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Factors Affecting Posttraumatic Growth of Nurses Caring for Patients with COVID-19 in Regional Medical Centers

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Purpose: This study investigates the factors affecting Posttraumatic Growth (PTG) among nurses providing care for patients with COVID-19 in regional medical centers.
Methods: A total of 170 nurses from D, P, and G regional medical centers participated in this study. Data were collected through self-administered questionnaires from March 16 to March 31, 2023. IBM SPSS Statistics 27 was used for data analysis, including descriptive statistics, t-test, ANOVA, Pearson's correlation, and hierarchical regression analysis.
Results: Statistically significant differences in PTG were observed based on gender, religion, and experience in caring for patients with emerging infectious diseases. PTG was significantly correlated with resilience, social support, and deliberate rumination. Resilience (β=.22, p=.003), social support (β=.18, p=.012), and deliberate rumination (β=.46, p<.001) were identified as factors influencing the posttraumatic growth of the participants. These variables accounted for 50.1% (F=29.33, p<.001) of the variances in PTG.
Conclusion: The findings of this study demonstrate the necessity of developing intervention and counseling programs aimed at enhancing deliberate rumination, resilience, and social support to promote PTG among nurses caring for patients with emerging infectious diseases.

Keywords: COVID-19; Posttraumatic growth; Resilience; Rumination; Social support

Introduction

As international exchanges and travel have been increasing, there is an increased likelihood that recurrent outbreaks of emerging infectious diseases will occur at any time [1]. As the COVID-19 pandemic situation was exacerbated due to the spread of COVID-19, regional medical centers, which are supposed to serve as regional base hospitals in the event of a national disaster according to the Act on the Establishment and Operation of Local Medical Centers, cleared existing beds to treat COVID-19 patients and converted them into beds for confirmed COVID-19 patients [2]. Nurses working on the front line of COVID-19 treatment experienced increased stress and physical fatigue due to wearing personal protective equipment, medical waste management, and environmental management while struggling to cope with fear and anxiety about unpredictable situations and coronavirus infections [3].

Trauma refers to a range of negative psychological reactions resulting from experiencing an unexpected distressing event, and can lead to a life crisis or stress symptoms [4]. Regarding nurses' experiences of the COVID-19 pandemic situation, it has been reported that some COVID-19 patients refused to accept that they were infected with COVID-19, and were uncooperative towards treatment [5]. COVID-19 caused a greater number of deaths compared to previous emerging infectious diseases, and nurses got to experience unexpected patient deaths and had to care for patients who eventually died in isolation rooms without receiving any care from their family [6]. In addition, it has been founded that the experience of caring for COVID-19 patients was a signifi-

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cant traumatic event for nurses, and it may ultimately have a negative impact on their treatment of patients [7]. However, those who have experienced a traumatic event do not always undergo negative effects such as post-traumatic stress disorder (PTSD), and some people may achieve positive internal changes through the experience of a traumatic event, which is referred to as post-traumatic growth (PTG) [4]. In a qualitative study of nurses working at a dedicated COVID-19 hospital, nurses were found to have undergone negative experiences such as post-traumatic stress disorder while caring for patients with COVID-19, but they also gave new meaning to their work, but the participants also reported experiencing post-traumatic growth, which is a positive impact, through social support [5].

Tedeschi & Calhoun [4] defined posttraumatic growth (PTG) as psychological growth that occurs through an individual's coping methods after experiencing psychological trauma in a stressful situation experienced either directly or indirectly. According to a previous study, among the people who have experienced trauma, some manage to regulate emotional stress based on their resilience, which is the ability to appropriately respond to and recover from negative situations such as stressful situations or traumatic events [8]. In addition, some people experiencing traumatic events experience psychological growth beyond their pre-traumatic level of psychological functioning through deliberate rumination, which is a process of overcoming negative environments based on social support received from other people and trying to reconsider and understand the meaning of traumatic events for their life or reflecting on the lessons learned from traumatic events [4]. According to some previous studies, resilience is a pre-traumatic trait of individuals and refers to the ability to overcome adversity and actively cope with stress, and it directly promotes PTG [9] or has a positive effect on PTG through deliberate rumination [10]. In a previous research on a structural model of posttraumatic growth, a higher level of social support from the family, friends, and others was associated with a higher level of PTG, and deliberate rumination was found to play a key role in PTG [11].

As the unpredictable and unavoidable outbreaks of emerging infectious diseases are likely to occur continuously in the future, it is imperatively needed to identify factors affecting PTG and promote PTG among nurses working at regional medical centers, which function as infectious disease hospitals when there are outbreaks of emerging infectious diseases. Research on factors affecting PTG among nurses working at regional medical centers is expected to contribute to facilitating their PTG as a positive change beyond reducing their negative experiences when they experience traumatic events in the process of caring for COVID-19 patients. However, although resilience, social support, and deliberate rumination have been reported as factors affecting posttraumatic growth, there have been no research attempts to examine the experiences of traumatic events of nurses and comprehensively analyze how resilience, social support, and deliberate rumination affect PTG among nurses working at regional medical centers and caring for COVID-19 patients by including all the three factors, based on the theory of posttraumatic growth proposed by Tedeschi & Calhoun [4] and previous studies. Therefore, this study aimed to conduct a detailed exploration of the effects of resilience, social support, and deliberate rumination on overcoming traumatic events experienced while caring for COVID-19 patients and achieving PTG through the experience among nurses at regional medical centers. Through this research, we sought to provide basic data for the development of management strategies or intervention programs that can contribute to the promotion of PTG in nurses in the future.

Methods

Study design

This study is a descriptive survey research to identify factors affecting posttraumatic growth among nurses working at regional medical centers who had the experience of caring for COVID-19 patients.

Participants

The participants of this study were recruited among nurses currently working at regional medical centers designated as dedicated COVID-19 hospitals in D Metropolitan City, P City, and G City. The specific inclusion criteria for the participants were as follows: nurses with the experience of caring for COVID-19 patients for one month or longer; the presence of the experience of a traumatic event in the process of caring for COVID-19 patients; people who participated in a survey using a traumatic experience assessment tool and responded to questions regarding traumatic events. In order to extract a sample of participants from nurses with sufficient clinical nursing experience, newly employed nurses with less than 6 months of clinical experience were excluded, and the participants were selected based on the responses to the questions of an assessment tool prior to conducting the study.

The sample size was calculated using the G*Power ver. 3.1.9.7 program. Based on the effect size of a previous study that investigated factors associated with PTG among intensive care unit nurses by performing regression analysis [12], a medium effect

size of .15, a significance level of .05, and a power of .80 were used. As a result of calculating the sample size for 19 predictive factors, the minimum sample size was calculated as 153 people. A survey was conducted by distributing questionnaires to 175 people by considering a dropout rate of 15%. Among the respondents, 4 people who did not meet the inclusion criteria presented above and 1 person who gave insincere responses were excluded from analysis, and the data of a total of 170 people were finally included in the analysis.

Measures

In this study, data collection was conducted after receiving prior approval from the developer of each scale via e-mail.

1. Experience of traumatic events

The experience of traumatic events was assessed using the tool developed by Cho [13]. This tool contains a total of 12 items, which consist of 11 items to measure the frequency of traumatic events experienced by respondents and 1 item that requires respondents to select the most painful event among the traumatic events that they have experienced. Except for the last item, the other items are rated on a 5-point Likert scale ranging from 1 point (='Rarely experienced') to 5 points (='Very often experienced'). Total scores range from 11 to 55 points and a higher score indicates a higher frequency of the experience of traumatic events. Regarding the reliability of the tool, the value of Cronbach's α was .80 in Cho [13] and .83 in this study.

2. Resilience

Resilience was measured using a Korean version (K-CD-RISC) of the Connor Davidson Resilience Scale (CD-RISC) developed by Connor and Davidson [14]. The K-CD-RISC was developed and validated by Baek et al. [15], and was created through the translation and adaptation of the original version. This scale contains a total of 25 items in 5 subdomains: 9 items on strength, 8 items on perseverance, 4 items on optimism, 2 items on support, and 2 items on spirituality. Each item is rated on a 5-point scale ranging from 0 points ('Not at all') to 4 points ('Almost always'). Total scores range from 0 to 100 points, and higher scores indicate higher levels of resilience. The value of Cronbach's α was reported as .89 in Connor and Davidson [14] and as .93 in Baek et al. [15], and it was calculated as .94 in the present study.

3. Social support

The level of perceived social support was measured using a Korean version of the Multidimensional Scale of Perceived Social Support (MSPSS) developed by Zimet et al. [16]. The Korean version used in this study was developed by Shin & Lee [17] through the translation and adaptation of the original scale. This scale contains a total of 12 items in 3 subdomains categorized based on the specific source of support: 4 items on family support, 4 items on friend support, and 4 items on support from significant others. Each item is rated on a 5-point Likert scale ranging from 1 point (='Not at all') to 5 points (='Very much so'). Total scores range from 12 to 60 points, and higher scores indicate higher levels of perceived social support. The value of Cronbach's α was reported as .91 by Zimet et al. [16] and .89 by Shin & Lee [17], and it was calculated as .96 in this study.

4. Deliberate rumination

The level of deliberate rumination was measured using a Korean version of the Event Related Rumination Inventory (ERRI) developed by Cann et al. [18]. The Korean version of the ERRI (K-ERRI) was developed by Ahn et al. [19] through the translation and adaptation of the original version, and it was also validated by the same authors [19].

The K-ERRI is composed of the two subdomains of invasive rumination and deliberate rumination. However, in this study, the items of invasive rumination were excluded and only the 10 items on deliberate rumination were used. Each item is rated on a 4-point scale ranging from 0 points (='Never') to 3 points (='Often'). Total scores range from 0 to 30 points, and a higher score indicates a higher degree of the performance of deliberate rumination. Regarding the reliability of the tool, Cronbach's α was reported as .88 in Cann et al. [18] and .95 in Ahn et al. [19], and it was calculated as .95 in this study.

5. Posttraumatic growth

The level of posttraumatic growth was assessed using a Korean version of the Posttraumatic Growth Inventory (PTGI) developed by Tedeschi & Calhoun [20]. The Korean-translated version of the PTGI (K-PTGI) used in this study was created through the translation and adaptation of the original scale and validated by Song et al. [21]. This scale consists of 4 subdomains and a total of 16 items: 6 items on changes in self-perception, 5 items on increased depth of interpersonal relationships, 3 items on discovery of new possibilities, and 2 items on increased interest in spirituality and religion. Each item is rated on a 6-point Likert scale ranging from 0 points (='Never experienced') and 5 points (='Very often experienced'). Total scores range from 0 to 80 points, and a higher score indicates a higher level of posttraumatic growth. As to the reliability of the scale, the value of Cron-

bach's α was .90 in the study by Tedeschi & Calhoun [20], .91 in the study by Song et al. [21], and .95 in this study.

Data collection

In this study, data collection was conducted for 16 days from March 16 to 31, 2023 through an online survey. Before conducting data collection, the researcher visited each of the nursing departments of the medical centers in D Metropolitan City, G City, and P City which were national designated infectious disease hospitals, explained the purpose and procedures of the study to the nurse managers, and received prior approval to conduct the survey. Then, a participant recruitment notice for online survey research that contained the URL link and QR code for the online survey was distributed to the research participants, and only those who read the participant information sheet and the consent form on the first page of the online survey and directly expressed their consent to participate were allowed to respond to the survey.

Ethical considerations

This study was conducted after receiving approval from the Institutional Review Board of Kyungpook University (IRB No: KNU-2023-0062). The participant recruitment notice clearly stated the purpose and details of the study, the time required for the survey, and the possibility of withdrawal from the study at any time without any disadvantages if a participant wishes to withdraw from the study. In addition, this notice also specified that all the measurement data collected through this survey would be kept anonymous in accordance with the Personal Information Protection Act, would never be used for purposes other than research, and would be permanently deleted or destroyed after it is kept for three years from the completion of research in accordance with research ethics guidelines.

Data analysis

The collected data was analyzed using IBM SPSS Statistics 27.0. The levels of general characteristics, experience of a traumatic event, resilience, social support, deliberate rumination, and posttraumatic growth (PTG) among the participants were analyzed by calculating the frequency and percentage, mean, and standard deviation. In order to verify the differences in PTG according to the general characteristics of the participants, the Mann-Whitney U test, Independent t-test, and one-way ANOVA were performed. In addition, Pearson correlation coefficient was used to analyze the correlation between variables, and hierarchical regression analysis was performed to identify factors that have a statistically significant impact on PTG in the participants.

Results

General characteristics

The participants of this study were a total of 170 nurses, and they consisted of 160 women (94.1%) and 10 men (5.9%). People aged 23 to 29 years were 63 people (37.1%), and the mean age was 34.30 ± 8.80 years. In marital status, 99 people (58.2%) were single, and regarding the presence of religion, 107 people (62.9%) had no religion. In terms of total clinical career, the mean career length was 10.72 ± 9.14 years, and 44 people (25.9%) had the clinical career length of more than 10 years and less than 20 years. As for working position, the majority of the participants were staff nurses (143 people, 84.1%), and regarding working type, 148 people (87.1%) worked in three shifts. In terms of working department, 124 people (72.9%) were general ward nurses. The period of caring for patients with COVID-19 was reported as less than 12 months (< 12 months) by 45 people (26.5%), 12 months to less than 18 months (≥ 12 to < 18 months) by 49 people (28.5%), 18 months to less than 24 months (≥ 18 to < 24 months) by 40 people (23.5%), and 2 years or longer (> 24 months) by 36 people (21.2%). The average period of caring for COVID-19 patients was 17.86 ± 10.70 months. For education level, nurses with an associate's degree were 47 people (27.6%), those with a bachelor's degree were 112 people (65.9%), and those with a master's degree or a higher academic degree were 11 people (6.5%). 84 nurses (49.4%) responded that they had turnover intention due to their experience of caring for COVID-19 patients. Among the participants, 98 nurses (57.6%) had the experience of caring for nursing patients with new infectious diseases such as severe acute respiratory syndrome, novel swine-origin influenza A, and Middle East respiratory syndrome. Also, 115 nurses (67.6%) responded that they had intention to directly participate in caring for new infectious diseases in the future. In addition, 98 nurses (57.6%) had the experience of receiving education on new infectious diseases, and 26 nurses (15.3%) had the experience of participating in a mental health management program after caring for patients with new infectious disease (Table 1).

Levels of the experience of traumatic events, resilience, social support, deliberate rumination, and posttraumatic growth

The average score for the frequency of experiencing traumatic events was 24.05 ± 6.63 out of 55 points. The most frequent traumatic event experienced by the participants while caring for

Table 1. General Characteristics of Subjects (*N*=170)

Characteristics	Categories	n	%	M ± SD
Gender	Male	10	5.9	
	Female	160	94.1	
Age (year)	23~29	63	37.1	34.30 ± 8.80
	30~39	60	35.3	
	≥ 40	47	27.6	
Marital status	Single	99	58.2	
	Married	71	41.8	
Religion	Yes	63	37.1	
	No	107	62.9	
Total Clinical career (year)	< 2	23	13.5	10.72 ± 9.14
	≥ 2~ < 5	34	20.0	
	≥ 5~ < 10	32	18.8	
	≥ 10~ < 20	44	25.9	
	≥ 20	37	21.8	
Working position	Staff nurse	143	84.1	
	≥ Chief nurse	27	15.9	
Working Department	Ward†	124	72.9	
	Special unit‡	24	14.2	
	OPD§	22	12.9	
Period of caring for patients with COVID-19 (month)	< 12	45	26.5	17.86 ± 10.70
	≥ 12~ < 18	49	28.5	
	≥ 18~ < 24	40	23.5	
	> 24	36	21.2	
Working type	Regular working	22	12.9	
	8 hours shift	148	87.1	
Education level	Associate	47	27.6	
	Bachelor	112	65.9	
	≥ Master	11	6.5	
Intention to turnover post COVID-19 experience	Yes	84	49.4	
	No	86	50.6	
Experience of caring for patients with emerging infectious disease‖	Yes	57	33.5	
	No	113	66.5	
Intention to caring for patients with emerging infectious disease	Yes	115	67.6	
	No	55	32.4	
Experience of education for infectious disease management	Yes	98	57.6	
	No	72	42.4	
Joining mental health programs post COVID-19 experience	Yes	26	15.3	
	No	144	84.7	

†medical/surgical ward, nursing care service ward, & hospice ward.
‡intensive care unit, emergency room, operating room/anesthesiology unit, & hemodialysis room.
§outpatient department.
‖emerging infectious disease = Severe Acute Respiratory Syndrome, Novel Swine-origin Influenza A, & Middle East Respiratory Syndrome.

COVID-19 patients was the experience of caring for a patient showing abnormal behavior (violent acts, screaming, delirium, inappropriate sexual behavior, etc.), with an average score of 3.38 ± 1.24 out of 5 points. The second and third most frequent traumatic events were verbal or physical violence from the family of a patient with an average score of 2.65 ± 1.15 points, and end-of-life and postmortem care with an average score of 2.62 ± 1.10 points. Regarding the most painful event among the traumatic

events experienced by the participants while caring for COVID-19 patients, the sudden death of an unexpected patient was reported as the most painful event by the largest number of nurses (44 people, 25.9%), followed by caring for a patient showing abnormal behavior (violent acts, screaming, delirium, inappropriate sexual behavior, etc.) (39 people, 22.9%) and verbal or physical violence from the family of a patient (24 people, 14.1%).

The mean score for resilience was 57.54 ± 14.02 out of 100 points, and the mean score for social support was 48.89 ± 9.37 out of 60 points. The mean score for deliberate rumination was 17.69 ± 6.40 out of 30 points, and the mean score for posttraumatic growth (PTG) was 42.92 ± 14.59 out of 80 points (Table 2).

Differences in posttraumatic growth according to general characteristics

There were significant differences in posttraumatic growth (PTG) according to gender (t = 2.41, p = .017), religion (t = 2.24, p = .028), and experience of caring for patients with emerging infectious disease (t = 2.17, p = .032). In other words, the level of PTG was significantly higher in females, in the group with religion, and in the group with experience of caring for patients with emerging infectious disease (Table 3).

Correlations between resilience, social support, deliberate rumination, and posttraumatic growth

Posttraumatic growth (PTG) was significantly positively correlated with resilience (r = .55, p < .001), social support (r = .49, p < .001), and deliberate rumination (r = .65, p < .001). In addition, there was a significant positive correlation between social support and resilience (r = .06, p < .001), between deliberate rumination and resilience (r = .05, p < .001), and between deliberate rumination and social support (r = .43, p < .001) (Table 4).

Factors affecting posttraumatic growth

In order to identify factors affecting posttraumatic growth (PTG) among the participants, hierarchical regression analysis was performed. In Model 1, among general characteristics, the variables that showed a statistically significant relationship with PTG were entered. In other words, gender, religion, and experience in caring for patients with emerging infectious disease were entered into Model 1 and treated as dummy variables. In Model 2, resilience, social support, and deliberate rumination, which showed a statistically significant correlation with PTG, were additionally entered to examine the effects of resilience, social support, and deliberate rumination on PTG after controlling for the effects of general characteristics on PTG.

The tests for assumptions of regression analysis were performed before conducting regression analysis, and the assumptions were all satisfied. More specifically, the Durbin-Watson statistic was 1.79, close to the reference value of 2, indicating that there was no autocorrelation between residuals and the assumption of independence of residuals was satisfied. As a result of

Table 2. Level of Traumatic events experience, Resilience, Social Support, Deliberate Rumination and Posttraumatic Growth (N=170)

Variables	The most painful event n (%)	Total M ± SD	Range	Item M ± SE
Traumatic events	4 (2.4)		11-55	2.19 ± 0.05
End of life care and postmortem care	44 (25.9)	2.62 ± 1.10	1-5	
Sudden death of an unexpected patient	11 (6.5)	2.29 ± 0.93	1-5	
Death of child or young patient	24 (14.1)	1.32 ± 0.61	1-5	
Verbal or physical violence of patient's family	17 (10.0)	2.65 ± 1.15	1-5	
Verbal violence or personal attacks of colleague and supervisor nurses	6 (3.5)	1.52 ± 0.82	1-5	
Verbal or physical violence of doctor	39 (22.9)	1.70 ± 0.96	1-5	
Abnormal behavior of a patient	4 (2.4)	3.38 ± 1.24	1-5	
Care of patients with open surgical wounds, massive bleeding, severe physical damage	6 (3.5)	1.98 ± 0.99	1-5	
Care of patients with a risk of disease transmission	9 (5.3)	2.34 ± 1.15	1-5	
Accident related to patient safety	6 (3.5)	2.11 ± 0.96	1-5	
Failure to resuscitate the patient despite continuous treatment	6 (3.5)	2.16 ± 0.92	1-5	
Resilience	57.54 ± 14.02		0-100	2.30 ± 0.04
Social support	48.89 ± 9.37		12-60	4.07 ± 0.06
Deliberate rumination	17.69 ± 6.40		0-30	1.77 ± 0.05
Posttraumatic growth	42.92 ± 14.59		0-80	2.68 ± 0.07

Table 3. Posttraumatic Growth according to General Characteristics (*N*=170)

Variables	Categories	M ± SD	t or F (*p*)	
Gender†	Male	32.30 ± 16.40	2.41	(.017)
	Female	43.59 ± 14.26		
Age(year)	23~29	40.14 ± 12.37	2.76	(.066)
	30~39	42.90 ± 15.22		
	≥ 40	46.68 ± 15.91		
Marital status	Unmarried	41.23 ± 14.25	-1.80	(.074)
	Married	45.28 ± 14.82		
Religion	Yes	46.41 ± 17.20	2.24	(.028)
	No	40.87 ± 12.44		
Total Clinical career(year)	< 2	44.96 ± 13.48	1.57	(.184)
	≥ 2~ < 5	38.26 ± 13.45		
	≥ 5~ < 10	41.03 ± 11.52		
	≥ 10~ < 20	44.77 ± 15.55		
	≥ 20	45.38 ± 16.80		
Working position	Staff nurse	42.71 ± 14.20	-0.45	(.656)
	≥ Chief nurse	44.07 ± 16.73		
Working Department	Ward	43.33 ± 14.33	0.40	(.670)
	Special unit	43.21 ± 16.18		
	OPD	40.32 ± 14.65		
Period caring patients with COVID-19 (month)	< 12	41.18 ± 14.86	0.69	(.558)
	≥ 12~ < 18	45.27 ± 14.66		
	≥ 18~ < 24	42.95 ± 13.71		
	> 24	41.89 ± 15.26		
Working type	Regular working	42.64 ± 18.41	-0.10	(.922)
	8 hours shift	42.97 ± 14.01		
Education level	Associate	43.21 ± 16.67	0.07	(.930)
	Bachelor	42.67 ± 13.76		
	≥ Master	44.27 ± 14.66		
Intention to turnover post COVID-19 experience	Yes	43.12 ± 13.69	0.17	(.863)
	No	42.73 ± 15.49		
Experience of caring for patients with emerging infectious disease	Yes	46.30 ± 17.00	2.17	(.032)
	No	41.22 ± 12.96		
Intention to caring for patients with emerging infectious disease	Yes	43.23 ± 14.88	0.40	(.689)
	No	42.27 ± 14.07		
Experience of education for infectious disease management	Yes	42.93 ± 15.08	0.01	(.996)
	No	42.92 ± 13.99		
Joining mental health programs post COVID-19 experience	Yes	45.31 ± 14.73	0.91	(.367)
	No	42.49 ± 14.57		

†Comparisons between the male and female groups were assessed by the Mann-Whitney U test (p = .024).

Table 4. Correlations among Resilience, Social Support, Deliberate Rumination and Posttraumatic Growth (*N*=170)

Variables	Resilience	Social support	Deliberate Rumination	Posttraumatic growth
	r (*p*)			
Resilience	1			
Social support	.51 (< .001)	1		
Deliberate rumination	.50 (< .001)	.43 (< .001)	1	
Posttraumatic growth	.55 (< .001)	.49 (< .001)	.65 (< .001)	1

checking the normal P-P plot and scatter plot of residuals, the normal P-P plot and scatter plot of residuals were found to be linear, and the residuals were evenly distributed around 0, indicating that normality, linearity, and homoscedasticity of errors were satisfied. As a result of testing multicollinearity, the tolerance values ranged from 0.58 to 0.91 and were all higher than the cut-off value of 0.1. and the variance inflation factor (VIF) values ranged from 1.11 to 1.73, and were all lower than the cut-off value of 10, indicating that there was no multicollinearity between the independent variables of this study.

Hierarchical regression analysis was performed to identify factors affecting posttraumatic growth (PTG), and in Model 1, among the general characteristics of the participants, gender, religion, and experience of caring for patients with emerging infectious disease, were entered. As a result, only gender (β = -.16, p = .033) was found to have a statistically significant impact on PTG, and this variable explained 5% of the variance of PTG. In Model 2, resilience, social support, and deliberate rumination were additionally entered. As a result, the explanatory power of the variables for PTG was increased to 50.1% %(F = 29.33, p < .001), and deliberate rumination was found to be the most significant factor affecting PTG among the participants (β = .46, p < .001), followed by resilience (β = .22, p = .003) and social support (β = .18, p = .012). In other words, a higher level of PTG was significantly associated with a higher level of deliberate rumination, a higher level of resilience, and a higher level of perceived social support among the participants (Table 5).

Discussion

This study analyzed factors affecting posttraumatic growth (PTG) among nurses working at regional medical centers with the experience of caring for COVID-19 patients, based on the theory of posttraumatic growth proposed by Calhoun & Tedeschi [4] and previous studies on posttraumatic growth. The present research ultimately sought to contribute to promoting nurses' occupational health, and provide basic data for developing posttraumatic growth programs and establishing support policies for nurses.

The mean score for the frequency of experiencing traumatic events among the participants was 2.19 points (24.05 out of 55 points). This score is higher than the mean score of 21.82 points in a study of dedicated COVID-19 hospital nurses [22], but it is lower than the mean score of 31.71 points in a study of intensive care unit nurses [12]. In this regard, it should be pointed out that the traumatic event experience assessment scale used in this study was developed for intensive care unit (ICU) nurses, and different implications may be derived from the assessment results depending on the disease severity and disease characteristics of patients and the time point of the study, so there is a need to conduct follow-up studies by using different variables to repeatedly verify research findings. In addition, there is a need to develop a traumatic experience assessment tool by reflecting factors such as the increase of physical and psychological stress due to wearing personal protective equipment (PPE) [3] and revising the question on 'caring for patients with risk of disease transmission (AIDS, tuberculosis, etc.)' into a question suitable for the environment of caring for patients with emerging infectious diseases.

Table 5. Factors Influencing Posttraumatic Growth (N=170)

Variables	Model 1			Model 2		
	B	β	t (p)	B	β	t (p)
(constant)	48.57		22.56 (< .001)	-.51		-.01 (.922)
Gender	-10.00	-.16	-2.16 (.033)	-.59	-.01	-.17 (.868)
Religion	-4.21	-.14	-1.80 (.073)	-1.90	-.06	-1.11 (.269)
Experience of caring for patients with emerging infectious disease	-3.62	-.12	-1.52 (.130)	-.13	-.01	-.07 (.944)
Resilience				.22	.22	3.01 (.003)
Social support				.27	.18	2.54 (.012)
Deliberate rumination				1.05	.46	7.10 (< .001)
R^2		.075			.519	
Adjusted R^2		.058			.501	
F (p)		4.47 (.005)			29.33 (< .001)	
Durbin-Watson = 1.79, Tolerance = 0.58~0.91, VIF = 1.11~1.73						

Reference group = Gender (Female), Religion (Yes), Experience of caring for patients with emerging infectious disease (Yes).

The most frequently experienced traumatic event was found to be caring for a patient showing abnormal behavior (e.g., disturbance, screaming, delirium, sexual behavior). This finding is in agreement with the results of a previous study of nurses in a dedicated COVID-19 hospital [22] as well as the results of a prior study of intensive care unit nurses [12]. As to the most painful event, in this study, the sudden death of an unexpected patient was perceived as the most distressing event by the largest number of nurses (44 people, 25.9%), followed by the abnormal behavior of a patient (violent acts, screaming, delirium, sexual behavior, etc.) (39 people, 22.9%). In this connection, it has been reported that nurses may have experienced a large number of patient deaths and unexpected, sudden fatalities due to the characteristics of COVID-19 [6], and patients with infectious diseases may experience various emotional problems such as anxiety, depression, and aggressiveness when they are placed in an isolation room [23]. While caring for such patients, nurses were exposed to traumatic events, but there has been a lack of interest in the traumatic experiences of nurses caring for patients with emerging infectious disease in Korea. In view of this situation, there is a need for continuous monitoring of traumatic events experienced by nurses, and when developing therapeutic intervention programs for nurses who have experienced traumatic events, it is necessary to ensure that such programs should include the content that helps to heal the mind of nurses who have experienced unexpected sudden deaths and abnormal patient behaviors. In addition, programs that provide education on infectious disease control and prevention and emotional support to patients receiving treatment in isolation should be provided to prevent patients' abnormal behaviors.

In this study, the mean score of resilience was 2.30 points (57.54 out of 100 points). This is a similar level to the mean score of 57.54 points in a study of nurses caring for COVID-19 patients at a national designated infectious disease hospital [24] and the mean score of 2.30 points in a study of intensive care unit nurses [25]. Meanwhile, 115 out of 170 nurses (67.6%) responded that they had intention to care for patients with emerging infectious diseases in the future. This means that more than half of the participants responded positively. In other words, the majority of the participants showed intention to participate in caring for patients with emerging infectious disease in the future, although they experienced various traumatic events in the unexpected situation of caring for patients with emerging infectious disease. This finding is thought to suggest that the participants of this study had the disposition that enabled them to appropriately cope with traumatic events and overcome them through resilience. With respect to social support, the mean score of social support was 4.07 points (48.89 out of 60 points). This score is a similar level to the mean score of 48.34 points in a previous study of nurses caring for COVID-19 patients [26] but it is higher than the mean score of 3.44 points reported in a study of general hospital nurses [27]. A relatively higher score for social support in this study is believed to reflect socially shared feelings of gratitude toward medical staff during the pandemic period, as shown in "Thanks Challenge" on social media platforms, as well as the interest and encouragement of people around nurses. As for deliberate rumination, the mean score was 1.77 points (17.69 out of 30 points). This score is a similar level to the mean score of 18.69 points in a previous study of nurses caring for COVID-19 patients [7], but it is higher than the mean score of 13.2 points in a previous study of emergency room nurses [28]. Ae relatively higher mean score for deliberate rumination among the participants of this study is thought to indicate that they experienced a high level of deliberate rumination while pondering upon the meaning of caring for patients with emerging infectious diseases, and giving new meaning and value to their painful experiences they underwent in the process of directly caring for COVID-19 patients.

In this study, the mean score for PTG was 2.68 points (42.92 out of 80 points). This score is lower than the mean score of 46.54 points among nurses who cared for COVID-19 patients [7], and it was similar to the mean score of 2.66 points among general hospital nurses [29]. As the COVID-19 pandemic became prolonged, nurses had to bear the burden of caring for COVID-19 patients, but as nurses working at dedicated infectious disease hospitals designated by the government, they felt a sense of pride in caring for patients with emerging infectious disease based on a sense of responsibility for patients and their professionalism, and they also got to have a determination to overcome COVID-19 infections [5]. Their professional pride and determination to overcome the COVID-19 crisis had a positive impact on PTG among nurses [5]. In consideration of the findings described above, it is important to develop and implement practical and specific programs and policies that can facilitate PTG among nurses caring for patients with emerging infectious disease. However, since there is a lack of research on the PTG of nurses caring for emerging infectious diseases such as COVID-19, further research should be conducted to identify factors significantly associated with PTG by including various variables that have been previously identified, based on the theory of posttraumatic growth and previous studies.

With respect to the level of posttraumatic growth (PTG) ac-

cording to the general characteristics of the participants, the mean score for PTG was statistically significantly higher in women, in the group with religion, and in the group with previous experience in caring for nursing patients with emerging infectious diseases. Regarding the relationship between PTG and previous experience in caring for nursing patients with emerging infectious diseases, it is presumed that the nurses' previous experience of caring for patients with infectious diseases acted as a factor leading to posttraumatic growth, and thus had a positive effect on caring for other patients with emerging infectious diseases afterwards. As for the relationships between PTG and general characteristics described above, similar research results have been reported in literature. In particular, a previous study of nurses caring for COVID-19 patients reported that there were statistically significant differences in PTG according to age, marital status, religion, clinical experience, position, and willingness to participate in caring for emerging infectious diseases in the future [7]. In addition, a prior study of emergency room nurses found that there were significant differences in PTG according to age, marital status, religion, education level, clinical experience, position, and working pattern [28]. As described above, religion was identified as a significant variable in previous studies as well as this study, and these research results may be considered to provide a ground for promoting religious community activities, support for religious events, and support for mental and spiritual well-being programs. However, there is a need to conduct further research to investigate the level of PTG according to general characteristics in order to comparatively verify the results of this study. In addition, it is necessary to develop a customized posttraumatic growth program tailored to the characteristics of subjects by considering factors such as gender, religion, and experience in caring for patients with emerging infectious diseases.

In this study, deliberate rumination was the most significant factor affecting PTG. This result is in agreement with both a previous study of nurses caring for COVID-19 patients [7] and a prior study of psychiatric nurses [30], which reported that deliberate rumination was the factor that had the greatest impact on posttraumatic growth. Deliberate rumination refers to a cognitive process in which an individual contemplates about an event that caused him or her to experience pain and distress, and it is an act of seeking to understand the meaning of a deeply stressful experience and is considered an important process for achieving PTG [11]. To enhance deliberate rumination, it is necessary to develop an intervention program that includes mindfulness, meditation, and keeping a gratitude journal in order to help nurses caring for patients with emerging infectious diseases to reflect deeply upon the meaning of their act of nursing for themselves as well as changes in themselves and in their relationships with others that resulted from caring for patients with emerging infectious diseases [7].

Resilience was also identified as a factor influencing PTG in the present study. This finding is consistent with a previous study of nurses who cared for COVID-19 patients in Wuhan, China [31] and a previous research of nurses who cared for COVID-19 patients at a dedicated infectious disease hospital designated by the government [24]. These two previous studies also reported that resilience was a significant influencing factor for PTG among the participants. These findings suggest that there is a need to develop intervention programs that can improve stress management and promote positive thinking, and to establish an effective support system in order to enhance resilience in nurses caring for patients with emerging infectious diseases and thereby help them to achieve posttraumatic growth.

In addition, social support was also identified as a factor affecting PTG in this study, and this finding is consistent with the research results from a study of intensive care unit nurses [12] and a study of psychiatric nurses [30], which showed that there is a need to create a culture providing social support to nurses in order to improve PTG in nurses. Social support is a positive resource that nurses can receive from others, and it has been reported to be associated with a reduction in the psychological burden of nurses in the public health crisis of the COVID-19 pandemic. In view of these findings, efforts at the national level should be made to ensure that nurses at regional medical centers who have experienced traumatic events can continuously receive social support.

Conclusions

This study attempted to identify factors affecting posttraumatic growth in nurses working at regional medical centers who are likely to perform nursing for patients with infectious disease in the event of an outbreak of emerging infectious diseases, based on the theory posttraumatic growth presented by Calhoun & Tedeschi [4]. In this study, deliberate rumination was found to have the greatest impact on PTG among nurses caring for COVID-19 patients at regional medical centers, followed by resilience and social support. The findings of this study can hopefully be utilized as useful basic data for developing intervention programs and establishing policies.

This study was conducted with nurses working at regional medical centers designated as dedicated infectious disease hospi-

tals in a few specific cities at a specific time, so there are limitations in generalizing the results of this study. Therefore, follow-up studies should be conducted by considering nurses who cared for patients with emerging infectious disease when cases of newly emerging infectious disease occurred, the time point of research, and the disease severity levels of patients. In addition, there is a need to develop an assessment tool for the experience of traumatic events that is appropriate for the situation of the outbreaks of emerging infectious diseases. Further, it is also necessary to conduct further research by including a wider range of variables identified as influencing factors for PTG in previous studies. Despite the limitations described above, this study is considered to have meaningful aspects. First, the present research comprehensively investigated the traumatic events experienced by nurses working at regional medical centers as their main duty was shifted from caring for general patients to directly caring for patients with emerging infectious diseases due to the spread of COVID-19. In addition, this study analyzed the level of posttraumatic growth among the nurses, and identified the factors influencing their posttraumatic growth.

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Authors' contributions

Jaehwa Bae contributed to conceptualization, data curation, formal analysis, funding acquisition, methodology, project administration, visualization, writing - original draft, review & editing, investigation, resources, software, supervision, and validation. Eun Suk Choi contributed to conceptualization, methodology, project administration, writing - review & editing, and supervision.

Data availability

Please contact the corresponding author for data availability.

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