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Professional quality of life profiles and its associations with turnover intention and life satisfaction among nurses: a prospective longitudinal study

Tongshuang Yuan[1], Hui Ren[2], Leilei Liang[1], Honghua Li[1,3], Kai Liu[1], Yajie Qing[1], Songli Mei[1*] and Hongyan Li[4*]

Abstract

Background   Nursing shortage is a global issue. Turnover intention and life satisfaction are significant predictors of turnover. The specific nature of nursing and stressful work schedules lead to impaired professional quality of life (ProQOL), and existing studies have confirmed the effect of a dimension of ProQOL (such as secondary trauma stress, burnout and compassion satisfaction) on turnover intention and life satisfaction. Yet the heterogeneity of ProQOL across individuals is not known. A lack of research on the relationship between potential ProQOL subgroups and turnover intention and life satisfaction, and the mechanisms underlying this relationship remain understudied. The study aimed to determine different ProQOL profiles, and their cross-sectional and longitudinal effects on turnover intention and life satisfaction, while exploring the mediating roles of job satisfaction and work engagement within the relationship.

Methods   Data were collected at a tertiary hospital in a northeastern province of China. An online questionnaire was administered twice over the course of six months. 1832 and 900 participates provided cross-sectional and longitudinal data respectively. We used latent profile analysis (LPA) and K-means clustering to identify ProQOL profiles, and used the PROCESS macro program to conduct mediation analysis.

Results   The LPA results supported a 4-profile solution, including balanced protection, good quality, traumatic satisfaction and burnout problem. ProQOL profiles directly predicted nurses' current and subsequent turnover intention and life satisfaction. In addition, job satisfaction and work engagement mediated the effects of ProQOL profiles on turnover intention and life satisfaction in cross-sectional sample, and mediated the effects of ProQOL profiles on turnover intention in longitudinal sample.

Conclusion   The findings suggest that nurses' ProQOL has distinct categorical characteristics and is strongly associated with turnover intention and life satisfaction. Hospital administrators should implement individualized, join

*Correspondence:
Songli Mei
meisongli@sina.com
Hongyan Li
hy_li@jlu.edu.cn
Full list of author information is available at the end of the article

management and interventions according to each profile. Furthermore, more attentions should focus on improving nurses' job satisfaction and work engagement levels to promote good work and life outcomes.

Keywords Professional quality of life, Job satisfaction, Work engagement, Turnover intention, Life satisfaction, Latent profile analysis

Introduction

Improving the quality of work life of healthcare workers is considered as the fourth goal of optimizing health performance [1], which is essential to achieve the primary goal of the healthcare system: improving the health of the population. Nurses, as the primary health service providers in the global healthcare system, account for approximately 50% of the global health workforce [2]. The long hours and high intensity of work result in high occupational stress for nurses, and as a high-risk occupational group, they frequently experience traumatic events, deterioration, pain, and even death of their patients, which lead to a decline in nurses' professional quality of life (ProQOL) [3]. ProQOL is the professional quality perceived by nurses in their work as helpers [4], which consists of three dimensions: secondary trauma stress (STS), burnout, and compassion satisfaction [5]. STS is a group of symptoms that encompasses intrusion, avoidance, and arousal from experiencing traumatic events as a result of caring for trauma victims [6]. Burnout is a syndrome resulting from prolonged exposure to work-related stress, which includes emotional exhaustion, depersonalization, and low personal accomplishment [7]. These two dimensions combine to reflect negative emotion at work. Compassion satisfaction, on the other hand, represents positive emotion at work and refers to the sense of accomplishment and satisfaction acquired from helping others.

Studies have shown that nurses are more susceptible to burnout and STS than other healthcare professionals [8]. A Meta-analysis showed that burnout and STS among nurses increased over time, with Asian nurses having the lowest levels of compassion satisfaction and the worst burnout and STS [9]. The epidemic may exacerbate these phenomena, with study showing that 61.5% and 64.5% of Chinese frontline nurses experienced moderate to severe burnout and STS during COVID-19, respectively [10]. Poorer ProQOL (i.e., low levels of compassion satisfaction and high levels of burnout and STS) is strongly associated with physical and psychological problems, and may lead to substance abuse, patient avoidance, and impaired quality of care, and further lead to an increased willingness to leave the job [11, 12].

The shortage and high turnover rate of nurses are pressing challenges in China and the world today [13, 14]. The number of nurses per 1,000 population in China is 3.75, which is lower than the world average and much lower than that of developed countries [15]. Nurse turnover would result in further reduction in nurse staffing level, increase work stress, and compromise quality of care and patient safety [16, 17]. Meanwhile, nurse turnover imposes greater economic cost on health system [18]. Turnover intention is an employee's intention to leave the current workplace, and it is primary in the turnover process [19]. According to a large-scale investigation results in China, 49.58% of nurses expressed the intention to leave the job, which is much higher than the rate of other countries [16]. Existing studies have shown that burnout and STS significantly and positively predicted nurses' turnover intention, and compassion satisfaction negatively predicted turnover intention [20, 21]. Additionally, burnout and STS may affect nurses' entire lives by triggering negative emotions, and decrease their life satisfaction [22]. However, the mediating mechanisms underlying ProQOL and turnover intention and life satisfaction need further investigation.

The self-determination theory (SDT) suggests that satisfying the three basic psychological needs of autonomy, competence, and relationships enhances an individual's internal motivation, which in turn promotes positive behavioral outcomes, mental health, and well-being [23]. Nurses with high levels of ProQOL usually work in a good working environment and therefore may feel that their autonomy is supported. And the organization may provide adequate training and support that could undoubtedly enhance their sense of competence. The fulfillment of the above basic psychological needs may contribute to nurses' work engagement and job satisfaction by enhancing their intrinsic motivation [24]. It has been established that a positive work environment facilitates the satisfaction of employees' basic needs and intrinsic motivation, thus promoting well-being and positive attitudes and behaviors [25]. In addition, the social exchange theory (SET) states that exchange relationships are subject to the principles of reciprocity and fairness [26]. Nurses with high ProQOL levels cannot do without organizational support and positive feedback. When nurses feel a high sense of organizational support, based on the principle of reciprocity, they become more focused on the interests of the organization and develop a sense of obligation to give back to the organization. Thus, nurses with high levels of ProQOL may be able to maintain stability in their exchange relationship with the organization by exhibiting more positive work attitudes and behaviors. Previous studies suggested that job satisfaction and work engagement were strong predictors of turnover intention

and could mediate the effect of other variables such as work resources on turnover intention [27, 28]. Rutledge et al. study has shown that that high levels of work engagement and job satisfaction promote positive work outcomes for nurses and reduce turnover intention [29]. Also, there may be spillover effects from work to other areas of life. When nurses feel loyal and satisfied with their work, they may develop more positive emotions and thus show more positive evaluations of their lives. On this basis, the present study proposes that job satisfaction and work engagement as mediating factors in the relationship between ProQOL and both turnover intention and life satisfaction.

However, the current examination of the relationships between ProQOL, turnover intention, life satisfaction, and other variables were mainly based on a variable-centered approach. The variable-centered approach emphasizes that three dimensions of ProQOL are independent from each other and neglect the joint effect of three dimensions. Mixed effects between different dimensions may form multiple latent categories that present unique characteristics and effects. Thus, this method is not flexible enough and is difficult to reflect the heterogeneous characteristics behind simple linear relationships [30]. Latent profile analysis (LPA), a person-centered approach, can be used as a promising grouping method to explore the latent profiles of ProQOL. LPA is a gaussian finite mixture modeling approach for identifying distinct clusters (i.e., profiles) based on participants' responses to a set of measures or variables estimated using maximum likelihood [31]. The method lends itself for finer clusters of group heterogeneity, thus capturing group heterogeneity that cannot be observed in variable-centered analysis [32]. And it could yield lower rates of misclassification and omission for individuals [33].

There is still a lack of a gold standard for statistical validation of data clustering results [34]. In order to test the validity and stability of the LPA grouping results, K-means clustering was used to conduct sensitivity tests. K-means clustering is an iteratively solved cluster analysis algorithm which attempts to classify M points in N dimensions into K clusters, which is a non-model-based grouping method [35]. K-means clustering is suitable for our research dataset and research purposes. Also, k-means clustering algorithm is simple and easy to use, has low time complexity. It is able to delineate the dataset in a more straightforward manner and generate clear cluster centers, which helps us to better understand the data distribution patterns. In addition, most of the existing studies have focused only on the immediate effects of ProQOL, not much longitudinal studies conducted on Chinese nurses to examine its delayed effects. This is not conducive to understanding the robustness of the variable relationships as we look at the long-term effects of

ProQOL from developmental and temporal cues. ProQOL and its effects are dynamic in nature, and longitudinal data can better reveal the role of ProQOL on turnover intention and life satisfaction than the cross-sectional study. To summarize, this study built a theoretical model of the role of ProQOL in nurses' turnover intention and life satisfaction through work engagement and job satisfaction on the basis of existing research, as well as on the basis of SDT and SET constructs. Prior researches have mainly focused on the direct correlation between the above relationships, and little is known about their underlying mediating mechanisms. Therefore, this study would contribute to the understanding of the mechanisms underlying the impact of ProQOL on turnover intention and life satisfaction, deepen the understanding of the impact of ProQOL, as well as provide practical guidance for hospital administrators and organizations to improve work environments in order to promote positive outcomes for nurses. In addition, this study combined cross-sectional and longitudinal research designs to clarify the immediate and delayed effects of ProQOL, so as to test the robustness of the above relationships and mechanisms in cross-sectional and longitudinal studies. Figure 1 visually depicts the entire model for this study. A theoretical model with ProQOL profiles as predictor variables, job satisfaction and work engagement as mediator variables, and turnover intention and life satisfaction as dependent variables was constructed.

Methods

Study design and participants

Data was collected from nurses in a tertiary hospital of China, collected through cluster sampling procedures. After obtaining the consent of hospital administrators, we created the questionnaire through "Questionnaire Star" platform, a widely used online survey platform in China. The head of nurses distributed electronic questionnaires via "WeChat", a popular social media app in China. The first page of the questionnaire explained in detail the purpose and procedure of the survey, and participants could choose to answer voluntarily after fully understanding the terms. Each question of the electronic questionnaire was set as a mandatory question to avoid any missing data, thus ensuring the integrity of the data obtained. This study adopted a longitudinal research design. Considering the purpose of the study, the time interval settings of previous similar longitudinal studies, and the limited resources, we adopted two data collections with an interval of 6 months [36, 37]. The 6-month time span was sufficient to capture changes in participants' job satisfaction, work engagement, turnover intention, and life satisfaction, and the two waves of data collection provided enough information to test the research hypotheses.
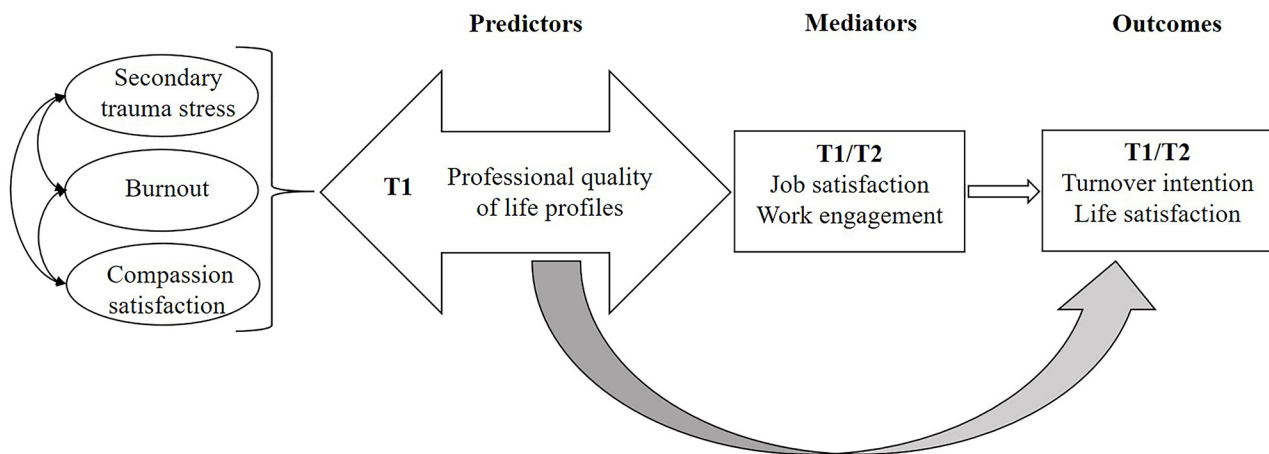
Fig. 1 The entire research model

The first data collection was conducted from November to December 2022 (T1). After six months, participants were investigated again from May to June 2023 (T2). Inclusion criteria were as follows: aged ranging from 18 to 60 years old and clinical registered nurses. After removing questionnaires with less than 3 min of response time and obvious patterns or duplicate responses, 1,832 samples were finally used for the cross-sectional data analysis and 900 valid samples were used for the longitudinal data analysis. There were no significant differences in demographic characteristics and study variables at T1 for losing subjects compared to subjects with complete data ($p > 0.05$).

Measurements
Demographic variables
Demographic variables in the present study contained gender, age, educational level, monthly income, marital status, negative life and workplace events.

Professional quality of life
The modified Chinese version of ProQOL was used at T1 and T2 for measuring nurses' overall professional quality [38]. The scale consists of 30 items based on the three dimensions: STS, burnout and compassion satisfaction. Each item is rated on a 5-point Likert scale, ranging from 1 (inappropriate) to 5 (very appropriate). The ProQOL scale is scored separately on three dimensions. The total score ranges from 10 to 50, with a higher score value indicating more severe STS, burnout and higher compassion satisfaction. The scale has shown good validity and reliability [39]. The Cronbach's α of each dimension for cross-sectional data ranged from 0.70 to 0.95. The Cronbach's α for longitudinal data ranging from 0.71 to 0.95 for T1 and 0.72 to 0.92 for T2.

Work engagement
Work engagement refers to a positive work state represented by traits such as vigor and dedication, and was measured in this study using a 3-item short-scale developed by Christian et al. [40]. The scale consists of one question for each of three dimensions: vigor, dedication and absorption. Example item is "I was absorbed by my job." All items are rated by a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). In the study, the Cronbach's α of the cross-sectional data was 0.89. For longitudinal data, the Cronbach's α was 0.89 for T1 and for 0.90 T2.

Job satisfaction
To assess nurses' global job satisfaction, a single item, "All things considered, how satisfied are you with your current job?" was used [41]. Participants were asked to rate their satisfaction with their current job on a 7-point Likert scale from 1 (not at all satisfied) to 7 (very satisfied). Job satisfaction is defined as an attitude in which individuals make positive or negative evaluative judgments about their current job or job situation [42]. The single-item measure has been widely used and demonstrated to have good psychometric properties [43].

Turnover intention
The measurement of turnover intention was referenced to Kash et al. study [44], assessed with a single item "Considering the current situation, I'm more likely to leave my current workplace." The item is rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The single-item approach has proved to have good validity and reliability [45].

Life satisfaction
The single item was used to measure overall life satisfaction. Participants respond to the item, "Taking everything

into consideration, how satisfied are you with your current life as a whole?". The item is rated on a 5-point Likert scale from 1 (not at all satisfied) to 5 (very satisfied). A single-item has shown excellent criterion validity and reliability [46].

Data analyses

First, descriptive analysis and Pearson's correlation coefficient were used to analyze the studied variables. T test and one-way analysis of variance (ANOVA) were used to determine the differences in turnover intention and life satisfaction in terms of demographic variables. Second, LPA was utilized to explore ProQOL profiles. Before LPA analysis, variables were transformed into Z-scores (Mean, M=0, Standard deviation, SD=1) [47]. The existence of multicollinearity between the observed variables was assessed using the variance inflation factors (VIF), which was greater than 10 was considered to be a significant multicollinearity [48]. The best fitting model was determined using the following statistical fit indices: (1) information evaluation indicators: Akaike information criterion (AIC), Bayesian information criterion (BIC), sample size-adjusted BIC (aBIC); (2) entropy index; (3) the Lo-Mendell-Rubin likelihood ratio test (LMRT), and bootstrap-based likelihood ratio test (BLRT). Smaller information evaluation indicators indicate better fitted model. Entropy index (ranging from 0 to 1) indicates the classification accuracy, while higher entropy value indicates more accurate classification [49]. Entropy values less than 0.60 indicate that more than 20% of individuals have classification errors, values above 0.70 are considered reasonable, and values above or equal to 0.80 indicate over 90% classification accuracy [50]. The *p*-values of the two indicators, the LMRT and BLRT, reach a significant level suggest the model with k profiles significantly outperformed the model with k-1 profiles [51]. When the sample size is large, the number of people in each profile is at least 5% of the total sample [52]. The present study also chose the final model with a combination of statistical fit indices, clinical significance, and interpretability of each profile [53].

In addition, we compared the scores of three dimensions of ProQOL between the latent profiles. The ANOVA and the LSD test were utilized to determine any significant differences between the identified profiles. Following this, the BCH method was utilized to compare the differences in turnover intention and life satisfaction across ProQOL profiles [54]. K-means clustering was used to investigate the stability of the classification results. Using the elbow method for optimal number of clusters [55]. Finally, Hayes's PROCESS macro program (Model 4) was performed to test the mediation model [56]. The 95% confidence interval (CI) was calculated based on a 5,000 bootstrap resampling, which does not

include 0 indicating the effect was significant. LPA and K-means clustering were performed by Mplus 7.4 and RStudio respectively, and other statistical analyses were conducted by SPSS 24.0. Statistical significance was defined as a two-tailed *p*-value smaller than 0.05.

Human ethics and consent to participate

The survey was anonymized to fully protect participants' privacy and online informed consents were obtained from all participants. The study was performed in accordance with the Declaration of Helsinki, and approved by the Medical Ethics Committee, School of Public Health, Jilin University.

Results

Demographic characteristics

Table 1 presents demographic characteristics of the sample in turnover intention and life satisfaction of 1,832 participants, 1,684 nurses were female (91.92%). 641 nurses aged between 35 and 39 (34.99%), and only 112 participants are over 45 years old (6.11%). Most participants held a bachelor degree (89.57%) and got married (76.58%). In terms of monthly income, only 5.40% of the participants had a monthly income below RMB 6,000. A total of 430 (23.47%) and 1,157 (63.16%) participants have experienced negative life and workplace events respectively. The score on turnover intention was significantly different across gender and age ($p < 0.01$). As for the score on life satisfaction, there were significant differences across gender, age, marital status and negative life events ($p < 0.05$).

Common method bias test

The common method biases testing was performed using the Harman single factor test [57]. The results showed that for cross-sectional and longitudinal data, the maximum factor variance explained was lower than the cut-off value of 0.40, indicating the study did not suffer from serious common method bias [58].

LPA

LPA was performed using the three dimensions of ProQOL as observational variables. Regarding the VIF, the results show that the maximum VIF was 2.78, indicating that no serious multicollinearity problems were observed. Table S1 displays the fitting indices of different LPA models. The results showed that the information indicators (AIC, BIC and aBIC) were decreasing from model 1 to model 6, where 4-profile, 5-profile, and 6-profile indicated good fit. The LMR and BLRT tests results were significant in 5-profile and 6-profile, but the information indicators did not improve significantly. And one profile accounted for less than 5% of the overall weight, which is considered limited significance in terms of practical

Table 1 Demographic differences in turnover intention and life satisfaction ($N = 1,832$)

Variables	n (%)	Turnover intention		Life satisfaction	
		M(SD)	t/F	M(SD)	t/F
Gender			2.91**		-2.83**
Male	148(8.08)	2.64(1.39)		3.64(0.93)	
Female	1,684(91.92)	2.31(1.30)		3.86(0.81)	
Age (years)			10.53***		10.23***
≤ 29	322(17.58)	2.22(1.24)		3.79(0.82)	
30–34	556(30.35)	2.53(1.33)		3.78(0.81)	
35–39	641(34.99)	2.37(1.32)		3.84(0.85)	
40–44	201(10.97)	2.16(1.33)		3.88(0.79)	
≥ 45	112(6.11)	1.75(1.14)		4.30(0.70)	
Educational level			1.32		2.98
Junior college or below	106(5.79)	2.46(1.37)		3.82(0.84)	
Bachelor degree	1,641(89.57)	2.34(1.31)		3.84(0.83)	
Master degree or above	85(4.64)	2.15(1.28)		4.06(0.76)	
Monthly income (RMB)			0.16		1.43
≤ 6,000	99(5.40)	2.26(1.38)		3.86(0.97)	
6,001–8,000	312(17.03)	2.34(1.35)		3.81(0.86)	
8,001–10,000	595(32.48)	2.35(1.28)		3.80(0.81)	
>10,000	826(45.09)	2.33(1.32)		3.89(0.80)	
Marital status			0.24		7.13**
Married	1,403(76.58)	2.33(1.33)		3.89(0.82)	
Unmarried	389(21.23)	2.33(1.25)		3.71(0.84)	
Divorce/widowhood	40(2.18)	2.48(1.47)		3.73(0.85)	
Negative life events			0.30		-2.21*
Yes	430(23.47)	2.35(1.30)		3.77(0.82)	
No	1,402(76.53)	2.33(1.32)		3.87(0.82)	
Negative workplace events			-1.04		0.32
Yes	1,157(63.16)	2.31(1.31)		3.85(0.83)	
No	675(36.84)	2.38(1.32)		3.84(0.82)	

Note M = Mean, SD = Standard deviation, $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

interpretation and application. Overall, given the model's simplicity and interpretability, the 4-profile was chosen as the final model. The k-means clustering results also supported a 4-class solution. For more detailed information, see Fig. S1 and Fig. S2.

As shown in Fig. 2, profile 1 is characterized by moderate to low values on STS and burnout, and moderate level of compassion satisfaction, and it was named balanced protection (35.4%); profile 2 is characterized by low levels of STS and burnout, and high level of compassion satisfaction, and it was named good quality (22.0%); profile 3 is characterized by high levels of STS and burnout, and moderate to high value on compassion satisfaction, and it was named traumatic satisfaction (20.6%); profile 4 is characterized by moderate to high level of STS, high values on burnout, and low values on compassion satisfaction, and it was named burnout problem (22.0%). Table S2 (Supplementary material) summarizes the ANOVA results, and all F-values were statistically significant. Post-hoc tests showed that each profile presented a different STS score, with a specific score traumatic satisfaction > burnout problem > balanced protection > good

quality. Each profile presented a different burnout score, as evidenced by burnout problem > traumatic satisfaction > balanced protection > good quality. Except for the balanced protection and traumatic satisfaction profiles, each profile exhibited a different compassion satisfaction score.

As shown in Fig. S3, ANOVA results showed significant differences in turnover intention ($F = 161.428$, $p < 0.001$) and life satisfaction ($F = 184.284$, $p < 0.001$) scores between different profiles. Post-hoc tests showed that burnout problem, traumatic satisfaction, balanced protection, and good quality decreased in descending order of turnover intention scores ($p < 0.05$). For life satisfaction score, the good quality scored the highest and the burnout problem scored the lowest.

Testing the mediation model
Cross-sectional model
The immediate mediation model was constructed on the basis of the cross-sectional data, and the results are shown in Fig. 3. The overall mediation analysis with life satisfaction and turnover intention at T1 as dependent
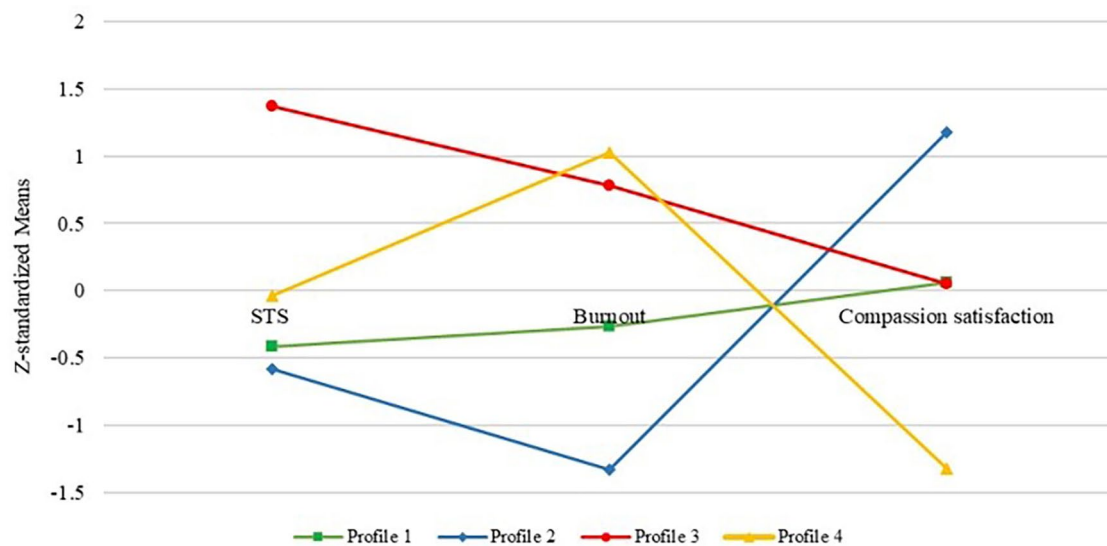
Fig. 2 Latent profile analyses of ProQOL ($N = 1,832$). Note Profile 1 = Balanced protection, Profile 2 = Good quality, Profile 3 = Traumatic satisfaction, Profile 4 = Burnout problem, STS = Secondary trauma stress
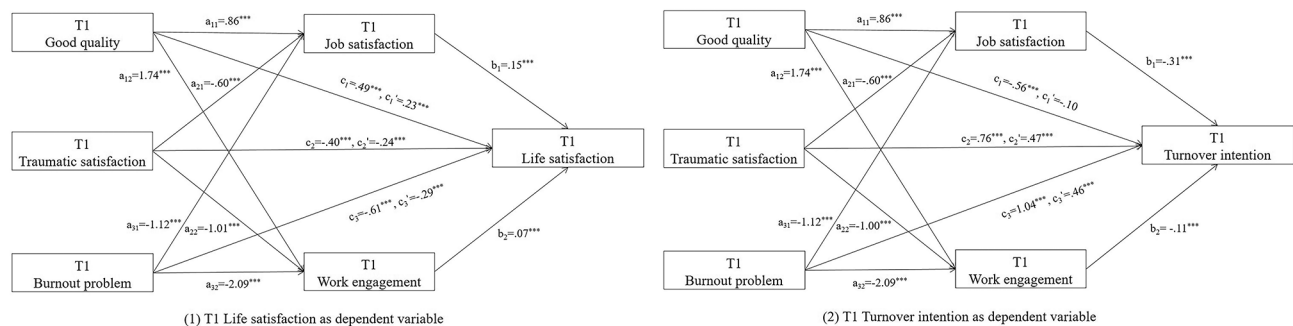

Fig. 3 The cross-sectional mediation model of ProQOL profiles, life satisfaction and turnover intention ($N = 1,832$). Note $^{***}p < 0.001$; Balanced protection profile served as reference group; When life satisfaction as the dependent variable, gender, age, educational level, marital status, negative life and workplace events as control variables; When turnover intention as the dependent variable, gender, age, educational level, negative life and workplace events as control variables

variables, respectively, showed that the overall total effect tests were significant [F (3,1822) = 178.07, $p < 0.001$; F (3,1823) = 154.94, $p < 0.001$], suggesting the three relative total effects were not all zero. The overall direct effect tests were significant [F (3,1820) = 31.72, $p < 0.001$; F (3,1821) = 23.51, $p < 0.001$], implying that three relative direct effects were not all zero, thus, relative mediation analysis for life satisfaction and turnover intention, respectively, was necessary.

Using balanced protection profile as the reference, the results showed other three profiles significantly predicted job satisfaction, work engagement, life satisfaction and turnover intention ($p < 0.001$). Job satisfaction and work engagement significantly predicted life satisfaction and turnover intention ($p < 0.001$), respectively. The predictive effect remained significant after removing all control variables. As showed in Table S3 (Supplementary material), the 95% CI all did not contain 0, indicating that the indirect effect of ProQOL profiles on life satisfaction and turnover intention, through the dual mediating roles of job satisfaction and work engagement were significant.

Longitudinal model

The ProQOL profiles were identified by LPA base on the longitudinal data of STS, burnout and compassion satisfaction at T1. The maximum VIF for the longitudinal data was 2.88, indicating that no serious multicollinearity problems were present either. The 4-profile solution was finally determined as the optimal model. The profiles results were similar to findings obtained from the cross-sectional sample. Detailed information is available in Supplementary materials (Table S4 and Fig. S4).

The overall mediation analysis with life satisfaction at T2 as the dependent variable showed that the overall total effects test was significant [F (3,890) = 21.63, $p < 0.001$].

The relative total effect of good quality was not significant ($p>0.05$), but the relative total effect of traumatic satisfaction and burnout problem were significant ($p<0.01$). The overall direct effect was not significant [$F(3,888)=1.70$, $p>0.05$]. After removing all control variables, the overall direct effect remained insignificant. Therefore, no further relative mediation analyses were needed.

When turnover intention at T2 was used as the dependent variable, the overall total effect was significant [$F(3,891)=24.41$, $p<0.001$], suggesting the three relative total effects were not all zero. The overall direct effect test was significant [$F(3,889)=4.54$, $p<0.01$], implying that three relative direct effects were not all zero, thus, relative mediation analysis was necessary. The relative mediation analysis results are shown in Fig. 4 and bootstrap results are shown in Table S5 (Supplementary materials). Using balanced protection profile as the reference, the 95% CI for the relative mediators of job satisfaction and work engagement for good quality profile were [-0.15, -0.02] and [-0.14, -0.02], respectively, both excluding 0. The above results indicated significant relative dual mediating effects of life satisfaction and work engagement [($a_{11}=0.28$, $b_1 = -0.29$, $a_{11}b_1 = -0.08$); ($a_{12}=0.51$, $b_2 = -0.15$, $a_{12}b_2 = -0.08$)], that is, nurses in good quality profile had higher job satisfaction and work engagement relative to balanced protection profile, so nurses in the good quality profile had correspondingly lower turnover intention, with a non-significant relative direct effect ($c'_1 = -0.12$, $p>0.05$). The relative total effect was significant ($c_1 = -0.28$, $p < 0.05$), with effect sizes of 29.51% and

28.09% for the relative mediating effects $a_{11}b_1$ and $a_{12}b_2$, respectively.

Similarly, relative to balanced protection profile, nurses in traumatic satisfaction profile and burnout problem profile had lower levels of job satisfaction and work engagement ($a_{21} = -0.62$, $a_{22} = -1.18$; $a_{31} = -0.61$, $a_{32} = -1.22$), and higher levels of turnover intention ($b_1 = -0.29$, $b_2 = -0.15$). The relative direct effect of the traumatic satisfaction profile was not significant ($c'_2 = 0.12$, $p>0.05$). The relative direct effect of the burnout problem profile was significant ($c'_3 = 0.24$, $p < 0.01$), indicating turnover intention of nurses in burnout problem profile was 0.24 higher than that of nurses in balanced protection profile without the consideration of mediating effects. Relative total effects were significant [($c_2=0.48$, $p<0.01$), ($c_3=0.60$, $p<0.001$)], with effect sizes of 37.47% and 37.45% for traumatic satisfaction profile for the relative mediating effects of $a_{21}b_1$ and $a_{22}b_2$, respectively; and the relative mediating effects of the burnout problem profile effect sizes for $a_{31}b_1$ and $a_{32}b_2$ were 28.90% and 30.56%, respectively. When control variables were excluded, the model significance results were consistent with the above findings, which allowed for the exclusion of potential effects of control variables.

Discussion

The current study explored the subtypes of nurses' ProQOL through a person-centered analysis of a Chinese sample, and a limited number of studies have examined ProQOL through this method. In addition, this study examined their immediate and delayed effects on nurses' turnover intention and life satisfaction, and further
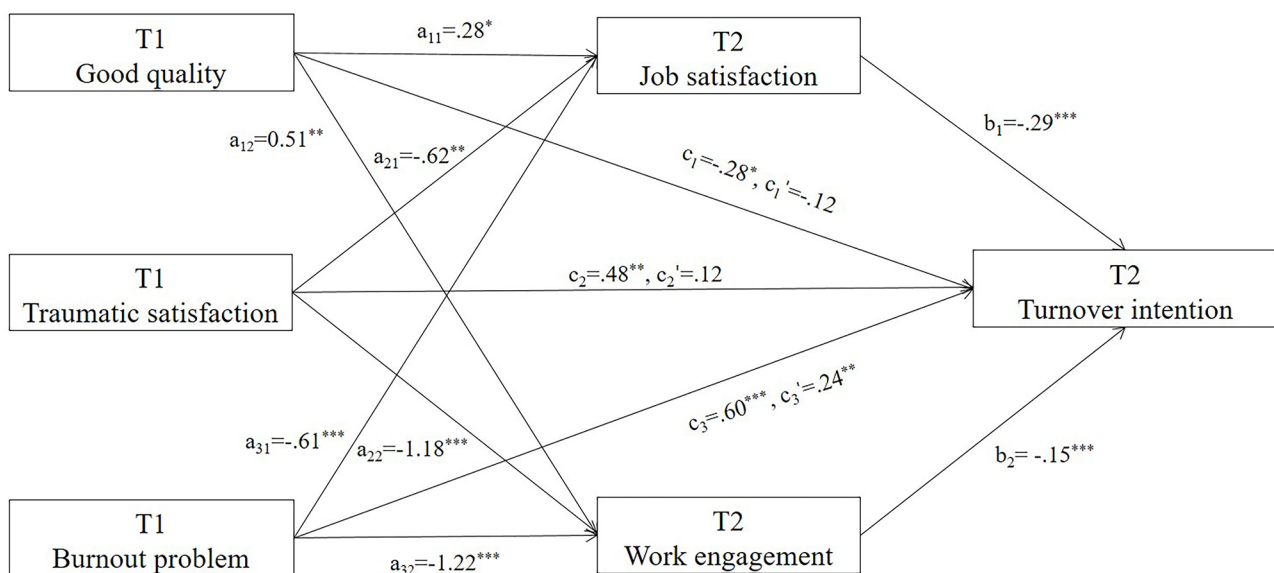

Fig. 4 The longitudinal mediation model of ProQOL profiles and turnover intention ($N=900$). Note $^*p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$; Balanced protection profile served as reference group; Gender, age, educational level, negative life and workplace events as control variables

tested the robustness of the above relationships and mechanisms in cross-sectional and longitudinal studies. By comparing and integrating immediate and delayed effects, the study could provide an important basis and reference for establishing comprehensive and effective interventions. Our study is unique in comparison to previous studies of nurses' ProQOL because of its longitudinal design. The main findings are as follows:

From the cross-sectional data, the study identified 4 ProQOL profiles, including balanced protection, good quality, traumatic satisfaction and burnout problem. The good quality profile, which accounted for 22.0% of the participants, had the best ProQOL, characterized by low levels of STS and burnout and high levels of compassion satisfaction. Compared to the other three groups, their turnover intention is the lowest and life satisfaction is the highest. The balanced protection profile accounted for the largest number of participants (35.4%), showing moderate to low levels of STS and burnout and moderate levels of compassion satisfaction, and was second only to the good quality profile in terms of good work and life outcomes. The above findings indicated that more than half (57.4%) of the nurses presented moderate and above levels of ProQOL, and that these two groups may not need interventions temporarily. The result was inferior to ProQOL level reported in a study on nurses of tertiary hospital before the epidemic [7]. Reasons for the situation may include uncertainty during the epidemic, fear of infection for themselves or relatives and increased need for care. However, our result was superior to nurses who cared for patients in the early stage of the COVID-19 [10]. This may be due to the fact that during the investigation period, the healthcare system and healthcare workers were already well informed about and responded to the outbreak, personal protection resources were adequate, and the physical and mental stress of the nurses was effectively relieved. Lluch-Sanz et al. identified two profiles of ProQOL through LPA utilizing three scales of ProQOL, burnout, and job satisfaction in both positive and negative aspects [50]. The ProQOL subgroups in this study were inconsistent with the results of the above subgroups, which may be due to differences in the selected observational variables. However, the proportion of nurses with moderate and above levels of ProQOL was similar to the high ProQOL in Lluch-Sanz et al. study, but lower than the results above. This may be influenced by different cultures, survey populations and time.

Most notably, the burnout problem profile comprised 22.0% of the participants, characterized by high burnout and low compassion satisfaction, reported with the highest level of turnover intention and lowest level of life satisfaction. This suggests that high burnout and low compassion satisfaction tend to occur concomitantly and have a cumulative effect. The finding is in accordance with the existing evidence that there was a significant and large negative correlation between burnout and compassion satisfaction [59]. Therefore, interventions that target burnout symptoms in combination with the improvement of compassion satisfaction may be more effective. It is noteworthy that nurses in the traumatic satisfaction profile had high turnover intention just below the burnout problem profile, and they also had low level of life satisfaction. The group comprised 20.6% of the participants, and the characteristics indicated that nurses with high STS could still have good level of compassion satisfaction. STS may not have a direct effect on compassion satisfaction, which is consistent with the previous study [59]. Interventions targeting this profile should prioritize improvement of STS and complement measures to alleviate burnout. These results implied that the focus should not only on the independent effects of STS, burnout and compassion satisfaction, but also need a deeper understanding on the effects of their mixed effects based on a person-centered perspective. With limited healthcare resources, intervention priorities should be set according to the characteristics of potential ProQOL profiles, first focusing on high-risk populations, including the burnout problem profile and traumatic satisfaction profile. In addition, categorical guidance as well as precision and joint management measures are provided to improve the work and life outcomes.

Additionally, the study found that ProQOL profiles predicted nurses' current and subsequent turnover intention and life satisfaction. Therefore, timely improvement of nurses' ProQOL is not only positive in the present, but the effect is sustainable. However, good quality profile was not a significant predictor of life satisfaction after six months, which might be attributed to the fact that life satisfaction is less sensitive to positive work outcomes than negative work outcomes [60]. In the cross-sectional model, the relative mediation analysis showed that compared with the balanced protection profile, the good quality profile resulted in lower turnover intention and higher life satisfaction through higher job satisfaction and higher work engagement. The traumatic satisfaction profile and burnout problem profile led to higher turnover intention and lower life satisfaction through lower job satisfaction and lower work engagement. This can be explained by the SDT [61], where positive ProQOL indicates that nurses' basic psychological needs are met to some extent, their intrinsic motivations are enhanced, and the commitment and enthusiasm for work is increased consequently. As the result, nurses would show lower willingness to leave their jobs, and increase the overall level of well-being. Conversely, when nurses' basic psychological needs are not met, they may act more passively and show dissatisfaction with their works, leading to negative work and life outcomes.

In the longitudinal model, job satisfaction and work engagement only mediated the relationship between ProQOL profiles and turnover intention, and their mediating effects were similar to the cross-sectional results, which is consistent the SDT. This finding is also supported by SET, which nurses classified in the good quality profile may feel recognized and rewarded for the care and effort they put into nursing, and may feel supported and resourced by the organization. Therefore, the levels of job satisfaction and work engagement were thereby increased, consequently, they would exhibit lower turnover intention. Conversely, nurses belonged to traumatic satisfaction profile and burnout problem profile perceived lower organizational support and held a negative impression of the organization, leading to lower job satisfaction and lower work engagement, which further reduced performance and behaviors in favor to the organization. However, the longitudinal mediating roles of job satisfaction and work engagement between ProQOL profiles and life satisfaction were not validated. This might because job satisfaction and work engagement only explain a part of life satisfaction and the effects may not be persistent. Life satisfaction is also influenced by personal characteristics, family factors, and other work-related factors [62, 63]. On the other hand, cross-sectional data are more susceptible to reverse causality among variables, thus, results that are significant from the analysis of cross-sectional data are difficult to validate in tracer studies.

The current findings have several implications for hospital management and future research. The study demonstrates the need to adopt a person-centered research orientation to assess nurses' ProQOL. Given the heterogeneity exhibited in ProQOL, hospital management and development of interventions can be guided by the needs suggested by different profiles' characteristics and focus mainly on the high-risk groups. In addition, based on the cross-sectional and longitudinal models results, designing measures to improve ProQOL helped to improve nurses' current and subsequent work and life outcomes. Hospital administrators and the organization can help nurses continually improve their professional skills and knowledge by providing ongoing professional development and training opportunities. And it is vital to optimize the working environment and conditions, rationalize working time and shifts, and provide good welfare benefits and incentive mechanisms. In addition, a good team atmosphere and mutual support mechanism should be established to motivate nurses to work actively, while encouraging them to participate in decision-making, listening to their opinions and solving problems at work instantly. All these measures contribute to the improvement of nurses' ProQOL. For the mediating roles played by job satisfaction and work engagement, an intervention program for both could help reduce their current and subsequent turnover intention. Although the intervention program helped improve nurses' current life satisfaction, the effects may not be persistent. Future research should incorporate other important factors that predict nurses' life satisfaction to provide an important basis for improving well-being.

Limitations

Our study has several limitations to consider. First, this study conducted two data collections and examined the effects of ProQOL over a short time interval. Future studies could take multiple surveys of the study population and follow them over a longer period of time to fully reveal the causal relationships and mechanisms between the study variables. Second, the data used derived from participants' subjective reports, and participants may suffer from socially approving factors and did not respond truthfully. Multiple reporters and more objective indicators should be adopted to improve the external validity in future researches. Third, the present study recruited subjects from only one hospital. Although the study has a large and representational sample, caution should be taken when generalizing the findings. A large-scale multicenter study should be conducted in the future. Finally, due to the number of questions and response time restrictions, this study only focused on the mediating effects of job satisfaction and work engagement, and it lacks the exploration of individual characteristics and situational factors as moderators. Previous researches suggest that individual personality traits, coping skills, and emotional intelligence, as well as contextual factors such as organizational-level variables and work resources (including physical and human resources, etc.) may have moderating effects on the relationship between the study variables [24]. Improved model should incorporate more comprehensive variables to fully understand the mediating and moderating mechanisms of ProQOL.

Abbreviations

ProQOL	Professional quality of life
LPA	Latent profile analysis
STS	Secondary trauma stress
SDT	Self-determination theory
SET	Social exchange theory
ANOVA	Analysis of variance
VIF	Variance inflation factors
AIC	Akaike information criterion
BIC	Bayesian information criterion
aBIC	Sample size-adjusted BIC
LMRT	Lo-Mendell-Rubin likelihood ratio test
BLRT	Bootstrap-based likelihood ratio test
CI	Confidence interval

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40359-024-02063-3.

Supplementary Material 1

Declarations

Ethics approval and consent to participate
Online informed consent was obtained from all participants. The first page of the online questionnaire is an informed consent which shows to participants. Participants could be fully aware of the study procedures and choose to participate in the study voluntarily. The investigation was carried out in accordance with the latest version of the Declaration of Helsinki, and the study protocol was approved by the Medical Ethics Committee, School of Public Health, Jilin University (Approval Number: 2019-05-07).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]School of Public Health, Jilin University, No.1163 Xinmin Street, Changchun, Jilin province 130021, China
[2]Department of Nursing, The First Hospital of Jilin University, Changchun, Jilin province 130021, China
[3]Department of Developmental and Behavioral Pediatrics, The First Hospital of Jilin University, Jilin province, Changchun, Jilin province 130021, China
[4]The First Hospital of Jilin University, No.71 Xinmin Street, Changchun, Jilin province 130021, China

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