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Predictors of professional quality of life among nursing staff following the Taiwan Formosa Fun Coast explosion

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ABSTRACT

Purpose: The Formosa Fun Coast Explosion was a major public disaster that caused international shock. Nursing staff made an all-out effort to care for patients injured in the explosion, and this may have caused a lot of stress among nurses. This study aimed to explore the predictors of professional quality of life among nursing staff experiencing major disaster events.

Material and Methods: This descriptive cross-sectional study was conducted in a medical center in Northern Taiwan in 2016. A total of 165 nurses were enrolled using convenience sampling. Data were collected on the demographic- and work-related characteristics of nurses, and the Perceived Stress Scale and Professional Quality of Life Scale were administered. Analyses included descriptive statistics and regression. The threshold for statistical significance was set at $p < 0.05$.

Results: The nurses' length of service in nursing ($\beta = -0.26, p = 0.029$) and perceived stress level ($\beta = 0.15, p = 0.002$) were important predictors of compassion satisfaction, while their age ($\beta = 0.42, p = 0.033$) and perceived stress level ($\beta = 0.20, p = 0.020$) were important predictors of compassion fatigue. Compassion fatigue was divided into burnout and secondary trauma. Nurses' age ($\beta = 0.18, p = 0.044$) and perceived stress level ($\beta = 0.14, p < 0.001$) were the key predictors of burnout. However, there were no significant predictors of secondary trauma among nurses.

Conclusions: Based on the present findings, it is proposed to reduce the level of stress among nurses to improve their professional quality of life.

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1. Introduction

Formosa Fun Coast is a large water park in Northern Taiwan. On June 27, 2015, “Color Creative Company” rented this park to host “Color Play Asia,” attracting more than 10,000 visitors. To create a grand stage effect, the host used colored dust created from self-developed food-grade toner. The dust was sprayed out to the audience to showcase a perfect end for everyone to enjoy. However, the dust suddenly caught fire and quickly spread to the entire dance floor. Tourists fled and sustained serious burns. This accident was called the Formosa Fun Coast explosion (FFCE), which resulted in 11 deaths and 488 injuries [1]. Following this major accident, most burn patients were treated in our medical center, of which about 85% patients had severe burns. During this period, apart from catering to the highest number of patients in Taiwan, we also achieved a zero mortality rate [2].

However, following the accident, several nursing staff members who were involved in caring for patients injured in the explosion reported experiencing substantial amounts of stress. This stress stemmed from different aspects, such as the burn wounds of the patients, difficult process of healing and rehabilitation, team members’ actions, and expectations of patients’ family members. Some of the nursing staff could deal with the stress positively and they could attain self-satisfaction by transforming the process of helping others into positive feelings [3]. However, in some staff members, the persistent stress could have led to compassion fatigue. Physically, the nursing staff could have experienced headaches, chronic fatigue, insomnia, or digestive discomfort [4–6]. Psychologically, the stress could have caused sadness, indifference, cynical attitude, excessive sensitivity, frustration, critical reactions, difficulty in concentrating, poor memory, self-isolation, loss of interest, anxiety, and other issues [6]. Spiritually, the nursing staff could have lost their spiritual consciousness, they would have started to doubt their original beliefs, and they could have questioned why such a horrible incident occurred with good people or why the patients and their families had to bear so much pain [5,6]. These series of impacts might have had negative effects on the nursing staff. It may have increased their rates of sick leave and turnover, reduced their efficiency, raised personnel costs, and intensified the interpersonal conflicts among nursing staff [6].

Professional quality of life pertains to the balance between compassion fatigue and compassion satisfaction. When someone is overly dedicated to helping others, ignoring the level of his/her own stress and accumulation of persistent stress induces compassion fatigue, which has negative effects on his/her physical and mental health. Compassion satisfaction is the self-satisfaction derived from the positive feelings one attains from helping others [3]. Previous studies about the professional quality of life of nursing staff have investigated relevant factors of compassion fatigue and compassion satisfaction, such as the nursing staff working in acute wards [7], intensive care units (ICUs) [3], and trauma units [8], as well as those with over one year of clinical experience [9]. Some studies have also explored the relationship of perceived stress with compassion fatigue and compassion satisfaction in

nursing staff working in neonatal special care units [10]. However, no study has examined the relationship of perceived stress with compassion fatigue and compassion satisfaction in nursing staff caring for burn patients during major disasters. Therefore, in the present study were explored the predictors of professional quality of life, including compassion fatigue and compassion satisfaction, among the nursing staff involved in this major event.

2. Materials and methods

2.1. Study design and participants

This descriptive study employed a cross-sectional design. Nurses were recruited using convenience sampling, from the burn ward, plastic surgical ward, general ward, surgical intensive care unit (SICU), and medical intensive care unit (MICU) of a medical center located in Northern Taiwan from August to December 2015. Nurses who met the inclusion criteria, such as being a registered nurse, being able to communicate in Mandarin, and agreeing to participate in the study, were recruited. This study was conducted after receiving approval from the Institutional Review Board of the medical center (2-104-05-145). A sample size of 103 was required to undertake a linear multiple regression analysis (determined using G^* power 3.1). A two-tailed p value was set at 0.05, effect size at 0.13, and power at 0.9. Considering a 70% response and completion rate, 165 subjects were recruited.

2.2. Instrument

The questionnaire used in this study included items about participants’ demographic and work-related characteristics, the Perceived Stress Scale (PSS) [11], and the Professional Quality of Life Scale (ProQOL) [12]. Five experts were invited to evaluate the content validity index (CVI) of relevance, accuracy, and appropriateness of the content. The scores ranged from 1 to 5; 1 being extremely inappropriate and 5 being extremely appropriate. After calculating the scores, the CVI value of the questionnaire used in this study was 0.97.

Demographic characteristics included age, gender, educational level (undergraduate degree, or colleague degree or above), marital status (single or married), and religious beliefs (yes or no). Work-related characteristics included ward (burn ward, plastic surgical ward, SICU, MICU, or general ward), length of service in nursing, experience of participation in educational sessions related to burn care (yes or no), and experience of caring for burn patients from the FFCE (yes or no).

The PSS, which was developed [13] and translated into Taiwanese [11], was used to measure the subjective stress experienced in the past one month. It contains 14 items, with Item 4, 5, 6, 7, 9, 10, and 13 being negatively worded. Each item is rated on a scale ranging from 0 to 4, with 0 being “never” and 4 being “always.” The total score ranges from 0 to 56, with a higher score indicating higher perceived stress. The Cronbach’s alpha for this scale was 0.76 in this study.

The ProQOL was developed and translated into Chinese [12]. The ProQOL is divided into three subscales, viz. compassion satisfaction, burnout, and secondary trauma. The

Table 1 – Demographic characteristics, work-related characteristics, and perceived stress level of nursing staff (N=165).

Variables	N(%) / Mean ± SD	
Demographic characteristics		
Age (years)	28.8	±6.3
Range		21–56
Gender		
Female	160	(97.0)
Male	5	(3.0)
Education level		
Undergraduate degree	27	(16.4)
Colleague degree or above	138	(83.6)
Marital status		
Single	137	(83.0)
Married	28	(17.0)
Religious belief		
Yes	89	(53.9)
No	76	(46.1)
Work-related characteristics		
Ward		
Burn ward	15	(9.1)
Plastic surgery ward	24	(14.5)
SICU	34	(20.6)
MICU	49	(39.7)
Others	43	(26.1)
Length of service in nursing (year)	6.7	±6.3
range		1–30
Participation in educational sessions related to burn care		
Yes	60	(36.4)
No	105	(63.6)
Participation in caring with burn patients in FFCE		
Yes	112	(67.9)
No	53	(32.1)
Perceived stress level	27.3	±5.5

SICU=surgical intensive care unit; MICU=medical intensive care unit; FFCE=Formosa Fun Coast Explosion; SD=standard deviation.

subscales of burnout and secondary trauma are also called compassion fatigue. Each subscale comprises ten items. Item 1, 4, 15, 17, and 29 are negatively worded. All items are rated on a scale ranging from 1 to 5, with 1 being “never,” and 5 being “always.” The total score on each subscale are transformed into Z scores, and T scores are calculated using the formula [$T=10Z+50$]. The level of score on each subscale is determined using T scores to compare with the normalization of 25% ($T=43$) and 75% ($T=57$). T scores <25%, 25%–75%, and >75% indicate low, moderate, and high severity, respectively. The Cronbach’s alpha for the total scale was 0.86 and it was 0.76, 0.76, and 0.57 for the subscales of compassion satisfaction, burnout, and secondary trauma, respectively, in the present study.

2.3. Statistical analysis

The data were analyzed using the SPSS 20.0 software for Windows (IBM, Corp, Armonk, NY). Means and standard deviations were used for the continuous variables, and frequencies and proportions for the categorical variables. In addition, a multiple linear regression analysis was conducted to examine the relationships between the independent variables and the outcome variable of ProQOL score (including scores on compassion satisfaction, burnout, and secondary

trauma). A p value <0.05 was considered statistically significant.

3. Results

3.1. Demographic characteristics, work-related characteristics, and perceived stress level

The mean age of the participants was 28.8 years. Most of the subjects were females (97.0%), had a college degree or above (83.6%), were single (83.0%), and had religious beliefs (53.9%). The mean length of service in nursing was 6.7 years. The largest proportion of the participants worked in the medical intensive care unit (39.7%). Majority of the participants had never participated in educational sessions related to burn care (63.6%), but they were involved in caring for the burn patients from the FFCE (67.9%). Participants’ perceived stress level was 27.3 points ($SD=5.5$) (Table 1).

3.2. Professional quality of life of nursing staff following the FFCE

The mean scores of compassion satisfaction and compassion fatigue were 28.5 ($SD=3.6$) and 58.2 ($SD=6.0$), respectively. The

Table 2 – Professional quality of life (compassion satisfaction and compassion fatigue) of nursing staff in FFCE (N=165).

Variables	N(%) / Mean ± SD	
Professional quality of life		
Compassion satisfaction	28.5	±3.6
Low	30	(18.2)
Moderate	113	(68.5)
High	22	(13.3)
Compassion fatigue	58.2	±6.0
Burnout	29.1	±2.7
Low	30	(18.2)
Moderate	97	(58.8)
High	38	(23.0)
Secondary trauma	29.1	±3.9
Low	30	(18.2)
Moderate	106	(64.2)
High	29	(17.6)

FFCE=Formosa Fun Coast Explosion; SD=standard deviation.

largest proportion of nurses scored moderately on compassion satisfaction (68.5%). Compassion fatigue was divided into burnout and secondary trauma. The largest proportion of nurses scored moderately on burnout (58.8%) and secondary trauma (64.2%) (Table 2).

3.3. Predictors of professional quality of life of nursing staff following the FFCE

As shown in Table 3, the significant predictors of compassion satisfaction among the nurses were length of service in nursing and perceived stress level after adjusting for demographic characteristics, work-related characteristics, and perceived stress level. The level of compassion satisfaction among nursing staff decreased by 0.26 points for every additional year of service in nursing (95% confidence interval (CI) = -0.50 to -0.03, $p=0.029$) and increased by 0.15 points for every additional point scored on the PSS (95% CI = 0.05–0.25, $p=0.002$). Age and perceived stress level had a significant influence on compassion fatigue. The level of compassion fatigue among nursing staff increased by 0.42 points for every additional year of age (95% CI = 0.03–0.80, $p=0.033$), and it increased by 0.20 for every additional point scored on the PSS (95% CI = 0.03–0.36, $p=0.020$).

Compassion fatigue was divided into burnout and secondary trauma. The significant predictors of burnout among the nurses were age and perceived stress level, after adjusting for demographic characteristics, work-related characteristics, and perceived stress level. The level of burnout among the nursing staff increased by 0.18 points for each increase of one year in age (95% CI = 0.004–0.35, $p=0.044$), and it increased by 0.14 points for every additional point scored on the PSS (95% CI = 0.07–0.22, $p<0.001$). However, there were no significant

Table 3 – Predictors of professional quality of life (compassion satisfaction and compassion fatigue) of nursing staff in FFCE (N=165).

Variable	Professional quality of life					
	Compassion satisfaction			Compassion fatigue		
	β	(95% CI)	p	β	(95%CI)	p
Demographic characteristics						
Age (years)	0.21	(-0.02, 0.44)	0.068	0.42	(0.03, 0.80)	0.033
Gender						
Female/Male	0.70	(-2.47, 3.88)	0.663	2.61	(-2.75, 7.97)	0.340
Education level						
Colleague degree or above/Undergraduate degree	0.20	(-1.25, 1.66)	0.782	-0.91	(-3.36, 1.54)	0.468
Marital status						
Married/Single	1.17	(-0.46, 2.81)	0.160	-0.21	(-2.98, 2.55)	0.879
Religious belief						
Yes/No	0.66	(-0.43, 1.74)	0.235	0.28	(-1.55, 2.11)	0.762
Work-related characteristics						
Ward						
Burn ward/Others	1.32	(-1.15, 3.79)	0.296	1.12	(-3.06, 5.29)	0.600
PS ward/Others	1.06	(-0.97, 3.09)	0.307	2.28	(-1.16, 5.72)	0.194
SICU/Others	1.33	(-0.68, 3.35)	0.195	2.97	(-0.44, 6.38)	0.088
MICU/Others	0.45	(-1.18, 2.07)	0.590	1.00	(-1.75, 3.76)	0.474
Length of service in nursing (year)	-0.26	(-0.50, -0.03)	0.029	-0.23	(-0.63, 0.16)	0.249
Participation in educational sessions related to burn care						
Yes/No	0.15	(-1.09, 1.40)	0.810	0.98	(-1.13, 3.09)	0.362
Participation in caring with burn patients in FFCE						
Yes/No	0.19	(-1.36, 1.74)	0.807	-0.58	(-3.20, 2.04)	0.664
Perceived stress level	0.15	(0.05, 0.25)	0.002	0.20	(0.03, 0.36)	0.020

FFCE=Formosa Fun Coast Explosion; PS=plastic surgery; SICU=surgical intensive care unit; MICU=medical intensive care unit; CI=confidence interval.

Table 4 – Predictors of compassion fatigue (burnout and secondary trauma) of nursing staff in FFCE (N=165).

Variable	Compassion fatigue					
	Burnout			Secondary trauma		
	β	(95% CI)	<i>p</i>	β	(95%CI)	<i>p</i>
Demographic characteristics						
Age (years)	0.18	(0.004,0.35)	0.044	0.24	(−0.01, 0.50)	0.060
Gender						
Female/Male	0.46	(−1.93,2.85)	0.708	2.15	(−1.37, 5.68)	0.231
Education level						
Colleague degree or above/Undergraduate degree	0.17	(−1.26, 0.93)	0.767	−0.74	(−2.36, 0.87)	0.367
Marital status						
Married/Single	0.05	(−1.19,1.28)	0.939	−0.26	(−2.08, 1.56)	0.777
Religious belief						
Yes/No	0.26	(−0.55, 1.08)	0.531	0.02	(−1.18, 1.22)	0.972
Work-related characteristics						
Ward						
Burn ward/Others	0.30	(−1.56,2.16)	0.749	0.81	(−1.93, 3.56)	0.562
PS ward/Others	1.24	(−0.30,2.77)	0.114	1.04	(−1.22,3.30)	0.367
SICU/Others	0.89	(−0.63,2.41)	0.251	2.08	(−0.17, 4.32)	0.070
MICU/Others	0.34	(−0.89,1.56)	0.589	0.67	(−1.14, 2.48)	0.471
Length of service in nursing (year)	−0.10	(−0.28,0.08)	0.264			
Participation in education related to burn care						
Yes/No	0.29	(−0.65,1.40-)	0.810	0.69	(−0.70, 2.08)	0.329
Participation in caring with burn patients in FFCE						
Yes/No	0.06	(−1.22,1.22)	0.925	−0.53	(−2.25, 1.20)	0.550
Perceived stress level	0.14	(0.07,0.22)	<0.001	0.05	(−0.06, 0.16)	0.360

FFCE=Formosa Fun Coast Explosion; PS=plastic surgery; SICU=surgical intensive care unit; MICU=medical intensive care unit; CI=confidence interval.

predictors of secondary trauma among the nurses after adjusting for demographic characteristics, work-related characteristics, and perceived stress level. The details of these findings have been presented in [Table 4](#).

4. Discussion

The present findings indicated that the length of service in nursing and perceived stress level are significant predictors of compassion satisfaction. Numerous studies have revealed that of the duration of work experience is a significant predictor of compassion satisfaction [14–16]. Specifically, these studies found that, during the nurses' first ten years of work, their compassion satisfaction decreased with the increase in work experience. However, among nurses with an experience of more than 20 years, compassion satisfaction increased with the increase in work experience. Evidently, nurses who have been working for 16–20 years gain satisfaction from work more easily than do those who have been working only for 3–5 years [15,16]. Less experienced nurses are more stressed, but if they obtain positive feedback or support in the workplace or from their patients or patients' family members, they can still find happiness from their stressful work. With work experience, nursing staff adjust to the physical and mental stress more effectively, deriving a greater sense of identity and a higher level of satisfaction from their work. They also obtain a high level of compassion satisfaction

more easily [17]. The present results showed that the level of compassion satisfaction decreased with an increase in the length of service in nursing. This could be because several senior nurses may have experienced a disaster like the FFCE for the first time. Thus, caring for a large number of patients with severe burns, leading new nurses, and training supporting staff would have been stressful for them.

This study also found a higher level of compassion satisfaction among nursing staff who perceived higher levels of stress. The results of some studies on the relationship between stress and compassion satisfaction among nurses working in neonatal ICUs and critical care units indicate that stress and compassion satisfaction are negatively correlated [10,18], whereas other studies on the work stress of clinical nurses revealed no significant relationship between work stress and compassion satisfaction [19]. During the accident, our hospital treated the largest number of burn patients from the explosion and the nursing staffs were mobilized to care for these burn patients. Although the nursing staffs were under tremendous stress, they provided excellent care, with zero mortality. This may have resulted in a sense of recognition, self-worth, and achievement among nurses, which may explain the differences between the present results and those of other studies.

In the present study, age and perceived stress level were identified as significant predictors of compassion fatigue. However, in the previous study, compassion fatigue is less correlation with age. In the study by Hunsaker et al., only

manager support but not age significantly and negatively predicted the level of compassion fatigue [20]. Studies have shown that nurses working in high-pressure units such as ICUs, neonatal intensive care units, and oncology wards, are more likely to experience compassion fatigue. Stress is also an important predictor of compassion fatigue; a positive correlation exists between the two [10,21]. Compassion fatigue can be caused by various factors, including prolonged contact with injuries, excessive empathy, over-involvement, and exhaustion while caring for patients. At the same time, nurses may overlook the stress of caring for patients and the accumulated stress from the surroundings. When nurses are not able to relieve this stress, they will develop a high level of compassion fatigue. Young nurses feel more stressed at work and may fail to adapt to the stress. This causes negative emotions, such as job dissatisfaction and self-doubt. Eventually, they may come up with the idea of quitting their job [22,23].

In this study, age and perceived stress level were also identified as significant predictors of burnout. Numerous studies have pointed out that burnout is significantly associated with age [15,20,24–26]. Studies on the burnout of nursing staff in ICUs have indicated that nurses aged between 20 and 29 years are more likely to experience burnout [25], while those aged between 31 and 40 years have greater burnout than those aged between 51 and 60 years do [15]. However, this study showed that the level of burnout among the nursing staff increased by 0.18 points for every additional year of age. Burnout is a syndrome associated with physical, emotional, and cognitive failure resulting from long-term excessive work demands, which have either exceeded the emotional capacities of individuals or fallen short of individuals' expectations. Our hospital is a medical center; therefore, it has greater demand for comprehensive nursing services of high quality. This might have caused the differences in the research results. Many studies have also indicated a positive correlation between stress and burnout [15,21,27]. Stress is a sustained feeling and process. When one is under stress, initially one will handle it with a positive attitude. However, if one fails to adjust to and cope with stress, a state of frustration and confusion can set in. Continuation of this state will produce negative impacts on one's physical and psychological health. The transformation from a positive to a negative attitude depends on the individual's perception of stress. In general, an individual with a high level of perceived stress is persistently in a state of confusion and frustration. People who handle stress with a negative attitude are more likely to experience a higher level of compassion fatigue and burnout and a lower level of compassion satisfaction [7,10,14]. When the nursing staff adjust to physical and mental stress more effectively, they are more likely to gain a sense of identity and satisfaction from their work and obtain a high level of compassion satisfaction and a low level of compassion fatigue and burnout [7,22].

Only the nursing staff in one medical center were recruited for this study and adopted a cross-sectional descriptive design was used. Therefore, the study's generalizability is limited. Future research can continue to study nursing staff who participated in treating patients injured in the FFCE. Follow-up studies on the nursing staff at different points in time after the incident can also be conducted to increase the generalizability of the findings and to provide information on the changes in

nurses' professional quality of life after participating in such major incidents. Accordingly, timely intervention measures, such as mindfulness-based stress reduction, exercise, massage, and so on, could be implemented to help nurses relieve their stress and improve their professional quality of life.

5. Conclusion

The FFCE was a serious accident that caused the largest number of injuries in Taiwan. Nursing staff with a shorter length of service in nursing and higher level of perceived stress were likely to experience a higher level of compassion satisfaction in caring for the burn patients injuring in the explosion. Further, more nurses who were older and perceived a higher level of stress tended to experience a higher level of compassion fatigue and burnout. The present findings suggest the relationship between perceived stress and professional quality of life among nurses involved in caring for victims of major disasters. These results may be a reference for clinical managers to help nurses cope with caring for patient from major incidents.

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Conflicts of interest

The authors declare that they have no competing interests.

Author contributions

Hsueh-Hsing Pan and Ya-Lin Chen conceived the study and designed the study. Ming-Hsiu Lu, Ling-Tzu Weng, Ya-Lin Chen and Chih-Hsin Wan were in charge of the data collection of the burn unit of Tri-Service General Hospital, Taipei. Hsueh-Hsing Pan and Chin Lin provided statistical advice on study design and analyzed the data. Hsueh-Hsing Pan and Ming-Hsiu Lu drafted the manuscript, and all authors contributed substantially to its revision. Hsueh-Hsing Pan takes responsibility for the paper as a whole.

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