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Identifying patterns of occupational stress trajectories among newly graduated nurses: A longitudinal study

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ABSTRACT

Background: Newly graduated nurses have comparatively high levels of occupational stress. Previous studies have evaluated stress across this population as a whole; however, little is known about potentially different occupational stress responses among new nurses and the impact of demographic and work-related characteristics on occupational stress responses.
Objectives: To determine differences in occupational stress levels of newly graduated nurses at different time points during the first 3 years of practice; to identify potential subgroups of nurses who perceive different occupational stress levels over time; and to evaluate differences in identified subgroups based on demographic and work-related characteristics.
Design: An observational longitudinal study.
Settings: Four tertiary hospitals in Shanghai were selected randomly using a computer-generated random number table.
Participants: All 343 newly graduated nurses employed in the selected hospitals were invited to participate. The inclusion criteria were (1) newly graduated without nursing experience, excluding nursing internship; (2) current employment in in-patient departments/ICU/operation room; and (3) consented to participate. A total of 152 participants met criteria and completed all four points of data collection.
Methods: Participants completed an annual paper survey. Occupational stress levels were measured using the Job Stress Scale for Newly Graduated Nurses. Occupational stress scores at different time points were compared using latent growth modeling. Group-based trajectory modeling was performed to identify subgroups of occupational stress trajectory. ANOVA and Fisher's exact test were conducted to examine the differences of demographic characteristics between classes.
Results: The entire sample of newly graduated nurses experienced a significant decrease in occupational stress during the first three years. The best-fitting group-based trajectory model described three distinctive trajectories: low occupational stress (19.1% of sample); medium occupational stress (67.1%) and high occupational stress (13.8%). The low occupational stress subgroup had a higher proportion of nurses from Shanghai, and the majority were employed as contact- based nurses. In comparison, the high occupational stress subgroup had the largest proportion of nurses from other provinces (outside of Shanghai), almost half of participants were employed as "bianzhi" nurses, and the majority reported to be assigned preceptor by shift.
Conclusions: Newly graduated nurses perceived occupational stress differently over time. Identified subgroups with different demographic characteristics have significantly different perceptions of occupational stress over the first three years of practice and future intervention programs such as peer-support programs or a standardized preceptorship should be tailored to meet the unique needs of these different subgroups.

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What is already known about the topic?

- Newly graduated nurses perceive high levels of occupational stress during their transition to practice.
- Increasing occupational stress can negatively impact newly graduated nurses' transitional experience, and ultimately intention to leave.
- Individual differences contribute to different perceptions of occupational stress in newly graduated nurses.

What this paper adds

- Newly graduated nurses perceive different levels of occupational stress during each of the first 3 years of practice and report the highest level of occupational stress at the start of their nursing practice.
- Three distinct occupational stress trajectory subgroups were identified among a population of newly graduated nurses.
- Results of this study point to opportunities for interventions such as peer-support programs or a standardized preceptorship to be tailored to support stress management in newly graduated nurses, especially nurses with atypical high occupational stress patterns.

1. Introduction

Occupational stress occurs when job-related factors interact with the worker, leading to individual change in the worker's psychological and/or physiological state (Richardson and Rothstein, 2008). In the nursing context, occupational stress may cause chronic psychological and physical health problems for newly graduated nurses (NGNs) if not effectively managed, as well as negative outcomes for both patients and organizations (Suresh et al., 2012; Blomberg et al., 2016). Associations between high occupational stress, poor health status, and job satisfaction among NGNs impacts stability in the workforce and the quality of nursing care (Cheng et al., 2015). In addition, intention to leave and turnover rates are well known organizational consequences associated with occupational stress (Yeh and Yu, 2009). In the United States, 13% of NGNs changed jobs after one year, and 37% reported that they felt ready to change employment or quit nursing within two to three years of practice (American Association of Colleges of Nursing, 2017). While in China, a one-year longitudinal study found that around 75% of NGNs working in large comprehensive and specialized teaching hospitals with at least 500 beds (tertiary hospitals) in Shanghai had intention to leave, and the variable of occupational stress consistently predicted their intention to leave (Zhang et al., 2017a,b). The alarming turnover rate related to occupational stress led to total costs ranging from $20,561 in the US to $48,790 in Australia (Duffield et al., 2014).

For almost two decades, researchers have conducted international studies on NGNs' transition theory, experience, and programs using both qualitative and quantitative methods of inquiry (Duchscher, 2008, 2009; Duchscher and Windey, 2018; Parker et al., 2014; Whitehead et al., 2016). It is well reported that regardless of their specific workplace (Blomberg et al., 2016), NGNs experience stress due to the transition, which includes a process of learning, adjustment, and socialization to the profession and practice of nursing (Philips et al., 2014). The transition has been consistently identified as stressful and unsatisfying, especially during the first year of practice (Cho et al., 2012; Wu et al., 2012; Edwards et al., 2015; Zhang et al., 2017a,b; Pasila et al., 2017).

A variety of reasons for NGNs' occupational stress have been proposed, for example, the cultural differences between the student experience and hospital condition, the lack of confidence in clinical skills and critical thinking, heavy workloads, inappropriate arrangement of high acuity patients, a lack of guidance and support, violence and bullying, interpersonal relationships, shift work, and a hierarchical environment (Suresh et al., 2012; Teoh et al., 2013; Monaghan, 2015; Chachula et al., 2015). Recent studies have shown that Chinese nurses are facing particular stressors that contribute to burnout and intention to leave (Zhang et al., 2014). A study among 527 nurses from Shanghai hospitals showed that nurses experienced a high level of work-related stress and burnout, and young nurses on shift work or those who worked in high-ranking hospitals were particularly vulnerable (Xie et al., 2011).

Transition is considered a dynamic journey that is not meticulously linear or established (Duchscher, 2008). Most studies on occupational stress, particularly with NGNs, have focused on discovering potential contributors and cross-sectional relationships between occupational stress and individual or organizational characteristics at specific points in time. It is important to note that previous studies have not given considerable attention to the longitudinal trajectory of occupational stress throughout the process of transition. Understanding how occupational stress changes over time is essential to design interventions that can provide timely and appropriate support for NGNs (Halpin et al., 2017). Halpin et al. (2017) measured NGNs stressors at the point of qualification, 6 months and 12 months post-qualifying, and provided insight into different stressors during their first 12 months of nursing practice. According to "From Novice to Expert" (Benner, 1984), the first three years of working at the same job or doing similar tasks is important for growing as a competent nurse. Although the initial 12 months are the most critical and difficult part of the transition, NGNs experience potential vulnerability throughout the first three to five years (Rudman and Gustavsson, 2011; Rudman et al., 2014).

Multiple stress models acknowledge the role of individual factors in the process of stress (Lazarus and Folkman, 1984; Edwards and Cooper, 1990). Due to various personal, psychological, and cultural factors, each NGN may react to stressors and use coping strategies heterogeneously (Rudman and Gustavsson, 2011), which may lead to different trajectories of occupational stress during the first three years of practice. Research in burnout also suggests that individual factors may lead to differences in how individuals' burnout levels change over time (Lancaster, 2013). Therefore, individual NGNs could experience different patterns of occupational stress throughout the first three years. However, longitudinal data have typically been summarized in terms of population averages at sequential time points (Halpin et al., 2017; Zhang et al., 2017a,b), there are few studies that have considered characterization of the patterns of occupational stress in individual NGNs over time.

This study aimed to address these gaps in the literature by (1) determining differences in occupational stress levels of NGNs at different time points during the first 3 years of practice (2) identifying potential subgroups of NGNs who perceive different occupational stress levels across the first 3 years of practice and (3) evaluating differences in identified subgroups based on demographic and work-related characteristics. The overall goal of this study was to better understand longitudinal occupational stress experiences of NGNs to improve individual-based stress management, aid in successful transition, and increase NGNs retention.

2. Materials and methods

2.1. Study design and setting

A longitudinal survey study was conducted over three years from August 2014 to August 2017 with annual data collection in four tertiary university hospitals in Shanghai China.

2.2. Sampling and recruitment

Participants were selected under the following sampling procedure: first, a computer-generated random number table was used to randomly select four out of 15 districts in Shanghai. Then, four participating tertiary hospitals were selected (one from each selected district) according to their willingness and availability to participate. The entire population of NGNs (n = 343) working in these four hospitals were invited to participate in the study at the beginning of their employment (August 2014).

2.3. Data collection procedures

Data were collected in August 2014 when participants were first employed, and annual in-person follow-up surveys were completed in August for three years, with study completion in 2017. For the first data collection point, a member of the research team attended the orientation meeting to give a presentation to explain the aims, attributes, benefits, uses, and disadvantageous effects of the study and to answer questions. Every potential respondent received an invitation letter containing an information sheet about the study program and an informed consent form during the presentation. NGNs who were interested in participating signed and returned the informed consent to the lead researcher. For participants who provided their informed consent, each anonymous paper-based questionnaire was individually distributed in an envelope. For the follow-ups, only the survey for that specific time point was distributed. All completed surveys were individually returned to the researcher in a sealed envelope. After each point of data collection, participants received a small gift for participating.

Among the 343 potential NGNs, 332 NGNs consented and completed the baseline questionnaires, yielding a response rate of 96.8%. Two-hundred and eighty-four NGNs completed the 1-year follow up survey, 230 NGNs completed the 2-year follow up survey, and 203 NGNs completed the 3-year follow up survey. In total, 152 participants completed the questionnaires at all four time points with no missing data. The excluded sample (N = 180) were compared with the 152 participants regarding age, gender, academic degree, hometown, employment type and preceptor assignment. The only difference found between the two groups was that there were more contract-based nurses in the excluded group (89% vs 68%, $\chi^2 = 22.339$, $p < .001$).

2.4. Measures and instruments

2.4.1. Demographic and work-related characteristics

Demographic and work-related characteristics of participants were collected: age, gender, academic degree, marital status, hometown, working unit, employment type, and preceptor assignment. In the Chinese employment system, there are two types of employment for nurses including 'bianzhi' nurses and contract-based nurses. 'Bianzhi' jobs are government-guaranteed positions with lifetime employment and these nurses cannot be dismissed by their employers. In addition, 'bianzhi' positions are considered to be an 'iron rice bowl' in China due to the guarantee of continuing benefits of housing, health insurance and pension. Contract-based nurses, in contrast are hired directly by hospitals and not by the Chinese government. As a result, contract-based positions generally come with lower job security and reduced job-related benefits such as housing, health insurance and pension.

2.4.2. Assessment of occupational stress for newly graduated nurses

The occupational stress scale for NGNs (Chinese version) developed by Taiwan scholars Yeh and Yu (2009) was used in this study. The scale includes 24 items, which are rated on a five-point unipolar Likert scale ranging from 1 = not stressful at all to 5 = extremely stressful. The items span four dimensions entitled: 'Tasks in general care' (nine items), 'Tasks in critical care' (four items), 'Role/interpersonal relationship' (six items) and 'Leadership and management' (five items). Sample items include rating the 'Policy of arranging working shifts, continuing education and caseload according to seniority', 'Encountering different styles of different preceptors', and 'Interpreting results of examinations or labs'. The total score ranges from 24 to 120, with a higher score reflecting a higher perceived occupational stress level. In Yeh and Yu's study, validity was confirmed by both content and construct validity that showed 61.06% of the variation could be explained. For reliability, the Cronbach's α coefficient for the entire scale was 0.93 and for the four dimensions ranged from 0.79-0.89, indicating satisfactory internal consistency. Wu et al (2012) examined work-related stressors and intention to quit among NGNs by using this scale, and the results demonstrated a promising overall Cronbach's α reliability of 0.95. In this study, the Cronbach's α for the scale was 0.95.

2.5. Data analyses

We applied latent growth model using Mplus (version 8.1) to examine the statistical difference in occupational stress over time. Group-based trajectory modeling (GBTM) using Stata (version 15.1) of the 3-year occupational stress data was used to identify subgroups of occupational stress trajectories among NGNs. Fisher's exact tests and one-way analyses of variance (ANOVA) were conducted in SPSS (version 21.0) to compare the differences of demographic characteristics among identified trajectory subgroups by GBTM. Significance was defined as $p < .05$.

GBTM was conducted to identify the distinct subgroups of individual NGNs following similar progressions of occupational stress over time (Nagin, 2005). Each unique trajectory is assumed to belong to a latent group, with the members in each group having a similar response pattern. Nagin and Odgers (2010) pointed out that model selection only based on the mechanical and formal statistical criterion may lead to an inferior choice. Thus, in this study model selection criterion involved both the iterative estimation of (1) statistical criteria and (2) non-statistical considerations.

The most commonly used statistical criteria for ascertaining the best fitting model include Akaike's Information Criteria (AIC), Bayesian Information Criteria (BIC) and relative entropy, and these were used in this study to guide model selection. Testing the adequacy of the selected model is an often-neglected step in the model selection process according to Nagin (2005). Thus, we used a minimum threshold of 0.7 to evaluate the average posterior probabilities of group membership for individuals assigned to each group and test whether the final model adequately addressed the research question.

Other key non-statistical decision points in GBTM include: (1) the number of subgroups or latent classes that best represents the heterogeneity in developmental trajectories (Nagin and Odgers, 2010), (2) reasonable sample size (at least 2.5% of the total sample) in each identified trajectory subgroup and (3) subjective judgment based on theories and prior literature.

2.6. Ethics statement

The study was approved by Shanghai Jiao Tong University School of Public Health and Nursing Ethics Committee (No. 2016001).

3. Results

3.1. Characteristics of subjects

The final study sample consisted of 152 NGNs who were mainly female (95.4%), which is representative of the current nursing

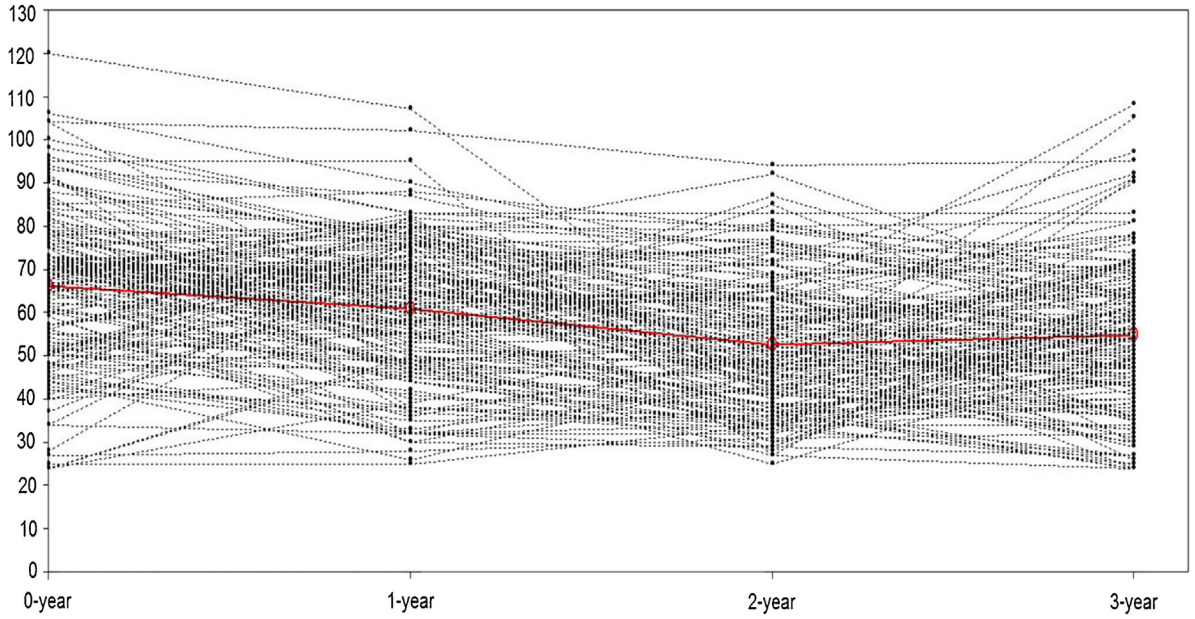

Fig. 1. Observed individual occupational stress scores (dash lines) and mean score (solid line) over time.

workforce in Shanghai. The mean age of subjects at baseline was 22.18 years (SD = 1.16, range from 19 to 27), and no participants were married. Among the subjects, only 29 (19.1%) had earned a bachelor's degree or higher. Forty-eight subjects (38.2%) were from the city of Shanghai while the remaining subjects (61.8%) were from other provinces in China. Forty-nine subjects (32.2%) self-reported as "bianzhi" nurses, which is a position guaranteed by Chinese government; and 103 (67.8%) were contract-based nurses, which encompasses jobs outside "bianzhi" that are made by an individual employer, presumably based on current needs and resources. Forty-six subjects (30.3%) reported working in more than three units during the first three years of practice. About one-third (32.9%) of subjects were assigned with one fixed preceptor during their transition and more than half of subjects (51.3%) reported they were assigned with different preceptors according to their shifts.

3.2. Mean-level change across the first three years of practice

The occupational stress trajectory for each participant and the total sample from baseline to the last time point is presented in Fig. 1. NGNs reported the highest level of occupational stress when they just started their nursing practice (M = 66.04, SD = 17.84). Scores declined to the lowest mean level two years after employment (M = 52.50, SD = 15.55), and increased slightly at three years after employment (M = 54.73, SD = 17.48)). Although statistically significant differences in occupational stress levels among the NGNs were identified between data collection years using a latent growth model (Intercept = 64.934, $p < .001$; Slope=-4.462, $p < .001$), the trajectory over time was relatively flat.

3.3. Group-based trajectory modeling results

Model fit measures are shown in Table 1. According to the model selection criteria set forth in Nagin (2005, 2010), the 3-class model presented in Fig. 2 was selected on the basis of (1) a relatively small BIC; (2) an average posterior probability of each group greater than 0.70 (Subgroup 1 = 0.85, Subgroup 2 = 0.91, Subgroup 3 = 0.89); (3) relative entropy greater than 0.70 (0.77 for 3-class model); (4) a reasonable sample size for each group (Subgroup 1 = 29 (19.1%), Subgroup 2 = 102 (67.1%), Subgroup 3 = 21 (13.8%)); and (5) subjective considerations based on previous literature. Specifically, Rudman and Gustavsson (2011) disclosed eight burnout development patterns among 997 NGNs over a three-year period, which supports a multiple trajectory model. As shown in Fig. 2, medium occupational stress trajectory (Subgroup 2) was the typical pattern of change, which was comparable to the mean-level occupational stress trajectory for the entire sample. Low occupational stress trajectory (Subgroup 1) comprised the lowest level of occupational stress at all four time points compared with other trajectory subgroups. In this trajectory, occupational stress was highest at the baseline time point and then slightly

Table 1
Goodness-of-fit statistics of Group-based Trajectory Modeling containing different numbers of classes.

Trajectory class models	AIC	BIC	Relative Entropy	Posterior Probability	Proportion in each class
1-Class Model	−2566.64	−2574.20		Class 1 (1.00)	Class 1 (100%)
2-Class Model	−2506.73	−2525.82	0.64	Class 1 (0.90) Class 2 (0.87)	Class 1 (64.5%); Class 2 (35.5%)
3-Class Model	−2505.57	−2523.72	0.77	Class 1 (0.85) Class 2 (0.91) Class 3 (0.89)	Class 1 (19.1%); Class 2 (67.1%); Class 3 (13.8%)
4-Class Model	−2498.47	−2522.66	0.83	Class 1 (0.88) Class 2 (0.91) Class 3 (0.91) Class 4 (0.91)	Class 1 (19.7%); Class 2 (2.6%); Class 3 (64.5%); Class 4 (13.2%)

Note: AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion.

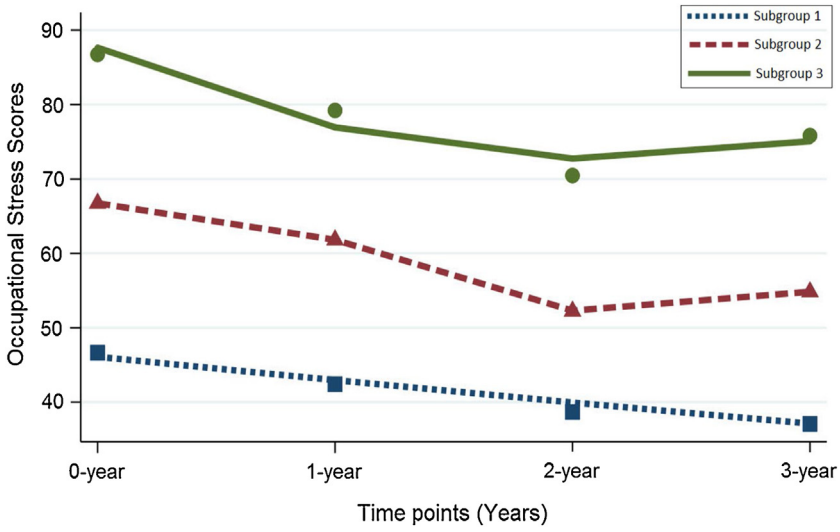

Fig. 2. Trajectories as defined by GBTM analysis of mean total Occupational Stress scores over time.

Table 2
Occupational stress scores among identified trajectory subgroups and ANOVA test.

Time point	All (N = 152)	ANOVA test for identified three trajectory subgroups				
		Subgroup 1 (N = 29)	Subgroup 2 (N = 102)	Subgroup 3 (N = 21)	F	p
0-year	66.04(17.84)	46.72(13.10)	66.72(13.27)	89.42(12.49)	64.733	<.000
1-year	60.85(16.30)	40.76(8.42)	62.53(12.44)	80.39(11.13)	74.184	<.000
2-year	52.50(15.55)	38.21(7.02)	52.74(13.64)	71.10(12.59)	42.101	<.000
3-year	54.73(17.48)	36.00(10.69)	55.27(13.47)	77.95(12.40)	65.234	<.000

decreased over the 3 years of data collection. While high occupational stress trajectory (Subgroup 3) members are likely to perceive the highest level of occupational stress over the three years, they have a significant decline in occupational stress from baseline to 2 years after employment, followed by a slight increase in the last year (although the final level is still lower than baseline). The mean and standard deviation of measured occupational stress levels at different time points for the entire sample and each trajectory group are shown in Table 2. The occupational stress scores for the three trajectory subgroups were significantly different from one another at each time point ($p < .001$).

3.4. Demographic predictors of trajectory subgroup membership

Fisher's exact tests and ANOVA were performed to identify the differences in demographic and work-related characteristics of the NGNs in the three trajectory subgroups (Table 3). A larger proportion of NGNs in high occupational stress trajectory (Subgroup 3) were from provinces outside Shanghai, employed as "bianzhi" nurses, and assigned their preceptors based on their shifts ($p < .05$). In contrast, 69% and 97% of NGNs in the low occupational stress trajectory (Subgroup 1) were Shanghai local residents and contact-based nurses, respectively. Occupational stress trajectory subgroups did not significantly differ based on age ($p = 0.430$), gender ($p = 0.477$) or nurses' academic degree ($p = 0.536$).

4. Discussion

The current study found that NGNs overall perceived occupational stress levels decreased across the first two years and then slightly increased from the second year to the third year. The mean-level trajectory was rather stable; however, there is a wide range in individual occupational stress trajectories during the first three years of practice. This study subsequently utilized GBTM to identify subgroups of occupational stress trajectories. Three different trajectory subgroups were identified in our study, which were named as low occupational stress trajectory (Subgroup 1), medium occupational stress trajectory (Subgroup 2) and high occupational stress trajectory (Subgroup 3). Furthermore, we found that hometown, employment type and preceptor assignment were able to distinguish trajectory group membership. NGNs who came from areas outside of Shanghai, were employed as 'bianzhi' nurses, or were not assigned one or few fixed preceptors were more likely to experience high occupational stress levels over time.

4.1. Mean occupational stress trajectory for the entire sample over time

This prospective longitudinal study of 152 NGNs provided evidence regarding the occupational stress developmental trajectory of NGNs during the first three years of practice. Previous studies have shown how stressful NGNs' entry into nursing practice can be (Teoh et al., 2013; Kinghorn et al., 2017). Perceptions of inadequate competency have been identified as the most significant source of occupational stress experienced by NGNs (Hoeve et al., 2018; Halpin et al., 2017; Zhang et al., 2017a,b), which may explain higher levels of occupational stress at the start of employment. After months of experience, NGNs achieve considerable improvement in their theoretical knowledge and practical competencies, which increases their confidence in their clinical practice and ultimately reduces their perceived occupational stress for the next two years after graduation (Duchscher, 2008; Zhang et al., 2017a,b). However, prior research indicates that in the later stages of transition, the predominant factors contributing to occupational stress change to frustrations in dealing with the system at large, such as power and authority

Table 3
Comparisons for mean and percentage differences in indicators for the three trajectory subgroups.

Characteristics	Occupational stress subgroups			X^2(df)	Asymptotic/Exact p-value
	Low (n = 29) N (%)	Medium (n = 102) N (%)	High (n = 21) N (%)		
Gender					
Female	28(97%)	96(94%)	21(100%)	1.48 (2)	.477/.546
Male	1(3%)	6(6%)	0(0%)		
Hometown					
Shanghai	20 (69%)	33 (32%)	5 (24%)	14.95 (2)	.001/.001
Other provinces	9 (31%)	69 (68%)	16 (76%)		
Academic degree					
Associate degree	25 (86%)	80 (78%)	18 (86%)	1.25 (2)	.536/.580
Bachelor degree or higher	4 (14%)	22 (22%)	3 (14%)		
Employment type					
"Bianzhi" nurses	1 (3%)	38 (37%)	10 (48%)	14.45 (2)	.001/.001
Contract-based nurses	28 (97%)	64 (63%)	11 (52%)		
Preceptor arrangement					
One fixed preceptor	5 (17%)	38 (37%)	6 (29%)	43.23 (4)	<.001/<.001
Few senior nurses	5 (17%)	18 (18%)	0 (0%)		
Assigned by shift	19 (66%)	46 (45%)	15 (71%)		
	M(SD)	M(SD)	M(SD)	F	p
Age	22.00 (.926)	22.26 (1.21)	22.00 (1.20)	.850	.430

Note: X^2 values were generated by Fisher's Exact Test; F values were generated by ANOVA test; df, degree of freedom.

negotiations, and leadership and management adaptation (Duchscher, 2008; Zhang et al., 2017a,b). This may explain the slight increase in occupational stress scores 3-years into practice.

4.2. Trajectory subgroups of occupational stress over time

In this study, more than two-thirds (67.1%) of participants followed the typical occupational stress development trajectory (Subgroup 2) during the 3-year process with gradual decline from baseline and a slight increase during the third year after employment. It is noteworthy that 13.8% of NGNs experienced high levels of occupational stress across all time points. Furthermore, the NGNs who followed the medium and high occupational stress trajectory simultaneously experienced an increase in occupational stress levels during the third year. NGNs in the low stress group (Subgroup 1) notably did not experience an increase in occupational stress from year 2 to 3. Rudman and Gustavsson (2011) pointed out that the stability at the mean level may hide potential distinct response patterns of individual changes over time and they identified eight change trajectories in burnout for NGNs over a three-year period. Lancaster (2013) identified that although nursing students were in the same work environment, they perceived different burnout levels as well as burnout changes over time. Although in the present study, the mean occupational stress levels for the entire sample were somewhat stable, the divergent distribution of individual trajectories provides support that there are potential distinct development patterns across all four time points, which indicate that the individual differences should be considered. The reason why NGNs in low stress trajectory experienced opposite trajectory compared with NGNs in medium and high stress trajectory maybe due to lower overall stress responses in this group, which began with lower levels at baseline (year 0) and continued over time. Or, due to differences in the demographic make-up of this group, which are discussed in additional detail below.

4.3. The employment type of NGNs between different trajectory subgroups

Our study also found that 'bianzhi' nurses were more likely to perceive higher occupational stress levels over time. There were only 3% of NGNs in the low occupational stress trajectory that self-reported as 'bianzhi' nurses, with the remaining 97% being contract based nurses. In contrast, in the high occupational stress trajectory, almost half of NGNs were 'bianzhi' nurses. This finding was inconsistent with previous studies that explored the effects of contract employment on nurse and patient outcomes (Shang et al., 2014; Qiu et al., 2017). Despite employment type, both categories of nurses hold the same role responsibilities in patient care. Although the Chinese government has applied the regulation of 'equal pay for equal work' for all nurses despite their employment type (Gong et al.,2016), contract-based nurses were reported as having higher dissatisfaction and intention to leave their position (Niu et al., 2016; Qiu et al., 2017). Interestingly, in our study, contract-based nurses were seemingly associated with lower level of occupational stress. This may be attributed to changes in hiring processes and the composition of nursing employment opportunities. Over the past two decades, Chinese hospitals have hired an increased proportion of contract-based nurses and gradually reduced the number of 'bianzhi' nurses, which led to the traditional 'bianzhi' positions being reserved for those with better qualifications such as a bachelor's degree or higher competencies (Shang et al., 2014). In this study, there were 37% of 'bianzhi' NGNs and 30% of contract-based NGNs that had a bachelor's degree. 'Bianzhi' nurses, due to their stronger academic background and competencies, may experience higher expectations during their transition. They are usually assigned more high-demanding tasks than contract-based nurses, such as conducting nursing research or quality improvement projects, and attending other trainings and workshops, which can contribute to increased overall stress (Zhang et al., 2017a,b). In addition, the NGNs recruited in this study are on the cusp of the 'post-90 s generation', are born between 1990 and 1999, and are the second generation as the only child in the family because of the 'one-child policy' in China which existed from 1980 to 2015. Individuals in the post 90′s generation are characterized as more realistic, have a greater sense of individuality, and have less sense of hierarchy in the workplace (Lampe et al., 2011). Therefore, when NGNs are challenged by an overwhelming sense of responsibility to patients and are faced with an unsupportive work environment and authority issues within a patriarchal hierarchical system, contract-based nurses may be more likely to leave the position. In contrast, the same decision may be much harder for 'bianzhi' nurses under the same circumstances because leaving the position represents giving up

the lifetime job security and continuing benefits. Currently, the contract signed by contract-based nurses in Chinese hospitals usually lasts for three or five years. In the four participating tertiary hospitals in this study, their contracts last for three years, which means that these NGNs can quit at the end of the first three years without paying penalty for breaking the contract. This may also explain why there is a larger proportion of 'bianzhi' nurses in the high occupational stress trajectory and why the NGNs in low stress trajectory (Subgroup 1) do not experience an increase of occupational stress levels during year 2 to year 3.

4.4. The preceptor arrangement for NGNs between different trajectory subgroups

According to our findings, NGNs who reported to be assigned to different senior nurses based on their shift were more likely to perceive higher levels of occupational stress over time. Preceptorship has been found to be effective in establishing positive professional attitudes and competencies among NGNs (Whitehead et al., 2016). Like other countries, NGNs are assigned to a preceptor (s) in each unit as a practice-based teacher in China. However, the process of assigning preceptor(s) is performed differently at each hospital or even among units within the hospital, including (1) NGN assigned to one fixed preceptor, (2) NGN assigned to a few senior nurses, or (3) NGN assigned to a different senior nurse for each shift. Researchers have reported that the one-to-one relationship between preceptor and NGN (preceptee) is cornerstone of an effective preceptorship (Ward and McComb, 2017, 2018). It is noteworthy that nurses in China usually experience shift rotation every 5–6 days including 8h-day shift, 12h-day shift, 12h-night shift and 2–3 days' off. Thus, in our study, NGNs may only work with one preceptor, or if they were paired with preceptors based on their shift, they may need to switch among multiple different preceptors almost daily. According to a study conducted in the Midwest region of the US, NGNs reported that having an inconsistent preceptor was a major stressor (Oermann and Garvin, 2002). Ultimately, these NGNs could face more challenges in maintaining an authentic relationship with different preceptors due to different teaching and learning styles compared to those who were assigned to one or few fixed preceptors (Willemsen-McBride, 2010). Additionally, without knowing what clinical practices have been taught by other preceptors and how they teach, as well as the added workload due to multiple roles of every preceptor in single shift (Valizadeh et al., 2016), some preceptors may feel less responsible for precepting NGNs.

4.5. The hometown of NGNs between different trajectory subgroups

In this study, 68% of NGNs in the medium stress trajectory (Subgroup 2) and 76% in the high stress trajectory (Subgroup 3) are nonlocal, while the proportion of non-local NGNs in the low stress trajectory (Subgroup 1) is only 31%. China experiences domestic nurse movement across provinces, especially in Shanghai. Shanghai, as one of the global financial centers, attracted nearly 10 million people in 2017 (around 40% of the total population of Shanghai) from other provinces or other countries (Shanghai Statistical Yearbook, 2017). In the nursing population, Shanghai hospitals have been recruiting more than 50% of nurses from other areas outside of Shanghai (Li, 2014). For these nurses, lack of familiarity with Shanghai dialect is one of the most challenging issues facing nonlocal nurses, which is essential to foster interpersonal relationships with patients and other healthcare providers. Nonlocal nurses reported discrimination and marginalization due to regional cultural differences (Baptiste, 2015). The financial burden experienced by nonlocal nurses due to housing costs is also a leading contributor for their stress levels due to the precipitously increased cost of housing in Shanghai (Zhang et al., 2006). Furthermore, nonlocal NGNs usually have a less robust social support system because their families or friends remain in their hometown. All of these factors may impede their ability to work at their highest aptitude, which can negatively impact their professional development and ultimately contribute to higher levels of occupational stress compared to native Shanghai nurses. Generally, nonlocal nurses reported that the reason they work in Shanghai, a bigger city than their hometown, is to fight for better career opportunities and development (Zhang and Yu, 2018). However, the enthusiasm cannot protect them from the frustration caused by occupational stressors. Ye et al (2017) found out that nonlocal nurses are more likely to have higher turnover intention and ultimately quit their job to return to their hometowns, especially during the third year of practice. This may explain the NGNs in the medium and high stress trajectories (Subgroup 2 and 3) experience of an increase in occupational stress between year 2 and 3.

4.6. Non-significant differences of age, gender and academic degree between trajectory subgroups

In our present study, there were no significant relations between age, gender and academic degree and occupational stress trajectory. Although, previous studies have reported the effect of NGNs' age, gender and academic degree on their occupational stress, variability in findings have been noted. A 12-month longitudinal study conducted by Halpin et al. (2017) found that there was a significant negative correlation between the NGNs total frequency of reported stressors and age. In China, the NGNs employed by hospitals every year are almost all recent graduates from schools or universities, which results in a homogeneous age group among NGNs. In our study, 93.3% of participants were 21 to 24 years old. This might be a contributing factor to the lack of statistically significant differences between trajectory subgroups based on age. Nursing has historically been a female dominated profession, and male nurses tend to experience more stressors regarding role conflict, which leads to less satisfaction and greater turnover intentions than their female counterparts (Hsu et al., 2010). On the contrary, no significant difference between gender and occupational stress was reported in Blomberg's 2016 study. Our study did not have enough gender distribution to be able to confidently evaluate differences between different trajectory subgroups. Men represented 11% of nurses licensed between 2010 and 2013 in the US (American Nurses Association, 2014), and 1.8% of registered nurses were male in China in 2012 (China Health Statistical Yearbook, 2013). Although tertiary hospitals in Shanghai may recruit more male nurses compared to other hospitals or provinces, males still comprise a low proportion of participants in our study (4.6%). In terms of academic degree, our study found no statistical difference between academic degree and occupational stress levels across time, although previous studies had reported that NGNs with a bachelor's degree or higher were more likely to experience higher levels of occupational stress during their first year of practice in comparison to those who had an associate degree (Zhang et al., 2017a,b). The interaction between academic degree and occupational stress may have been missed here due to the relatively low proportion of NGNs who graduated with a bachelor's degree in this study (19%).

5. Limitations and future research

Only 4 tertiary hospitals in Shanghai were included, which is not representative for other areas of China. Thus, future studies including participants from other provinces across China and other countries are needed to verify the results generated in this study. Only 152 participants who completed all four measures were included for data analysis, and others were excluded due to

turnover, sick leave and other reasons. However, these NGNs may have quit or asked for sick leave because of high levels of occupational stress. Considering this, further studies should be conducted to evaluate the role of occupational stress as a contributing factor to turnover or sick leave. Future studies including more male nurses and larger samples are also highly recommended. Furthermore, although a 3-class model was selected based on both objective and subjective considerations, this model did not hold the smallest AIC and BIC values. Further longitudinal studies should continue to verify subgroups of occupational stress over time among NGNs. Furthermore, based on our findings, future research should investigate whether early evaluation of occupational stress levels within the first few months or year of employment can predict a NGNs occupational stress trajectory, which may allow for earlier intervention and additional support for nurses with atypical high occupational stress patterns. Lastly, only differences in demographic characteristics between occupational stress trajectory subgroups were tested. In future studies, the impact of other variables such as personality traits, coping strategies, resilience and professional identity on occupational stress should be explored.

6. Conclusion and implications

This study was designed to identify subgroups of occupational stress trajectories and to examine the differences between subgroups. The results showed that NGNs in this study typically followed a trajectory of decreasing levels of occupational stress during the first three years of nursing practice. Three different trajectory subgroups were identified in our study: low occupational stress trajectory (Subgroup 1), medium occupational stress trajectory (Subgroup 2) and high occupational stress trajectory (Subgroup 3). NGNs who came from areas outside of Shanghai, were employed as 'bianzhi' nurses, or were assigned multiple preceptors were more likely to experience high occupational stress levels over time. The findings in our study provide a more nuanced picture of occupational stress developmental trajectories among NGNs during the first three years of practice. Additionally, our findings can guide the early identification of NGNs with high occupational stress and the development of targeted and tailored interventions to manage occupational stress of NGNs.

Further, given that every individual NGN has different characteristics, it is important for nurse managers and educators to pay close attention to different groups of NGNs and implement orientation programs that suit their individual needs to support successful transitions to practice. For example, language workshops, cultural workshops, and peer-support programs could be implemented to assist non-local NGNs integrating into a new environment; standardized preceptorship for NGNs should be improved to ensure effective one-on-one precepting; regular meetings with 'bianzhi' nurses can be conducted to talk about their experiences and stressors, and then timely support should be provided to address the stressors or improve their stress management abilities. Overall, according to our findings in this study, managers should identify and target at-risk NGNs and suggest more customized interventions to better manage their occupational stress.

Conflicts of interest

There are no conflicts of interest to report.

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