mental health under stressful events.¹⁻³ Previous studies have shown its effects on work performance, job satisfaction and work commitment,⁴⁻⁶ and it is crucial in a medical ward, as it indicates how well nurses could cope with stress.⁷⁻⁹ Improvement

of resilience is crucial for reducing retention and stress,⁹ and may protect against mental health issues,¹⁰ as well as reduce burnout and maintain retention.^{7-9,11} Nurses working in emergency room (ER) are generally facing more challenges, both physically and mentally, as they frequently encounter unpredictable circumstances, such as public health emergencies. Nursing professionals working in hospital emergency units tend to demonstrate intermediate resilience,¹² yielding an



urgent need for better understanding of factors associated with resilience. In addition, as for frontline healthcare professionals, high resilience may enhance nurses' ability to cope with work-related stress and prevent burnout as well as potential mental problems,^{7,8} and is associated with positive coping style.^{13,14} Therefore, analyzing factors associated with high or low resilience are crucial in improving ER nurses' overall fitness and assist with better nursing management and maintenance of nurse retention.

A public health emergency is a situation when its health-related consequences may affect the community to the extent that it could not cope with,¹⁵ and examples include an outbreak of a major disease of unknown cause, major infectious disease, significant food or occupational poisoning. Under such emergencies, such as the recent coronavirus disease of 2019 (COVID-19) pandemics, the frontline healthcare workers are facing more stress, fatigue, burnout, anxiety, and depression.¹⁶⁻¹⁸ Therefore, resilience plays a crucial part in healthcare professionals, as low resilience may be related with more anxiety and stress when facing the dynamic and complex situations,¹⁹ while higher resilience may protect mental health and reduce burnout.^{10,11}

Previous studies have shown that ER nurses showed moderate level of resilience,¹² indicating a special need to improve understanding of factors impacting resilience in the cohort. Understanding factors associated with resilience status may provide better insight into the causes of reduced resilience, and point to potential directions for interventions.

Though various studies have explored factors associated with resilience status in different cohort in frontline workers including nurses, at present, only a few studies have been carried out in ER nurses. Existing studies on psychological resilience exclusively in ER nurses frequently focused on single and limited number of aspects only, such as burnout,²⁰ moral distress,^{21,22} job satisfaction,²² as well as fear and anxiety for the current COVID-19,²³ or focused on a specific public health emergency, such as the COVID-19 pandemic.²⁴ This study utilized quantitative and qualitative methods using construction-grounded theory (CGT) approach to analyze factors associated with resilience in ER nurses when facing public health emergencies, and to provide a basis for the development of interventions that may assist ER nurses

to maintain physical and mental health, as well as to cope better as key participants in public health emergencies.

Materials and Methods

Population

This study was reviewed and approved by the Ethics committee of Shanghai Zhoupu Hospital (reference number: 2020-C-081-E01). The written informed consent was obtained from each subject prior to study initiation. ER nurses from 5 tertiary hospitals, and who have experienced public health emergencies, were recruited between January 2021 and April 2021 with the following criteria: (1) hold a Nurse Practitioner Certificate; (2) has been working as an ER nurse for 1 year or over; (3) has experienced and participated in response to a public health emergency within 3 months before recruitment; (4) gave informed consent and participated voluntarily. ER nurses were excluded when: (1) absent from the position due to continuing education, sick leaves, maternity leaves or other reasons; (2) present neurasthenia or severe sleep disturbances; (3) has experienced significant stress from major life events within 3 months before recruitment.

Study Design

Following recruitment, participants were first asked to complete a series of questionnaires, including the Chinese version of Connor-Davidson Resilience Scale (CD-RISC),²⁵ Zung Self-Rating Depression Scale (SDS), and Maslach Burnout Inventory-Human Services Survey (MBI-HSS). Following completion of questionnaires, an in-depth interview was carried out for each participant. CGT approach was applied. CGT is an approach where theory is developed along the process.²⁶ The approach allowed data collection and analyses at the same time.²⁷ The method has been previously performed in the investigation on nurses in an ER setting.³ The participants were recruited using purposive sampling to increase the depth of understanding,²⁸ and snowball technique was utilized to enrich samples from this specific population of interest,²⁹ which consist of participants with

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high-resilience and non-high-resilience. Data collection was continued until saturation was reached.³⁰

Data Collection

The structure and components of the interview were developed based on literature review and consultation with specialists in nurse management. The interviews were carried out by 2 investigators, with 1 holding a background of psychological education and more than 5 years of work experience. Participants were interviewed onsite in a quiet and private office in the hospital, with no interruptions during the interview. The purpose and methods of the study were explained to each participant, and informed consent acquired before the interview. Open-up questions were as follows: (1) How did you feel when facing public health emergencies? (2) What do you think are factors affecting your psychological resilience during public health emergencies? (3) How do you solve an issue when it raised? (4) How will you seek help from others? (5) How do you adjust yourself when there is a need?

The interview lasted 20 to 40 min, and was audio recorded throughout the process. During the interview, participants' nonverbal behaviors, such as facial expressions and gestures were observed and recorded.

Questionnaires including CD-RISC, SDS, and MBI-HSS were completed by participants on day of interview. The CD-RISC consists of 25 items evaluated on a 5-point Likert scale as follows: 0=not true at all; 1=rarely true; 2=sometimes true; 3=often true; 4=true nearly all the time. The scale presents good reliability, with higher scores indicating higher resilience.¹ The Chinese version of CD-RISC has been previously validated, with Cronbach's alpha being 0.75 for the full scale.²⁵ The SDS scale is composed of 20 items, using a 4-point Likert scale ranging from 1 to 4. SDS index was calculated as follows: $\text{SDS index} = \text{Raw score} \times 1.25$.³¹ The Cronbach's alpha for SDS has been previously reported to be 0.87.³² The MBI-HSS consists of 22 items, with scores ranging from 0 to 6, and includes 3 scales, namely emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA).³³ The Cronbach's alpha for MBI-HSS has been previously reported to be 0.7 or over.^{34,35}

Data Analysis

The total scores as well as the scores for subcategories were calculated. Data was analyzed using SPSS (Version 28). Descriptive analysis was initially carried out to determine the mean and standard deviation of CD-RISC. Participants were categorized into high resilience and non-high resilience according to criteria published previously.³⁶ In brief, high resilience was defined as resilience score \geq mean + 1 standard deviation (SD), while non-high resilience was defined as resilience score $<$ mean + 1 SD. Pearson's correlation was carried out to determine the association between resilience and other scales and parameters.

Audio recordings were transcribed into texts within 24h following the interviews. Transcripts were read carefully, and Colaizzi's method was used for qualitative data analysis, with 7 steps briefly as follows³⁷: (1) Read and reread participants' descriptions; (2) Extract significant statements; (3) Formulate meanings of the significant statements; (4) Categorize formulated meanings into clusters of themes; (5) Exhaustively describe the investigated phenomenon; (6) Return to participants for validation; (7) Incorporate changes based on participants' feedback into final description. Specifically, transcriptions were read carefully, and data was open coded initially and categorized through constant comparison and analysis. Subsequently, focused coding was performed, where the investigators grouped the open codings independently. When agreement between investigators were reached, theoretical coding was subsequently performed.

Trustworthiness

The trustworthiness was evaluated by applying Charmaz's criteria,³⁸ which covered aspects including credibility, originality, resonance and usefulness.³⁸ The rich data was generated with thick descriptions, and direct quotes from various participants were utilized to support commentary.³⁹ The rich data was peer-reviewed by a senior researcher to ensure credibility of the study. The abstracted categories were compared with literatures to determine whether novel concepts emerged. In addition, reflections from experienced researchers were also considered to determine the originality of the study.⁴⁰ Comments from other co-authors were collected to achieve resonance.⁴¹ The criteria for usefulness was considered to be met as the findings would add novel knowledge in nurse resilience in an ER setting. Therefore, the methodology of the study was considered rigorous.

Results

Demographics

Thirteen participants were recruited according to criteria described above. The average age was 34 ± 9 years, with 2 males and 11 females. The average work experience was 13 ± 10 years, while the average ER work experience was 9 ± 8 years. In the cohort, 4 participants were single, while 9 were married (Table 1).

CD-RISC, SDS Index, and MBI-HSS

The average CD-RISC score in the ER nurses participated was 66 ± 21 (range from 36 to 100 points), among which 3 participants were considered as presenting high resilience, indicating that the majority of emergency nurses were of moderate or low resilience, consistent with the previously reported study.¹² The average of SDS index was 49 ± 14 , and MBI-HSS was 49 ± 12 . Pearson's correlation revealed that resilience was negatively correlated with SDS index

Table 1. Demographics and Scales.

Case	Gender (F/M)	Age (Years)	Work years	ER years	Marital status (Y/N)	CD- RISC	Tenacity	Strength	Optimism	Zung SDS index	MBI-HSS	EE	DP	PA
N1	F	54	34	25	Y	70	36	25	9	41.25	39	10	1	28
N2	F	39	19	19	Y	68	38	23	7	52.50	66	31	8	27
N3	F	24	4	1	N	100	52	32	16	47.50	36	2	0	34
N4	F	42	18	6	Y	82	45	27	10	27.50	37	2	1	34
N5	F	39	13	4	Y	56	29	20	7	53.75	46	23	5	18
N6	F	27	8	8	Y	88	50	26	12	60.00	52	19	8	25
N7	F	34	15	5	Y	36	13	16	7	71.25	58	31	5	22
N8	M	22	1	1	N	53	23	18	12	35.00	36	11	0	25
N9	M	36	13	10	Y	90	47	32	11	28.75	46	6	1	39
N10	F	28	6	1	N	42	21	15	6	57.50	56	26	9	21
N11	F	45	27	22	Y	51	24	19	8	62.50	47	24	7	16
N12	F	31	10	8	Y	76	36	28	12	41.25	75	36	10	29
N13	F	24	4	1	N	41	19	16	6	58.75	40	17	7	16
Mean \pm SD		34 \pm 9	13 \pm 10	9 \pm 8		66 \pm 21	33 \pm 13	23 \pm 6	9 \pm 3	49.04 \pm 13.51	49 \pm 12	18 \pm 11	5 \pm 4	26 \pm 7

Note: ER = emergency room; CD-RISC = Connor-Davidson Resilience Scale; SDS = Self-Rating Depression Scale; MBI-HSS = Maslach Burnout Inventory-Human Services Survey; EE = emotional exhaustion; DP = depersonalization; PA = personal accomplishment.

Table 2. Pearson's Correlation Among Scales.

	CD-RISC	SDS	MBI-HSS total	EE	DP	PA
CD-RISC		$R = -.571$ $P = .042^*$	$R = -.122$ $P = .692$	$R = -.527$ $P = .064$	$R = -.364$ $P = .221$	$R = .817$ $P < .001^{***}$
SDS	$R = -.517$ $P = .042^*$		$R = .313$ $P = .298$	$R = .617$ $P = .025^*$	$R = .601$ $P = .030^*$	$R = -.758$ $P = .003^{**}$
MBI-HSS total	$R = -.122$ $P = .692$	$R = .313$ $P = .298$		$R = .872$ $P < .001^{***}$	$R = .785$ $P = .001^{**}$	$R = -.088$ $P = .776$
EE	$R = -.527$ $P = .064$	$R = .617$ $P = .025^*$	$R = .872$ $P < .001^{***}$		$R = .858$ $P < .001^{***}$	$R = -.547$ $P = .053$
DP	$R = -.364$ $P = .221$	$R = .601$ $P = .030^*$	$R = .785$ $P = .001^{**}$	$R = .858$ $P < .001^{***}$		$R = -.543$ $P = .055$
PA	$R = .817$ $P < .001^{***}$	$R = -.758$ $P = .003^{**}$	$R = -.088$ $P = .776$	$R = -.547$ $P = .053$	$R = -.543$ $P = .055$	

Note. CD-RISC = Connor-Davidson Resilience Scale; SDS = Self-Rating Depression Scale; MBI-HSS = Maslach Burnout Inventory-Human Services Survey; EE = emotional exhaustion; DP = depersonalization; PA = personal accomplishment.
* $P < .05$. ** $P < .01$. *** $P < .001$.

($R = -.571$, $P = .042$), and positively correlated with PA ($R = .817$, $P < .001$) (Table 2), indicating that depressive mood and PA presented a more direct correlation with psychological resilience in ER nurses.

Theme 1—Physical Tolerability

Under a public health emergency, the surge of patients inevitably induced increased workload, prolonged procedures and fatigue, which all challenged the physical tolerability of ER nurses, and subsequently, difficulties in adapting with the busy schedule and reduced resilience.

Workload. ER is generally featured for its busy routine, as it is the frontline for almost all kinds of medical emergencies, such as trauma, burning, drug abuse, toxic reagents ingestion, and infectious disease. The unpredictable conditions put much workload to the limited number of medical staff, introducing great challenge to the physical tolerability for the work. During a public health emergency, the number of patients inevitably surged, bringing heavy burden and challenging the physical tolerability of healthcare professionals. As an important member of frontline healthcare workers, ER nurses cover a great number of medical works, and therefore, are more frequently challenged during a public health emergency. For instance, during the COVID-19 pandemic, sudden multiplication of workload has been identified as a factor for psychological resilience of ER nurses.²⁴ The emergence of the situation challenged the physical tolerability, and subsequently made it harder for them to cope with the situation. In addition, the increased workload not only induced fatigue, but also directly affect physical health, for example, sleep disturbances. In the interview, almost all nurses highlighted that public health emergencies add extra pressure to the workload. Nurse N1 said,

We always face surge of patients in ER. For instance, in a case of toxicity ingestion, we had five patients coming at the same time, all in severe conditions and needed resuscitation. Even the surge of the small number increased our workload as we have limited number of staff. This shortage and workload pressure became more obvious under public health emergencies, for example, the ongoing COVID-19 pandemic, as it takes longer to take care of critically ill patients. A direct effect resulting from the workload is that many of us encountered sleep problems.

Prolonged procedures. Though ER is facing various types of emergencies, more attention needs to be paid when encountering an infectious disease that has not been well known. Under such conditions, precautions need to be made to ensure the safety of both patients and healthcare workers. This includes additional personal protective equipment, additional tests, as well as decontamination and handling of waste. These prolonged procedures increased time needed to perform procedures, which results in relative increase of workload. In addition, being unfamiliar with the procedures also affects psychological resilience.²⁴ In the interview, a majority of nurses mentioned that additional procedures were placed in public health emergencies. This reduced the relative efficiency of their work, and affected their ability to adjust with the changing environment. Nurse N4 said,

Take COVID-19 for example. First of all, the patients need to get a COVID test as well as other necessary tests as a precaution, which takes time for the result to return. In addition, we also need to wear additional PPEs and follow the steps to handle patients. This all takes longer for us to perform even the daily task, and load more stress.

Fatigue. Increasing workload and prolonged procedures challenged physical as well as mental health. The associated stress frequently leads to fatigue, and chronic fatigue has been

previously shown to predict lower work resilience in nurses.⁴² The feeling of helpless and fear, as well as physical exhaustion all reduced ER nurses' ability to cope with the changing environment in a public health emergency. The analysis of the present study revealed that fatigue also played a crucial part in psychological resilience in ER nurses. Nurse N3 said,

As patient number surges after COVID test, the workload increases greatly. In addition, there are also other tasks, which further increased our workload. We are always short of hands, as many patients need extra care during the pandemic. So sometimes we feel tired and even exhausted.

In summary, physical tolerability was identified in psychological resilience in ER nurses. This issue stood out particularly during a public health emergency. Though prolonged procedures are essential under such conditions, and adjustments may not be practical, strategies such as increasing staffing levels⁴³ may be developed to reduce workloads for these nurses.

Theme 2—Psychological Tolerability

Psychological tolerability plays a crucial part in different aspects in work and life. The psychological vulnerability is more obvious for ER nurses under public health emergencies, and subsequently affects level of resilience.

Affected mental health. Mental health status was greatly involved in maintaining daily activities and abilities to cope with stress. Investigation on nurses under COVID-19 pandemic revealed an increased risk of developing depression in this cohort.⁴⁴ Given that depression was more likely to be present in healthcare workers with lower resilience,⁴⁵ it might be hypothesized that depression was potentially a factor for psychological resilience in nurses. The present study showed that the average SDS index was relatively high within the normal range, and was negatively correlated with resilience, further supporting the importance of mental health in maintaining resilience. Depression is not the only type of mental problem encountered in ER nurses during a public health event. In fact, higher anxiety tended to be present in nurses with lower resilience.⁴⁶ During the interviews of the present study, many nurses mentioned the feeling of anxiety and depression that affected their coping ability, which reflects their level of resilience, as Nurse N10 said,

When I've been working for a longer time, handling more patients, or doing more shifts, I would feel exhausted. Sometimes this might lead to a low mood, or affect my sleep. Occasionally there would be a time that I felt I couldn't cope anymore.

Pessimistic personality. Personality is another aspect that have been previously considered to be a crucial factor affecting resilience. Optimism has been previously shown to correlate with resilience.^{47,48} Typically, an optimistic person tends to think more positively about issues that occurred, and would

seek for solutions more actively. This in turn brought more opportunities in solving a problem. In contrast, pessimistic people tend to think negatively, and suffered more from the negative thinking in a public health emergency. N5 nurse said,

I feel that my personality is also relatively important. I'm the kind of person who wants to be open and expects good things going on. Though COVID has introduced much pressure to me, I think: 'Well, I can cope with it and even make progress.' It's positive, isn't it?

N3 nurse said,

During the pandemic, sometimes we think about in another way – our situation is not as bad as some other regions which have increased number of cases.

Fear of injury and infections. ER came across various types of emergencies, such as trauma and other types of diseases. In a public health emergency, ER nurses may face more unknown conditions. For instance, for infectious disease including the current COVID-19 pandemic, little was known at the beginning of the outbreak, and therefore, the fear of the contagiousness and the unknown outcomes brought a higher concern about being injured or infected in medical staff including the ER nurses. It has been evidenced by previous finding that fear of becoming infected was negatively correlated with resilience in nurses during COVID-19 pandemic.⁴⁹ These fears may also be present in other public health emergencies, and put much stress to ER nurses and affected their level of resilience greatly. In the interview, all nurses expressed fear of infectiousness of the disease, with younger nurses presenting increased fear at the beginning of the pandemic. Noticeably, the stress from fear of injury or being infected dropped greatly as more is known about the disease. Nurse N3 said,

I was worried about the increased risk of being exposed in the disease and being infected. But as more is known about it and all precautions steps in place, I was not worried about it much. However, I'm still worried a bit on the chance of passing it on to my family during this special period of time.

Lack of self-confidence and self-efficacy. Self-confidence plays a role in work-related stress. Usually, young nurses with less experience may have this issue more, as they have undergone less training. In addition, self-efficacy has been previously shown to correlate with psychological resilience.^{47,48} In the interview, more young nurses mentioned how they were worried about their skills, or worried about missing out a step when carrying out a procedure. Nurse N2 said,

Sometimes I would hesitate and ask myself if I missed out anything or have dealt with all the steps in the procedure. I couldn't stop question myself even after work. This makes me feel more stressful and tired.

Overall, subcategories from psychological tolerability were identified as factors for psychological resilience of ER

nurses. Strategies would be made to facilitate improvement of psychological tolerability. For instance, workshops on coping and self-adjustment may facilitate maintenance of mental health, and facilitating optimism may promote psychological resilience.⁵⁰ In addition, academic and skills-related training may reduce fear of injuries and infection, as well as increase self-confidence and self-efficacy.

Theme 3—Tenacity of Internal Drive

Internal drive is a complex element that motivates a person to proceed toward a goal. ER nurses face challenges in everyday work, which magnify during a public health emergency. In the interview, components from this theme were frequently mentioned by participants, raising the importance of factors from this theme.

Low work passion and job satisfaction. Enthusiastic about work and job satisfaction also play positive roles in psychological resilience. The passion for work serves as an internal drive for the ER nurses to stay strong and act more positively. This is especially important in a public health emergency. Similarly, job satisfaction positively affects resilience in nurses,⁵¹ raising the attention of its importance as a factor for psychological resilience. In the interview, some nurses mentioned that they held great passion for the work they did, and were much satisfied with it. This encouraged them to stay strong during the public health event. Nurse N1 said,

I like my career and enjoy working in ER. For instance, once a patient underwent a heart arrest, but was successfully resuscitated by performing defibrillation and other CPR procedures. This gave me a sense of honour. I really feel satisfied with my job.

N7 nurse said,

Working as a nurse gave me a sense of satisfaction and happiness, as the job enables me to save patient's lives. However, it is not always the case, especially for young nurses.

Lack of personal engagement. Personal engagement at work is how much a person devoted him or herself into the job. Engagement has been previously shown to negatively correlate with psychological stress,⁵² which potentially affect psychological resilience. For ER nurses, strong personal engagement enables them to be involved more voluntarily when encountering an issue at work, especially in a public health emergency. In addition, this also assisted with more positive thinking. Some nurses mentioned that they enjoyed engaging tightly with the work during work hours. This made them stay more positive and would stay stronger. Nurse N6 said,

I love my job, and love to participate actively in my daily work. Focusing on these works makes me feel that I'm doing the right thing to help people, and this makes me feel happy and harder to

be beaten down by the stress emerged in a public health emergency.

To summarize, tenacity of internal drives, including low work passion and job satisfaction, as well as lack of personal engagement, have been identified as negative factors. Focused training and help groups may facilitate improvement in these aspects to increase level of psychological resilience.

Theme 4—Institutional Implementation

Institutional implementation facilitates and coordinates routine functions of ER. Its role stands out under a public health emergency. In the interviews, this aspect was mentioned by the participants, and was identified as factors for psychological resilience.

Inefficient communication and coordination. Communication competence was positively correlated with resilience of nurses from operation rooms,⁵³ and our study revealed that its importance spread from operation rooms to emergency rooms. Efficient communication not only facilitates smooth move of work and the subsequent reduced workload, but also relieves psychological stress. This includes communication with colleagues as well as with the organization. The latter one is essential to facilitate efficient teamwork within the ER and the hospital in a public health emergency. With efficient communication, there will be less time spent in discussion on flowchart, and improve speed for each procedure. In addition, there will be less chance of imbalance of workforce in different levels of tasks. Subsequently, there should be less workload and stress for ER nurses. The benefit of efficient communication has been discussed by some ER nurses when talking on what they think would assist with solving the problem and relieving stress. Nurse N9 said,

Sometimes there are some misunderstandings between medical staff and the organization. When the communication is less clear, we might rush into a position when there is already sufficient supply of resources or workforce, while other procedures might be left unattended.

N3 nurse said,

The hospital's coordination of work during the pandemic is especially important. For instance, our hospital managed to re-organize a flowchart for handling COVID-19 patients, which took off much of our workload so we could cope better with it.

Insufficient supply of resources. In a public health emergency, it is very important for the organization to provide sufficient supplies and resources medical staff need to ensure both the efficiency and safety of the staff. The resources not only include PPEs and other supplies, but also include relevant protocols, flowcharts, and special protocols. This reduces the

time needed for ER nurses to communicate with the organization and seek for these resources, and reduces stress of these nurses. The need for supply of resources has been mentioned by several nurses in the interviews. N1 nurse said,

The COVID-19 pandemic is an example of high workload. As it is an infectious disease, we feel stressful handling the emergency. In addition, we need extra PPEs and protections so we could deal with the situation more confidently and in a safe way.

In conclusion, inefficient communication and coordination, as well as insufficient supply of resources negatively affect psychological resilience of ER nurses. When developing strategies that focus on public health emergencies from ER, these factors may be taken into consideration to address the need for improvement of resilience of nurses.

Theme 5—External Adjustment

Though a person's reaction to public health events reflects his or her resilience, efficient interventions may improve resilience to some extent. For nurses with high resilience, they always seek actively themselves for ways of relieving the pressure, which in turns assisted to maintain high resilience. The methodologies for external adjustment vary, with some well acknowledged,^{50,54-56} while others at the exploration stage.

Talking and hobbies. For nurses with high resilience, different methods were developed to relieve stress, with some stating as useful. Most participants mentioned that talking to family, friends, as well as colleagues are efficient in relieving stress. In addition, some mentioned that keeping other hobbies such as listening to music, enjoying good food and traveling may also help with stress relieving. Nurse N1 said,

When there was huge pressure, I would like to talk with my family, for example, via video chat. I also like going to a concert.

Team building. Team building is useful in different ways. First of all, it provides a good chance for the staff to know each other better and to improve understanding of each other. This enables efficient communication and collaboration in the ER work. In addition, team building is usually established in a relaxed manner, and medical staff could also use it as a good chance to relax and relieve stress. Furthermore, team building may not only improve communication within the team, but also facilitate social connection, which has been shown to improve resilience.⁵⁰ Indeed, in the interview, some nurses found participating in team building help with improving understanding and communication with colleagues, which improve cooperation at work. Nurse N3 said,

I enjoyed participating team buildings. This gives us a good chance to understand and learn from each other, and helps us to work efficiently in the following collaboration of work.

Training program. Various training programs, such as the Mindful Self-Compassion training and the Stress Management and Resiliency Training program, have been shown to improve resilience in nurses.⁵⁴⁻⁵⁶ As a more professional way of interfering, training program on resilience serves as an option for ER nurses who are willing to make an adjustment. In fact, some nurses mentioned that participating in the resilience training program seemed to be an effective way to adjust themselves so they could cope better. Nurse N4 said,

Luckily, there are chances for us to get trainings. This not only includes skills training, but also include psychological trainings that assist us to adjust in a more effective and efficient way to cope when facing increased pressure. I find it very useful.

In summary, external adjustment was identified to be a factor, and was considered one of the most approachable factors that could be modified to improve psychological resilience in ER nurses. Though the approaches may vary among individuals, more programs may be developed to achieve the goal more efficiently.

Discussion

Previous studies have shown that resilience is related with physical and mental health,^{4,57} and is correlated with working conditions, relationship status, as well as physical and mental health.^{4,57} However, the factors associated specifically with ER nurses remain unclear and need further investigation. The present study performed quantitative as well as qualitative investigations on factors associated with psychological resilience in ER nurses. Quantitative analysis revealed a negative correlation between resilience and SDS index, consistent with previous findings on nurses at a disaster preparedness stage.⁵⁸ In addition, we also revealed a positive correlation between resilience and PA, which was different from previous report,⁵⁹ indicating that psychological resilience may present specific factors in ER nurses. The in-depth interview revealed 5 clusters of themes (Figure 1), namely physical tolerability, psychological tolerability, tenacity of internal drive, institutional implementation, and external adjustment. These findings furthered understanding and knowledge on factors related to psychological resilience of ER nurses.

ERs are usually the first place to face various types of public health emergencies, and ER nurses are easier to develop fatigue, negative emotions and burnout, which affect their physical and mental health. Increasing workload is a factor challenging both physical and mental tolerability. In the present study, workload burden has been constantly raised by participants. Particularly, this issue is more pronounced during public health emergencies such as the current COVID-19 pandemic. The surge of patient number in ER as well as prolonged procedures exacerbate the burden, causing various problems, with some participants reported having sleep disturbances. In addition, some participants

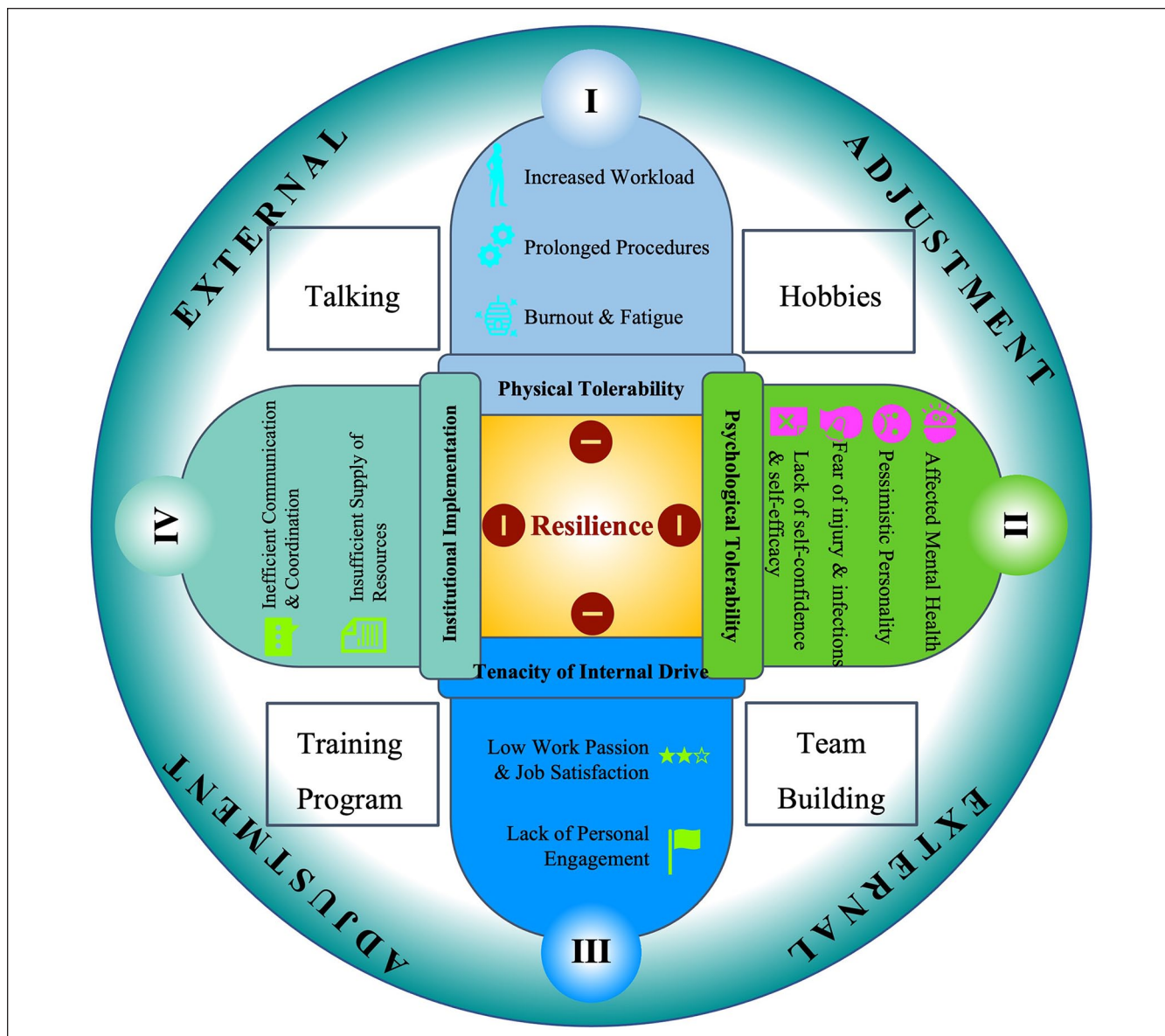


Figure 1. Illustration of clusters of themes generated from in-depth interviews. Five clusters of themes have been identified from the in-depth interviews, including physical tolerability, psychological tolerability, tenacity of internal drive, institutional implementation, and external adjustment.

mentioned that the increase of workload raised difficulties and confidence in professional performance, as well as their ability to cope with family life. These lead to a challenge to both physical and mental tolerability, and subsequently affecting level of resilience.

Mental health also plays an essential part in resilience. Our study showed that resilience was negatively correlated with SDS index in ER nurses, suggesting that depressive status contributes greatly to resilience. A variety of causes of depressive status, such as increased workload, personality characteristics, professional burnout, work environment including lack of efficient communication with colleagues and organizations all contribute greatly to it. Therefore,

mental health should be addressed in daily health management and maintenance.

It has been shown that personality characteristics, such as optimism, personal satisfaction, self-control, self-confidence are all associated with resilience.^{47,48,60,61} In addition, increased skills confidence and self-efficacy may increase resilience.^{22,47,48,62,63} These factors do not stand alone, but instead, cross-react with other factors to affect resilience. In the present study, we found that some nurses, especially young nurses are more worried about their skills, which increased their psychological stress. Therefore, it is worthwhile to organize training programs for nurses, to improve their skills and ability to overcome emotional stressors, and

more satisfaction with patient care have all been shown to improve resilience.²² Our study showed that nurses with high resilience are usually more satisfied with their performance and career, and are more confident on handling patients and dealing with relevant issues, while nurses with low resilience are less confident and worried more about their work. Together, these findings are consistent with previous findings, indicating that personality characteristics are important factors. Though it is difficult to modify a person's character, sufficient training and support may help build self-confidence, and subsequently improve psychological resilience.

Organizational support is a crucial element from the external support system, and may be involved in a positive way in resilience of nurses. Previous study showed that nurses' resilience is positively correlated with workplace engagement.²¹ In addition, coping style has also been shown to be associated with resilience.^{47,48} Furthermore, interactions between organization and the personnel are also important, as positive perceptions of organization's understanding of emotional support and belief of sufficient educational resources, as well as leadership support have all been shown to be associated with higher level of resilience.⁶⁴ In our study, the effect of organizational support and importance of coping style have both been mentioned by several participants, reflecting the potential effect of these factors. Therefore, it is possible to provide sufficient supplies and resources, as well as to organize training programs to assist nurses to develop better coping methodologies, which in turn to increase resilience. In addition, managers and organizations may hold regular meetings to communicate with nurses, to help improve understanding and communication between the 2 sides.

Other studies have shown that age and stress both reduced resilience,^{12,65,66} while duration of professional experience is positively correlated with resilience.¹² The association between age and resilience was not observed in the present study. This might be due to the small cohort analyzed. Stress has been mentioned by majority of nurses during the interview. Though the duration of professional experience is not acutely adjustable, it could be potentially managed by maintaining retention.

The present study has several limitations. Firstly, the sample size was relatively small. Therefore, greater variation might exist, potentially affecting the power of quantitative analysis. Secondly, the variation for work experience is relatively large. Given that work experience is correlated with resilience in nurses,⁶⁷ the variation might present as a co-factor that potentially affects the power of quantitative analysis. Thirdly, the cohort involved ER nurses, but not differentiated which subgroups they belonged to (eg, pediatric, internal medical and surgical), and therefore, could not compare differences among subgroups. Future studies with large sample sizes, and from a diversity of sub-cohorts are desired to investigate these factors for psychological resilience in details.

Conclusion

The present study utilized both quantitative and qualitative methods to investigate factors associated with level of resilience in ER nurses under public health emergencies, and revealed 5 clusters of themes that were considered to be closely related to resilience. The results not only provide novel insights into resilience in the cohort where average resilience score remains moderate, but also provide potential directions for intervention.

Author Contributions

JL, PT, and WL contributed to the conception and design of the work. JL collected/analyzed the data and drafted the manuscript. PX, JG, and HZ contributed to data collection and commented on the initial version of the manuscript. PT and WL completed critical review and finalized the manuscript before submission.

Author Statement

All authors listed meet the authorship criteria and all authors are in agreement with the content of the manuscript.

Data Sharing Statement

All the data supporting the findings are included in this paper.

Declaration of Conflicting Interests

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Ethics Approval and Consent to Participate

All methods used in this study were carried out following all relevant guidelines and regulations (Declaration of Helsinki). The Ethical Review Committee at Shanghai University of Medicine & Health Sciences Affiliated Zhoupu Hospital provided ethical clearance (Ethics No. 2020-C-081). The purpose of the study was fully disclosed to all participants, and all participants provided informed consent. All data gathered for this study was kept private and secure, and the anonymity was maintained throughout the study, with participants' names replaced with number NX (X stands for the participant's number).

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Supplemental Material

Supplemental material for this article is available online.

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