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Stress, anxiety, depression, and burnout as predictors of post-traumatic growth in nurses during the COVID-19 pandemic: a descriptive correlational study

Ayten Demir[a], Başak Demirtaş[a], Eda Özge Yazgan[b]*, Yasemin Çekiç[a], Burcu Ağdemir[c]*, Sultan Türkmen Keskin[a], Gülçin Korkmaz Yenice[c]*, Meltem Özduyan Kiliç[a], Gülsüm Ançel[a], Funda Özdemir[a], Ayfer Tezel[a], Tufan Asli Sezer[a], Aslihan Öztürk Eyimaya[a], Filiz Salman[d], Fatma Özlem Öztürk[a], Ayşegül Yavaş Ayhan[a], Şahinde Canbulat[a], Ezgi Yildirim[a], Figen Işik Esenay[a], Sevinç Kutlutürkan[a], Ayşegül Öztürk Birge[a], Deniz Harputlu[a]*, Melike Kara[e]*, Nuran Coşkun[f] and Melike Ergüven Boğa[f]

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ABSTRACT

COVID-19, with the losses it has caused worldwide, can be considered a potentially traumatic event for many individuals. Individuals develop psychopathological outcomes in the wake of traumatic event; besides, post-traumatic growth may be encountered. This study aimed to examine how the stress, anxiety, depression, and burnout experienced by nurses during the COVID-19 pandemic affected their post-traumatic growth. This study used descriptive and correlational research. The sample consisted of 1,353 nurses in health care institutions in Turkey. The relevant data were collected using the Personal Information Form, Depression Anxiety and Stress Scale-21, Maslach Burnout Inventory, and Post-Traumatic Growth Inventory. Data were analyzed using linear and hierarchical multiple regression analyses. The analyses showed that depression and emotional exhaustion were negatively associated with post-traumatic growth, whereas stress and personal accomplishment were positively associated with it. These findings suggest that interventions aimed at promoting stress management and personal accomplishment, while reducing depression and emotional exhaustion, could be important in supporting post-traumatic growth in healthcare workers. Based on these findings, policymakers should adopt a proactive approach, developing both individual and institutional plans to empower healthcare workers in the face of future challenges that may impact public health.

KEYWORDS

Anxiety; burnout; COVID-19; depression; post-traumatic growth; nurse; stress

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Introduction

COVID-19 was detected in the city of Wuhan in China in December 2019 and the World Health Organization (WHO) declared it a pandemic in March 2020. The World Health Organization (WHO, 2023) reported that the number of confirmed COVID-19 cases worldwide has exceeded 660 million, with over 6.7 million deaths. The number of confirmed COVID-19 cases in Turkey has exceeded 17 million and around 100,000 people died (TMoH, 2023). This study was conducted in Turkey during the COVID-19 pandemic, between June 1 and September 1, 2021, approximately 15 months after the initial outbreak. During this three-month period, Turkey continued to report COVID-19 cases, with 1,162,873 confirmed cases and 9,473 deaths (TMoH, 2023). Vaccination efforts began on January 14, 2021, and as of May 22, 2021, 18.88% of the population has received at least one dose of COVID-19 vaccine (Turkish Medical Association, 2021).

The health care professionals who have endeavored to prevent the disease from spreading throughout the world and to treat it have encountered a number of difficulties. These included contracting the virus, the fear of infecting family members, and the emotional burden of caring for those suffering from the disease (Sampaio et al., 2021; Tengilimoğlu et al., 2021). Furthermore, nurses struggled with inadequate protective equipment, long working hours, and high workload, which negatively impacted their mental health, leading to anxiety, depression, burnout, and stress (Al Maqbali et al., 2021; Chew et al., 2020; Lai et al., 2020). Studies have reported that the uncertainty and demanding working conditions during the pandemic intensified burnout among healthcare workers (Pappa et al., 2021). Burnout is a psychological syndrome characterized by emotional exhaustion, depersonalization, and a reduction in personal accomplishment (Maslach et al., 1986). The quality of care or service provided by nurses may decline as a result of burnout (Chen et al., 2021). Studies conducted during the COVID-19 pandemic have reported that nurses experienced moderate to high levels of emotional exhaustion (42.3–78.5%), low to moderate levels of depersonalization, and varying levels of personal accomplishment (Chen et al., 2021; Hu et al., 2020; Murat et al., 2021; Sayilan et al., 2021; Zhang et al., 2020). Additionally, one study found a significant relationship between depression and burnout, indicating that emotional exhaustion and depersonalization increase with depression, while personal accomplishment decreases (Yörük & Güler, 2021). Furthermore, Yuan et al. (2021) reported that post-traumatic stress disorder (PTSD) symptoms were observed in 26.9% of healthcare workers during the COVID-19 pandemic.

The global emergence of new infectious diseases affects all individuals, but not everyone responds with the same symptoms (Han & Lee, 2013). In addition to the numerous negative psychological and physical outcomes that individuals may experience following a traumatic event, there are also potential positive developments (Okoli et al., 2021). Traumatic events can lead to significant shifts in pre-traumatic assumptions and views about oneself, others, and the world. As individuals work to rebuild these beliefs, post-traumatic growth (PTG) can occur (Brooks et al., 2020; Tedeschi and Calhoun, 2004). PTG is a subjective experience involving positive psychological changes that arise after a traumatic event (Tedeschi & Calhoun, 2004). Tedeschi and Calhoun (1996, 2004) state that this growth occurs in five different dimensions: (1) greater appreciation of life and changed priorities; (2) warmer, more intimate relationships with others; (3) a greater sense of personal strength; (4) recognition of new possibilities or paths for one's life; and (5) spiritual development. Through the process of reinterpreting their lives in the wake of trauma, individuals can improve their sense of self, their relationships with others, and their attitude toward life (Calhoun et al., 2010). This positive change may also lead individuals to form more meaningful interpersonal relationships, gain a stronger sense of personal power, alter their priorities, and live a more existential or spiritual life (Tominaga et al., 2020). However, few studies have assessed the conditions of PTG among nurses during the pandemic.

In a study conducted by Li et al. (2022) in China, it was found that nurses had higher post-traumatic growth (PTG) scores compared to the general population. In another study on the same topic, nurses caring for COVID-19 patients in intensive care units had higher PTG scores, and those with higher PTG scores experienced less burnout (Chen et al., 2021). Another study report that the PTG scores of frontline nurses are influenced by factors such as the number of years they have been working, their educational background, self-confidence, and risk awareness, as well as whether or not they receive psychological support (Cui et al., 2021). Additionally, other research have shown that demographic characteristics and psychosocial experiences of nurses are associated with PTG (O'Donovan & Burke, 2022; Zhang et al., 2021).

No study was found in the literature in which the relationship between all of the stress, anxiety, depression, burnout variables experienced by nurses during the COVID-19 pandemicand posttraumatic growth was investigated. In addition, this is the first large-scale study on this subject. The results of the study are expected to contribute to the literature in developing strategies for stress, anxiety, depression and burnout symptoms that have the potential to affect nurses' private life and work performance during the pandemic process and in determining the factors that promote

post-traumatic growth. This study aims to examine the relationship between depression, anxiety, stress, and burnout that the nurses have gone through during the COVID-19 pandemic and post-traumatic growth. Specifically, the research question is: Does the depression, anxiety, stress, and burnout experienced by nurses affect their PTG?

Methods and materials

Design and setting

The study design was descriptive and correlational research. The STROBE Statement Checklist was used in reporting this study.

Sample

The study population comprised of nurses working in primary, secondary, and tertiary healthcare institutions (including private hospitals, university hospitals, and Ministry of Health affiliated healthcare facilities) across Turkey. Nurses who were actively working in these institutions and voluntarily agreed to participate in the study were included in the research. Non-nursing healthcare professionals, nurses not practicing in Turkey, and duplicate submissions were excluded. Using a snowball sampling method through social media platforms, a total of 1,366 nurses voluntarily participated in the study. The final sample consisted of 1,353 nurses after excluding thirteen participants due to incomplete and duplicate responses. A post-hoc power analysis was conducted using G-Power 3.1.9.7 software to ensure adequate statistical power. The analysis, performed with parameters of $\alpha = 0.05$, sample size = 1,353, and effect size = 0.1834, yielded a statistical power of 100%, confirming the sample size adequacy for the study objectives.

Data collection

Data collection was conducted between June 1 and September 1, 2021, using a structured online questionnaire administered through Google Forms and, access to the online survey form was closed after September 1, 2021. Due to the ongoing COVID-19 pandemic restrictions, participant recruitment was facilitated through various social media platforms (Instagram, Twitter, WhatsApp, and Facebook) using a snowball sampling technique. Prior to participation, potential respondents were presented with an informed consent page detailing the study's purpose, voluntary nature of participation, and confidentiality measures. Only nurses who provided explicit consent by accepting the terms were able to proceed to the survey questions. All data were stored in a password-protected Google

Drive account accessible only to the researchers. No personally identifiable information was collected.

Data collection instruments

The data collection instruments were the Personal Information Form, Depression Anxiety and Stress Scale (DASS – 21), Maslach Burnout Inventory (MBI), and Post-Traumatic Growth Inventory (PTGI).

Personal Information Form:

The Personal Information Form was developed in parallel with the related literature (Al Maqbali et al., 2021; Chen et al., 2021; Chew et al., 2020; Cui et al., 2021; Hu et al., 2020; Li et al., 2022). The form consists of 27 questions that cover the descriptive characteristics of the nurses, the issues that they experienced during the COVID-19 pandemic, and what they gained.

Depression Anxiety Stress Scale (DASS-21)

The DASS-21 is a shortened version of the original 42-item DASS developed by Lovibond and Lovibond (1995). The scale was translated and linguistically validated in Turkish language by Yıldırım et al. (2018), who also examined its psychometric properties in both healthy individuals and patients in Turkey. The Turkish version of DASS-21 includes three subscales: Depression, Anxiety, and Stress, with 7 items in each subscale. It is scored using a 4-point Likert scale: 0 = 'never', 1 = 'sometimes,' 2 = 'frequently', and 3 = 'always'. The Turkish validation study reported Cronbach's alpha values of 0.89 for Depression, 0.87 for Anxiety, and 0.90 for Stress (Yıldırım et al., 2018). In this study, Cronbach's alpha values ranged from 0.88 to 0.92 for Depression, Anxiety, and Stress.

Maslach Burnout Inventory (MBI)

The MBI was developed by Maslach et al. (1986) and was translated and linguistically validated for the Turkish population by Ergin (1992). The Turkish version of the scale consists of 22 items, divided into three subscales: Emotional Exhaustion, Personal Accomplishment, and Depersonalization. During the Turkish adaptation process, Ergin (1992) modified the original 7-point Likert scale to a 5-point Likert scale: 0 = 'never' to 4 = 'always'. Higher scores on the Emotional Exhaustion and Depersonalization subscales, along with lower scores on the Personal Accomplishment subscale, indicate higher levels of burnout. In the Turkish validation study, Cronbach's alpha values were reported as 0.83 for Emotional Exhaustion, 0.72 for Personal Accomplishment, and 0.65 for

Depersonalization (Ergin, 1992). In the present study, Cronbach's alpha values for the subscales ranged from 0.78 to 0.92.

Post-Traumatic Growth Inventory (PTGI)

The PTGI was developed by Tedeschi and Calhoun (1996) and was translated and linguistically validated in Turkish language by Kağan et al. (2012). The Turkish version of the PTGI is a 21-item scale used to measure positive psychological changes following a traumatic event. The scale consists of three subscales: Change in Self-Perception (10 items), Change in Relationships (5 items), and Change in Philosophy of Life (6 items). It uses a 6-point Likert scale, where 0 = 'I have never experienced this change as a result of a stressful incident(s)', 1 = 'I have, but to a small degree', 2 = 'I have, to some extent', 3 = 'I have, to a moderate level', 4 = 'I have, to a large extent', and 5 = 'I have experienced this change at a very high level as a result of a stressful incident(s)'. Higher scores indicate greater positive psychological change. The Turkish validation study had Cronbach's alpha values of 0.88 for Change in Self-Perception, 0.77 for Change in Relationships, 0.78 for Change in Philosophy of Life and 0.92 for all items (Kağan et al., 2012). In this study, Cronbach's alpha values for the scale and its subdimensions ranged from 0.87 to 0.96.

Ethical approval

Ethical approval was obtained from the Ankara University Ethics Commission before conducting the study (decision dated 26/04/2021 and numbered 07/91) and permission (2021-04-10T17_42_25) from the Ministry of Health. The research conforms to the provisions of the Declaration of Helsinki (as revised in Brazil 2013). The participants gave their consent using an informed consent form that was filled out electronically. Permission was obtained from the authors of the scales used in the study.

Data analyses

Sample size was calculated using G*Power version 3.1.9.7 program, and analyses were conducted using SPSS 22.0 software. The normality of data distribution was assessed using Skewness-Kurtosis values (±2) (George & Mallery, 2010). Descriptive statistics were presented as frequencies, percentages, means, and standard deviations. Preliminary analyses included independent samples t-test and one-way ANOVA with post-hoc comparisons (Tukey's HSD or LSD as appropriate) to examine differences in PTGI scores across descriptive characteristics (Supplementary Table 1). Pearson correlation coefficients were used to examine relationships between continuous variables (DASS-21, burnout, and PTGI scores) (Supplementary

Table 2). Multiple linear regression analyses were conducted to examine the effects of DASS-21 and burnout on both PTGI total score and its subscales. Subsequently, hierarchical multiple regression analysis was performed to determine the relative contribution of sociodemographic characteristics and psychological variables on post-traumatic growth total score. The model incorporated sociodemographic variables showing significant associations in preliminary analyses in the first step, followed by the DASS-21 subscale scores (Depression, Anxiety, and Stress) in the second step, and burnout subscale scores (Emotional Exhaustion, Depersonalization, and Personal Accomplishment) in the final step. This hierarchical approach allowed examination of the incremental contribution of each variable set through changes in R^2 values. Regression assumptions including multicollinearity (VIF < 10), independence of residuals (Durbin-Watson test), and normality were confirmed. Statistical significance was set at $p < 0.05$.

Results

The mean age of the participants was 32.32 ± 8.12, the mean years of professional experience was 10.18 ± 8.66 years, the average number of patients they provided care for during the COVID-19 period 18.47 ± 28.37, and the average weekly working time was 48.42 ± 10.70 h. The descriptive characteristics of nurses are given in Table 1.

The total and subscale mean scores of the scales are shown in Table 2. The mean score was 9.887 ± 5.963 (Min = 0; Max = 21) for 'depression', 7.252 ± 5.181 (Min = 0; Max = 21) for 'anxiety', 9.401 ± 5.772 (Min = 0; Max = 21) for 'stress', 19.883 ± 8.654 (Min = 0; Max = 36) for 'emotional exhaustion, 18.565 ± 5.697 (Min = 0; Max = 32) for 'personal accomplishment', 6.800 ± 4.544 (Min = 0; Max = 20) for 'depersonalization', 46.420 ± 24.679 (Min = 0; Max = 105) for 'PTGI total score', 23.750 ± 12.876 (Min = 0; Max = 50) for 'change in self-perception', 13.640 ± 7.244 (Min = 0; Max = 30) for 'change in life philosophy', 9.030 ± 6.283 (Min = 0; Max = 25) for 'change in relations with others'.

The impact of nurses' descriptive characteristics on PTGI scores was examined through multivariate linear regression analysis (Table 3). The model explained 2.3% of the variance in total PTGI scores ($F = 11.435$, $p = 0.001$). Key findings revealed that male gender was associated with lower PTGI scores ($ß = -7.166$), while higher education predicted higher scores ($ß = 5.405$, $p < 0.05$). Similar patterns were observed across PTGI subscales, with education level emerging as a consistent positive predictor.

Another regression analysis examined the influence of DASS-21 and Burnout scales on PTGI scores and subscales (Table 4). This model explained 14.6% of the variance in total PTGI scores ($F = 39.456$, $p = 0.0001$). Results showed that higher Depression ($ß = -0.831$) and Emotional

Table 1. Distribution of nurses according to descriptive characteristics (*N*:1353).

Groups	Frequency (*n*)	Percentage (%)
Age Mean 32.324 ± 8.129 (Min 21–Max 59)		
The mean years of professional experience Mean 10.186 ± 8.665 (Min 0.10–Max 37.0)		
The average number of patients they provided care for during the COVID-19 period Mean 18.478 ± 28.371 (Min 1.00–Max 300.00)		
The average weekly working time Mean 48.424 ± 10.701 (Min 12.00–Max 96.00)		
Gender		
Female	1190	88.0
Male	163	12.0
Marital status		
Married	727	53.7
Single	626	46.3
Number of children		
None	736	54.4
1	237	17.5
2	322	23.8
3 and above	58	4.3
Hospital type in which they work		
University hospital	358	26.5
Hospitals of the ministry of health	900	66.5
Private health institution	95	7.0
Having a chronic disease		
Yes	266	19.7
No	1087	80.3
Educational background		
High school	115	8.5
Bachelor	1005	74.3
Graduate	233	17.2
Unit in which they work		
Emergency department	137	10.1
Intensive care	428	31.6
Medical department	225	16.6
Surgical department	148	10.9
Gynecology department	51	3.8
Psychiatry department	25	1.8
Pediatrics department	51	3.8
Polyclinics	119	8.8
Operating room	63	4.7
Primary health care organization	106	7.8
Change of hospital at the time of the pandemic		
Yes	373	27.6
No	980	72.4
Change in duty station for the duration of the pandemic		
Yes	686	50.7
No	667	49.3
Any care given to a COVID-19 patient		
Yes	932	68.9
No	421	31.1
Training for COVID-19 patient care		
Yes	608	44.9
No	745	55.1
Types of support in COVID-19 patient care?[a] (*n*: 2657)		
Patient care	472	34.9
Psychosocial support	164	12.1
Administrative support	165	12.2
Support in materials and resources	696	51.4
Usage of personal protective equipment (PPE)	1160	85.7
Adequacy of support given to nurses		
Yes	93	6.9
No	1260	93.1
Access to PPE's as needed		
Yes	861	63.6
No	492	36.4

(*Continued*)

Table 1. Continued.

Groups	Frequency (*n*)	Percentage (%)
Frequently used isolation measures		
I have separated from the family members whom I live together.	105	7.8
I have moved into another place/ house temporarily.	74	5.5
I have continued living with my family, taking necessary precautions.	849	62.7
I live alone and have not isolated myself.	270	20.0
I have not taken any measure at home	55	4.1
COVID-19 vaccination		
Yes	1064	78.6
No	289	21.4
Getting a COVID-19 test		
Yes	1168	86.3
No	185	13.7
Positive Result in COVID-19 test (*n*:1168)		
Yes	472	40.4
No	696	59.6
Level of Covid-19 symptoms (*n*:472)		
Asymptomatic	38	8.1
Mildly	258	54.7
Severely	176	37.3
Transmission the family members		
Yes	204	43.2
No	268	56.8
Did you lose anyone that you know because of COVID-19?		
One of the family members	160	11.8
A colleague that works in the same clinic	27	2.0
A team member at the same clinic	17	1.3
A health worker that I know	263	19.4
Other	389	28.8
I have not lost any person close to me	656	48.5
Did you experience any of the following during the pandemic?		
Lack of sleep	1077	79.6
Nutritional deficiency	726	53.7
Eating disorder	534	39.5
Sedentary life	618	45.7
Other	30	2.2
Areas of development during the pandemic[a] (*n*: 2565)		
I have developed my skill to solve a problem	590	43.6
I have used my time more efficiently	409	30.2
I have spared more time for the family members	350	25.9
I have supported my personal development	323	23.9
I have started to exercise regularly	120	8.9
I have started to nourish better	278	20.5
I have started to have a well-quality sleep	68	5.0

[a]Multiple responses possible.

Exhaustion ($\beta = -0.350$) scores were associated with lower PTGI scores ($p < 0.05$), while higher Stress ($\beta = 0.836$) and Personal Accomplishment ($\beta = 1.626$) scores were linked to higher PTGI scores ($p < 0.05$). The analysis indicated that post-traumatic growth was significantly and negatively

Table 2. Total and sub-dimension score means of the scales ($N = 1353$).

	Mean	*SD*	Min.	Maks.
PTGI Total Score	46.420	24.679	0.000	105.000
Change in Self-Perception	23.750	12.876	0.000	50.000
Change in Life Philosophy	13.640	7.244	0.000	30.000
Change in Relations with Others	9.030	6.283	0.000	25.000
Depression	9.887	5.963	0.000	21.000
Anxiety	7.252	5.181	0.000	21.000
Stress	9.401	5.772	0.000	21.000
Emotional Exhaustion	19.883	8.654	0.000	36.000
Personal Accomplishment	18.565	5.697	0.000	32.000
Depersonalization	6.800	4.544	0.000	20.000

SD: Standard Deviation.

associated with Depression and Emotional Exhaustion, and positively associated with Stress and Personal Accomplishment. No significant effects were found for Anxiety or Depersonalization on the total PTGI score ($p > 0.05$). When examining the effects of DASS-21 and MBI scores on the PTG subdimensions: In the Changes in Self-Perception sub-dimension ($F = 46.217$; $p = 0.0001$, $R^2 = 0.167$), increases in Depression ($\beta = -0.380$) and Emotional Exhaustion ($\beta = -0.176$) scores had a negative effect, while increases in Stress ($\beta = 0.328$) and Personal Accomplishment ($\beta = 0.919$) scores had a positive effect ($p < 0.05$). In the Changes in Life Philosophy sub-dimension ($F = 28.459$; $p = 0.0001$, $R^2 = 0.109$), an increase in Depression scores ($\beta = -0.156$) had a negative effect, while increases in Stress ($\beta = 0.295$) and Personal Accomplishment ($\beta = 0.399$) scores had a positive effect ($p < 0.05$). In the Changes in Relationships sub-dimension ($F = 26.455$; $p = 0.0001$, $R^2 = 0.101$), only increases in Depression ($\beta = -0.295$) and Emotional Exhaustion ($\beta = -0.130$) scores had a significant negative effect ($p < 0.05$). Detailed regression coefficients and statistical significance for all variables are presented in Table 4.

A hierarchical multiple regression analysis was conducted to determine the factors influencing the total score of the Post-Traumatic Growth Inventory (PTGI). The analysis was performed through a three-stage model (Table 5). In Model 1, sociodemographic variables (gender, marital status, and education) were included in the analysis, and the model explained 2.5% of the variance ($R^2 = 0.025$, $p < 0.001$). Gender and education level were identified as significant predictors of post-traumatic growth. When the burnout subscales (emotional exhaustion, personal accomplishment, and depersonalization) were added in Model 2, the explained variance increased to 15.0% ($R^2 = 0.150$, $p < 0.001$). This increase demonstrates the substantial impact of burnout dimensions on post-traumatic growth. Analysis revealed significant effects for emotional exhaustion ($\beta = -0.124$, $t = -3.655$, $p < 0.001$) and personal accomplishment ($\beta = 0.362$, $t = 13.963$, $p < 0.001$), where emotional exhaustion demonstrated a negative association with post-traumatic growth levels, while personal accomplishment exhibited

Table 3. Examination of the independent variables that have an impact on post-traumatic growth using multivariable linear regression model (*N*:1353).

	PTGI total score				Changes in self perception				Changes in life philosophy				Changes in relationships			
Variables	β	p	Lower (95%CI)	Upper (95%CI)	β	p	Lower (95%CI)	Upper (95%CI)	β	p	Lower (95%CI)	Upper (95%CI)	β	p	Lower (95%CI)	Upper (95%CI)
Constant	46.242	0.0001**	38.085	54.399	24.128	0.0001**	19.866	28.39	16.323	0.001*	6.869	25.777	8.543	0.0001**	6.460	10.626
Age	–	–	–	–	–	–	–	–	−0.295	0.026*	−0.555	−0.035	–	–	–	–
Total professional experience	–	–	–	–	–	–	–	–	0.188	0.114	−0.045	0.421	–	–	–	–
Gender	−7.166	0.0001**	−11.187	−3.145	−3.525	0.001*	−5.626	−1.425	−2.205	0.023*	−4.099	−0.311	−1.003	0.056	−2.03	0.024
Marital status	−2.098	0.117	−4.725	0.529	−1.197	0.087	−2.569	0.176	–	–	–	–	−0.75	0.028*	−1.421	−0.079
Number of children	–	–	–	–	–	–	–	–	0.665	0.183	−0.315	1.645	–	–	–	–
Existence of a chronic disease	–	–	–	–	–	–	–	–	−0.06	0.945	−1.771	1.652	–	–	–	–
Educational background	5.405	0.0001**	2.795	8.014	2.551	0.0001**	1.187	3.914	1.476	0.041*	0.059	2.893	1.299	0.0001**	0.632	1.965
Regarding the support provided to nurses as adequate	–	–	–	–	–	–	–	–	0.968	0.528	−2.041	3.977	–	–	–	–
Level of showing the symptoms of COVID-19 disease	–	–	–	–	–	–	–	–	1.062	0.040*	0.051	2.074	–	–	–	–
	Adjusted R^2 =0.023 (F = 11.435. p < 0.001)				Adjusted R^2 = 0.020 (F = 10.064. p < 0.001)				Adjusted R^2 = 0.018 (F = 2.104. p < 0.001)				Adjusted R^2 = 0.016 (F = 8.526. p < 0.001)			

Notes. *p < 0.05; **p<0.001; PTGI: Post-Traumatic Growth Inventory.

Table 4. Examination of depression, anxiety, stress and burnout that have an impact on the total grade of the Post-Traumatic Growth Inventory and the grades of their dimensions using a multivariable linear regression model (*N*: 1353).

		Total of PTGI				Changes in self perception				Changes in life philosophy				Changes in relationships			
DASS and Burnout Inventory	Mean+*SD*	*β*	p	Lower (95%CI)	Upper	*β*	*p*	Lower (95%CI)	Upper	*β*	*p*	Lower (95%CI)	Upper	*β*	*p*	Lower (95%CI)	Upper
Constant		21.071	0.0001	16.392	25.751	10.345	0.0001	7.935	12.756	5.889	0.0001	4.486	7.292	4.837	0.0001	3.616	6.059
Depression	9.88 ± 5.96	−0.831	0.001*	−1.302	−0.359	−0.38	0.002*	−0.623	−0.137	−0.156	0.031*	−0.297	−0.014	−0.295	0.0001**	−0.418	−0.171
Anxiety	7.25 ± 5.18	0.276	0.243	−0.187	0.739	0.155	0.203	−0.084	0.393	−0.034	0.632	−0.173	0.105	0.155	0.012*	0.034	0.276
Stress	9.40 ± 5.77	0.836	0.001*	0.337	1.334	0.328	0.013*	0.071	0.585	0.295	0.0001**	0.145	0.444	0.213	0.001*	0.083	0.344
Emotional Exhaustion	19.88 ± 8.65	−0.350	0.001*	−0.562	−0.138	−0.176	0.002*	−0.285	−0.066	−0.045	0.168	−0.108	0.019	−0.13	0.0001**	−0.185	−0.075
Depersonalization	6.80 ± 4.54	0.071	0.696	−0.286	0.429	−0.09	0.34	−0.274	0.095	0.037	0.498	−0.07	0.144	0.124	0.009*	0.031	0.217
Personal Accomplishment	18.56 ± 5.69	1.626	0.0001**	1.408	1.844	0.919	0.0001**	0.807	1.031	0.399	0.0001**	0.333	0.464	0.308	0.0001**	0.251	0.365
		Adjusted R^2 = 0.146 (F = 39.456. p < 0.001)				Adjusted R^2 = 0.167 (F = 46.217. p < 0.001)				Adjusted R^2 = 0. 109 (F = 28.459. p < 0.001)				Adjusted R^2 = 0.101 (F = 26.455. p < 0.001)			

Notes. *p < 0.05; **p<0.001; PTGI: Post-Traumatic Growth Inventory; DASS: Depression Anxiety Stress Scale; *SD*: Standard Deviation.

Table 5. Hierarchical multiple regression analysis: effects of sociodemographic characteristics, burnout, and psychological factors (depression, anxiety, and stress) on post-traumatic growth levels.

Dependent variable:	MODEL 1			MODEL 2			MODEL 3		
Post-traumatic Growth Scale	Beta (β)	*t*	*p*	Beta (β)	*t*	*p*	Beta (β)	*t*	*p*
Constant		11.121	<0.001		5.773	<0.001		5.489	<0.001
Gender	−0.095	−3.496	<0.001	−0.085	−3.345	0.001	−0.078	−3.058	0.002
Martial Status	−0.042	−1.567	0.117	−0.032	−1.250	0.212	−0.028	−1.096	0.273
Educational Status	0.109	4.063	<0.001	0.061	2.394	0.017	0.061	2.410	0.016
Emotional Exhaustion				−0.124	−3.655	<0.001	−0.132	−3.490	<0.001
Personal Accomplishment				0.362	13.963	<0.001	0.361	13.998	<0.001
Depersonalization				0.043	1.271	0.204	0.031	0.912	0.362
Depression							−0.191	−3.284	0.001
Anxiety							0.075	1.509	0.132
Stress							0.164	2.757	0.006
Model Summary	*R*	R^2	Adj. R^2	R^2 Change	*F* Change	*Df*1	*Df*2	*p*	D-W
Model 1 ($F[3, 1349] = 11.435$, $p < 0.001$)	0.157	0.025	0.023	0.025	11.435	3	1349	<0.001	
Model 2 ($F[6, 1346] = 39.660$, $p < 0.001$)	0.388	0.150	0.146	0.125	66.226	3	1346	<0.001	
Model 3 ($F[9, 1343] = 28.558$, $p < 0.001$)	0.401	0.161	0.155	0.010	5.551	3	1343	0.001	1.924

β: Standardized regression coefficient value; R^2: Determination coefficient, Ajd.R^2: Adjusted determination coefficient; *Df*: Degree of freedom; D-W: Durbin Watson value.

a positive relationship. In contrast, the depersonalization subscale yielded no significant effect ($\beta = 0.043$, $t = 1.271$, $p = 0.204$). Finally, in Model 3, DASS-21 subscales (depression, anxiety, and stress) were incorporated, and the total explained variance reached to 16.1% ($R^2 = 0.161$, $p < 0.001$). The model revealed that Depression negatively influenced post-traumatic growth ($\beta = -0.191$, $p = 0.001$), while Stress demonstrated a positive effect ($\beta = 0.164$, $p = 0.006$). Anxiety showed no significant impact ($\beta = 0.075$, $p = 0.132$). Detailed regression coefficients and statistical significance levels are presented in Table 5.

Discussion

Levels of post-traumatic growth and psychological variables

The COVID-19 pandemic may be considered an opportunity for learning and maturation apart from being a potentially traumatic event (Chen et al., 2021). This study identified the variables associated with depression, anxiety, stress, and burnout; and examined their impact on post-traumatic growth. Post traumatic growth (PTGI) scale and subscale scores of nurses was found to be lower than average, in this study. These findings are in

accordance with the findings of Salmani et al. (2023). On the other hand, there are other studies in the literature that reported moderate and high levels of post-traumatic growth in nurses (Cui et al., 2021; Peng et al., 2021; Mo et al., 2021; Zhang et al., 2021). The differences among literature may be attributed to sample size, cultural differences, personalities of participants, trauma experience, social and psychological support systems, differences in temporal context and working conditions.

This study found near-to-average depression and stress levels in nurses while anxiety levels were found to be lower than average. Other studies also reported low or moderate levels of depression, anxiety and stress among nurses (Murat et al., 2021; Pouralizadeh et al., 2020; Sheikhbardsiri et al., 2021; Tengilimoğlu et al., 2021). However, Zakeri et al. (2021) reported increased levels of concern, depression and anxiety among nurses compared to pre-COVID-19 period. This finding suggests that crisis situations like pandemic are stress factors for nurses. The physical and emotional difficulties experienced by nurses, especially during the pandemic, such as fatigue, insomnia, helplessness, and fear, may have contributed to the increase in psychological problems such as anxiety, depression, and post-traumatic stress disorder (Dincer & Inangil, 2021; Weiner et al., 2020). In this study, emotional exhaustion and personal accomplishment levels were at moderate, and depersonalization level was at low. These results are parallel to other studies conducted during COVID-19 (Hu et al., 2020; Manzano García & Ayala Calvo, 2021; Murat et al., 2021; Zakeri et al., 2021). Zakeri et al. (2021) study, which examined changes in burnout levels during the pandemic period, reported no significant difference in nurses' burnout levels before and during COVID-19. However, Guo et al. (2018) pre-pandemic study reported high levels of burnout among nurses. These findings suggest that burnout among nurses cannot be attributed solely to the pandemic.

Variables related to post-traumatic growth

Our findings revealed that higher educational levels were associated with increased PTGI sub-dimensions and total scores. Similarly, in studies conducted with nurses during the COVID-19 pandemic, it was reported that nurses with higher education level had higher PTG scores (Cui et al., 2021; Mo et al., 2021; Zhang et al., 2022). Previous research in other context have also demonstrated positive associations between educational level and PTG (Xu & Liao, 2011; Wang et al., 2014). However, some studies found no significant relationship between education level and PTG (Han et al., 2022; Peng et al., 2021). These findings suggest that nurses

may have approached problems more comprehensively and used effective coping strategies with the increase in education level.

The 'relationships with others' subscale score was lower in those who were single, in this study. This finding may be attributed to increased social isolation during the pandemic situation, particularly affecting those living alone. While Peng et al. (2021) found no association between marital status and PTG, Zhai et al. (2021) and Li et al. (2022) reported higher PTG scores among married nurses, suggesting the potential protective role of social support.

This study found a negative relationship between the increase in age and the PTGI subscale of Changes in Life Philosophy. Some studies show higher rates of post-traumatic growth in old age (Zhai et al., 2021) and other report no relationship between age and post-traumatic growth (Peng et al., 2021). These findings can be attributed to the fact that although aging means an increase in someone's life and professional experience, they also tend to take fewer risks when it comes to changes in their life philosophy.

The study's findings indicated lower levels of change in self-perception, life philosophy and total PTG among male nurses. Similarly, Hamama-Raz et al. (2020) reported that being female was associated with higher PTG scores in a study conducted with health professionals. According to a meta-analysis study examining gender differences in posttraumatic growth, it was determined that women reported more posttraumatic growth than men (Vishnevsky et al., 2010). Additionally, the study by Song et al. (2020) found that during the pandemic, men were more likely to experience depressive symptoms and post-traumatic stress disorder (PTSD) than women. This may help explain the lower levels of post-traumatic growth (PTG) observed among male nurses. Peng et al. (2021) found no relationship between gender and post-traumatic growth. Similarly, Chen et al. found that while females exhibited higher trauma responses compared to males, no significant gender differences were observed in post-traumatic growth. Given that post-traumatic growth is a form of learning from experience, it is thought the lower levels of stress in male nurses will lower their motivation to develop.

Effect of depression, anxiety, stress, and burnout on post-traumatic growth

The study found a relationship between nurses experiencing depression, anxiety, stress, and burnout and their post-traumatic growth. Regression analyses revealed several important relationships between the DAS-21, MBI, and PTGI dimension. Specifically, increased levels of depression and emotional exhaustion were associated with decreased changes in self-perception and relationships with others. Depression also showed a negative

relationship with changes in life philosophy. Regarding stress and personal accomplishment, there was a more complex pattern. While moderate levels of stress appeared to facilitate positive changes in self-perception, life philosophy, and relationships with others, excessive stress levels showed negative associations with these dimensions.

PTG is negatively affected by depression and emotional exhaustion and positively affected by stress and personal accomplishment. PTG reportedly occurs in addition to the negative psychological reactions during the COVID-19 pandemic (Zhen & Zhou, 2021). Li et al. (2022) reported that PTG was negatively related to emotional exhaustion, depression, anxiety and stress, and positively related to personal accomplishment. Emotional exhaustion is a situation that is characterized by lower self-confidence, weariness, fatigue, weakness, indifference/lack of interest in one's job, and a feeling of excessive burnout (Maslach et al., 1986). Depression, on the other hand, is a mental disorder in which the individual harbors negative perceptions of oneself, the world, and the future, in addition to including the whole picture of emotional exhaustion. Depression and emotional exhaustion include negative perception. According to the PTG cognitive model developed by Tedeschi and Calhoun (2004), a traumatic experience will trigger an individual's negative perception to become a positive one (Tedeschi & Calhoun, 2004). Our findings suggest that PTG was related to depression and emotional exhaustion, situations that involve negative perceptions of oneself. Therefore, interventions targeting self-perceptions and negative cognitions could lower depression and foster PTG by helping nurses to transform their negative perceptions into positive ones, following Tedeschi and Calhoun's model. The PTG model developed by Schaefer and Moos (1992) emphasized that personal and environmental elements will determine the traumatic event, what happens afterward, the cognitive processes, and coping patterns (Schaefer & Moos, 1992). Likewise, the PTG model developed by Tedeschi and Calhoun (2004) predicts whether PTG will occur or not according to how the trauma is processed cognitively. Therefore, as has been determined throughout our study, depression and emotional exhaustion are variables that hinder PTG because they lead to negative cognitive assessment.

Again, as determined in this study, the positive role played by stress and personal accomplishment on PTG is consistent with the model developed by Tedeschi and Calhoun (2004). The personal accomplishment variable determined in the study is important for the 'successful coping stage' in the model. The model associated low levels of traumatic stress with the occurrence of PTG and stated that the PTG process did require some amount of stress, not necessarily as intense as the initial stage of trauma, and that stress kept cognitive processing active (Tedeschi & Calhoun, 2004). Kira et al. (2013) reported in their study that moderate

stress was predictive of PTG. As determined in this study as well, stress is a necessary element of PTG. These findings lend support to theoretical frameworks positing that effective management of professional stress and sustained personal accomplishment are fundamental to positive psychological adaptation (Schaefer & Moos, 1992; Tedeschi & Calhoun, 2004).

Limitation

This study has several important limitations. Primarily, the cross-sectional design prevents drawing causal inferences from the findings. The use of snowball sampling method may have introduced selection bias, and the findings are limited to the specific study population. Moreover, the reliance on participants' self-assessments and the relatively modest explained variance in our regression models suggest that other unmeasured variables might play important roles in understanding PTG. The timing of data collection (June 1–September 1, 2021) coincided with the period when protective equipment and vaccines were widely available to healthcare workers and the pandemic was more controllable. These conditions may have contributed to reduced stress levels and increased empowerment among nurses. Therefore, the results reflect the situation of a specific time period and may not be generalizable to other contexts of the pandemic. Furthermore, the study did not examine the post-traumatic growth process and its lasting effects in depth. Longitudinal and qualitative methods may be utilized in future studies to gain a deeper understanding of healthcare workers' long-term experiences.

Conclusion

The study found that post-traumatic growth was related to gender, education, stress, anxiety, depression, and burnout. Accordingly, post-traumatic growth reduces with depression and emotional exhaustion, and increases with stress and personal accomplishment. Considering that nurses with good mental health can provide high-quality and safe patient care, nurses' health must be safeguarded and improved.

Considering the effects of the COVID-19 pandemic that we have recently experienced on healthcare workers, preparing for potentially traumatic events that may occur in the future is important. In this context, various interventions have been made to support the maintenance of mental health of healthcare professionals during the period of the pandemic. The results obtained from these studies revealed that interventions aimed at strengthening the mental health of healthcare professionals were effective in significantly reducing stress, anxiety, depression and burnout (Dincer & Inangil, 2021; Weiner et al., 2020). At this point, organizing events at

regular intervals to increase the resilience of nurses and other healthcare workers on an institutional basis can be supported. In addition, policy makers should take a proactive approach in situations that affect the health of the whole society and make individual and institutional plans for the empowerment of healthcare workers.

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Clinical implication

The article emphasizes the critical need for ongoing mental health support for healthcare professionals, particularly nurses, to foster post-traumatic growth and reduce stress, anxiety, depression, and burnout. It highlights the importance of resilience-building programs and proactive policy development to safeguard nurses' mental health, which in turn enhances the quality of patient care. By prioritizing mental health resources and preparing for future crises, healthcare institutions can ensure that their workforce remains healthy and capable of providing effective, compassionate care.

Author contributions

Study design: AD, BD, EÖY, YÇ, BA, STK, GKY, MÖK, GA, FÖ, AT, TAS, AÖE, FSS, FÖÖ, AGY, ŞC, EY, FIE, SK, AÖB, DH, MK, NC, MEB

Data collection: AD, BD, EÖY, YÇ, BA, STK, GKY, MÖK, GA, FÖ, AT, TAS, AÖE, FSS, FÖÖ, AGY, ŞC, EY, FIE, SK, AÖB, DH, MK, NC, MEB

Data analysis: EÖY, TAS, AD, STK

Manuscript writing: AD, AT, BD, GA, FÖ, EÖY, YÇ, BA, STK, GKY, MÖK, TAS, AÖE, FSS, FÖÖ, AGY, ŞC, EY, FIE, SK, AÖB, DH, MK, NC, MEB

Author notes

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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