



Research article

Determinants of perceived stress in health professional students during the COVID-19 pandemic

Running title: Perceived stress in health professional students

Belgüzar Kara*

Department of Internal Medicine Nursing, Faculty of Gülhane Nursing, Health Sciences University, Retired Faculty Member, Ankara, Turkey

* **Correspondence:** Email: seherbelguzarkara@gmail.com.

Abstract: Objective: There is not enough information in the literature about perceived stress among health professional students during the COVID-19 pandemic. This study aimed to determine the level of perceived stress and its determinants in Turkish undergraduate health professional students during the pandemic. **Methods:** This cross-sectional, online survey study included 402 undergraduate health professional students. Data were collected using a personal information form, the Perceived Stress Scale (PSS), the Contentment with Life Assessment Scale, and the Ways of Coping Inventory. Descriptive statistics, Mann–Whitney U test, Student’s t-test, one-way analysis of variance, correlation coefficients, and linear regression analysis were used for data analysis. **Results:** The PSS mean score of the students was 32.95 ± 7.34 , and 98.2% reported moderate-to-high levels of stress. The significant determinants of stress were younger age (unstandardized $\beta = -0.23$, $p = 0.035$), poor self-rated health (unstandardized $\beta = 1.60$, $p = 0.005$), the presence of sleep problems (unstandardized $\beta = 1.22$, $p = 0.021$), the history of direct contact with suspected COVID-19 patients or infected materials (unstandardized $\beta = 5.82$, $p < 0.001$), following the news about the pandemic closely (unstandardized $\beta = 0.60$, $p = 0.041$), lower life satisfaction (unstandardized $\beta = -0.32$, $p < 0.001$), and lower use of optimistic coping (unstandardized $\beta = -3.24$, $p < 0.001$) but greater use of helpless coping (unstandardized $\beta = 3.31$, $p < 0.001$). The regression model explained 57.6% of the variance in perceived stress. **Conclusions:** The level of perceived stress was relatively high among health professional students. This study highlighted the need for psychological support to reduce the level of perceived stress in this population during the COVID-19 pandemic.

Keywords: coping; COVID-19; health professional students; life satisfaction; sleep; stress

Abbreviations: CI: Confident interval; CLAS: Contentment with Life Assessment Scale; COVID-19: Coronavirus disease 2019; PSS: Perceived Stress Scale; SRH: Self-rated health; WCI: Ways of Coping Inventory; WHO: World Health Organization

1. Introduction

The coronavirus disease 2019 (COVID-19) was declared as a pandemic by the World Health Organization (WHO) on March 11, 2020 [1]. The COVID-19 pandemic has caused severe disruptions in all sectors of society. As of 1 April 2020, a total of 172 countries across the world have temporarily closed all educational institutions to prevent the spread of the pandemic. These country-wide closures have affected nearly 1.5 billion learners or 84.3% of the world's total enrolled learners [2]. Globally, as of 13 May 2021, a total of 160 074 267 confirmed cases of COVID-19 and 3 325 260 deaths of the disease have been reported [3].

Turkey has been ranked among the top 10 countries with the highest number of COVID-19 cases in the world [3]. The first confirmed case of COVID-19 in Turkey was reported on March 11, 2020, and a state of emergency due to the pandemic was declared by the Republic of Turkey Ministry of Health [4]. All universities were closed for three weeks on March 16, and then, online education was delivered for the spring term of the 2019–2020 academic year. Distance education continued to be offered to all university students in the 2020–2021 academic year.

Nowadays, the COVID-19 pandemic has presented new and difficult challenges to both high-risk or vulnerable populations and caregivers [6]. The global pandemic has impacted not only the physical health but also the mental well-being of university students and placed an unprecedented mental health burden on them [7]. In this crisis period, the prevalence of moderate-to-high stress ranges from 11.5% and 85.0% among university students [8–14]. Health professional students are particularly vulnerable to stress and are more likely to be affected by the COVID-19 pandemic because of their training program, and academic pressure [10,15]. There is evidence in the literature that medical students, mainly including clinical medicine and clinical nursing, report higher levels of stress than non-medical students during the pandemic in China, which may negatively affect their attitude toward learning and professional medical career [14]. A longitudinal study from India demonstrated an increase in perceived stress levels of medical students compared to before the COVID-19 pandemic [12]. Similarly, in a study conducted in Australia, about two-thirds of medical students (68.0%) were found to experience a deterioration in mental well-being since the onset of the pandemic [15]. A cross-sectional study from Iran indicated that intern medicine and nursing students working with COVID-19 patients were more likely to have higher stress levels than medical staff and the general population. Interestingly, the researchers found that the students and patients with COVID-19 had similar levels of perceived stress [16].

Several factors contribute to perceived stress among university students during the COVID-19 pandemic, but the results of relevant studies are conflicting. Some studies have shown that perceived stress is influenced by factors such as age [8,17], gender [17,18], the field of study [13,14], financial status [10], family income, status of the intern student, psychological and emotional problems (e.g., depression, fear, anxiety, helplessness, loneliness, and insomnia) [14], sleep quality [8,12], body mass index [8], health status, life satisfaction and coping styles [11]. Moreover, COVID-19-related characteristics such as the level of familiarity to COVID-19 [14], perceived COVID-19 symptoms, obtaining food supply, exposure to COVID-19 news [10], COVID-19-related general apprehension,

direct interaction with COVID-19 patient, the presence of COVID-19 patients in family and friends [12], ability to focus on academic work, obtaining medications and hygiene supplies [18] and place of residence during the confinement period [9] were found to be associated with perceived stress. Other studies have also demonstrated that the level of stress in university students was not affected by age [10,14], gender [10,12,14], grade, major, and the time spent looking for information on the pandemic [18].

Although many studies are dealing with perceived stress among university students during this crisis period, only a few of them have specifically focused on health professional students [12,14–16]. However, it is important to assess the perceived stress of health professional students to ensure sufficient support for high-risk groups during the pandemic. As far as we know, there is no study investigating the determinants of perceived stress among Turkish health professional students in detail.

This study, therefore, aimed to determine the level of perceived stress and examine the role of sociodemographic and COVID-19-related characteristics, life satisfaction, and coping strategies as potential determinants of stress in a sample of Turkish undergraduate health professional students during the COVID-19 pandemic. In this study of health professional students, we first determined the level of perceived stress, with the expectation that age, university year, self-rated health (SRH), sleep duration, sleep problems, having relatives diagnosed with COVID-19, the history of contact with suspected/confirmed patients or infected materials in the past 14 days, and the frequency of following the news about the pandemic will be associated with perceived stress, but without specific hypotheses for sociodemographic/COVID-19-related characteristics due to limited past research. Consistent with a prior study [11], we hypothesized that students with lower life satisfaction would be more likely to perceive higher levels of stress. Based on previous literature on stress [11,14], we also hypothesized that lower use of optimistic coping but greater use of helpless coping would be associated with a higher level of stress. We next explored which of these characteristics was most associated with perceived stress, when accounting for specific variables. This study may help to provide insights into a better approach to promote mental health and well-being among health professional students during the COVID-19 pandemic.

2. Materials and methods

2.1. Study design, setting, and sample

This cross-sectional study was conducted in a convenience sample of health professional students attending a university in a large Turkish city. Sample selection was not preferred and all the medical and health sciences students wishing to participate in the study were included. Of the 787 eligible students, 402 agreed to participate (response rate: 51.1%) and completed the survey. Several factors may have affected the response rate, such as the timing of the study, the survey method (online survey, via email), survey length, as well as low interest or motivation of the participants to respond. There was no missing data for the variables in this study.

A priori sample size was calculated as 172 participants using the following parameters for the multiple regression analysis (G*Power, version 3.1.9.2; Düsseldorf University, Düsseldorf, Germany) [19]: a medium effect size ($f^2 = 0.15$), an alpha of 0.05, power of 80%, and the number of predictors of 25 [20]. We recruited a higher number of participants to account for possible dropouts.

2.2. Measures

Participants were asked to complete a questionnaire assessing sociodemographic/COVID-19-related characteristics, stress, life satisfaction, and coping at the time of data collection.

2.2.1. Participant characteristics

A personal information form was designed by the researcher after reviewing relevant literature [8–18] and taking expert advice. Furthermore, a pilot study was performed with 15 students to determine the suitability and feasibility of the form. The form was revised based on the results of the pilot study. These students were excluded from the final sample of the current study. The personal information form included 23 questions in two parts. The first part of the form dealt with demographic characteristics, such as age, gender, marital status, the field of study, university year, employment status, household income, place of residence, living arrangement, sleep duration per night, the presence of sleep problems, and the presence of chronic disease. Furthermore, SRH was assessed by a single question and dichotomized into good (good/very good) and poor (fair/bad/very bad). The second part also dealt with COVID-19-related characteristics, such as having been diagnosed with COVID-19, having relatives diagnosed with COVID-19, having relatives died of COVID-19, having been quarantined because of COVID-19, and the history of contact with suspected/confirmed COVID-19 patients or infected materials in the past 14 days. The participants also rated their frequency of following the news about the COVID-19 pandemic on a 5-point Likert scale ranging from 1 (never) to 5 (always).

2.2.2. Stress

The Turkish version of the Perceived Stress Scale (PSS) was used to measure the level of perceived stress during the past month [21]. The 10-item scale is rated on a 5-point Likert scale that ranged from 1 (never) to 5 (very often). The total PSS score is calculated by reverse scoring of the positive items. The total PSS score ranges from 10 to 50, with a higher score indicating greater perceived stress. The scale demonstrated acceptable internal consistency (Cronbach's alpha = 0.70) [21]. Cronbach's alpha coefficient for the scale was 0.88 in the current study.

2.2.3. Life satisfaction

The Turkish version of the Contentment with Life Assessment Scale (CLAS) was used to measure life satisfaction [22]. The CLAS consists of 5 items and each item is rated on a 7-point Likert scale (1 = Strongly disagree, 7 = Strongly agree). The scale score is calculated after reversing the scores on the negative items. The total score ranges from 5 to 35, and a higher score means a higher level of life satisfaction. Psychometric analysis of the CLAS showed good reliability (Cronbach's alpha = 0.73) [22]. In this study, Cronbach's alpha coefficient of the CLAS was 0.83.

2.2.4. Coping

The strategies used to cope with stress were assessed using the Turkish version of the Ways of Coping Inventory (WCI) [23]. The 30-item scale includes five subscales: helpless approach (8 items), self-confident approach (7 items), submissive approach (6 items), optimistic approach (5 items), and seeking of social support approach (4 items). It is a 4-point Likert scale ranging from 0 (does not apply and/or not used) to 3 (used a great deal). The overall score is not calculated, and the subscale scores are calculated by summing the items within the subscale. Higher subscale scores indicate more use of coping strategies. The internal consistency values for the WCI subscales ranged from 0.45 to 0.80 [23]. Cronbach's alpha coefficients for the subscales varied between 0.61 and 0.85 in the current study.

2.3. Data collection

Data were collected by using an online survey (Google Forms) sent by e-mail to all participants from May 4, 2020, to June 4, 2020, approximately two months after the closure of universities across the country due to the COVID-19 pandemic. The participants filled out the web-based questionnaire in about 10 minutes.

2.4. Ethical considerations

The study was approved by the Ministry of Health (Consent code: 2020-04-30T15_59_15.xml) and the Non-interventional Research Ethics Committee of the University (Decision number: 2020/02/01) and performed following the Declaration of Helsinki principles. The electronic consent forms were completed by all participants before answering the questionnaire. Participants were not asked to provide any identifying information, and their email addresses/personal information were not collected in this study, thus providing anonymity.

2.5. Data analysis

Statistical analyses were conducted using the SPSS for Windows statistical software (Version 21.0; SPSS Inc., Chicago, IL, USA). A p-value of <0.05 was considered statistically significant for all tests. Descriptive statistics were used for data analysis. The normal distribution of the data was evaluated with the one-sample Kolmogorov-Smirnov test. Statistical differences between continuous variables were analyzed by the Mann-Whitney U test, the Student's t-test, or the one-way analysis of variance, followed by Tukey's post-hoc test. The relationships between the variables were evaluated by Spearman's rank correlation coefficient and Pearson's correlation coefficient.

Multivariate linear regression analysis with backward elimination was conducted to determine the factors associated with perceived stress. The categorical variables in the multiple regression model were university year, SRH, the presence of sleep problems, sleep duration, having relatives diagnosed with COVID-19, having relatives died of COVID-19, having been quarantined because of COVID-19, the history of close or indirect contact with someone who is confirmed of having COVID-19 and the history of direct contact with someone who is suspected of having COVID-19 or infected materials, while the continuous variables were age, the frequency of following the news

about the pandemic, the CLAS score, and the WCS subscale scores. Firstly, categorical variables were converted into binary dummy variables. We transformed each response category into a binary dummy variable (e.g., “1 = Yes”, “0 = No” for sleep problems, “1 = Poor” “0 = Good” for SRH, and “1 = Yes”, “0 = No” for the history of contact). Sleep duration was measured by using a variable with 3 categories (“1 = ≤ 6 hours”, “2 = 7–8 hours”, “3 = ≥ 9 hours”). Sleeping 9 hours or more per night was selected as a reference category, and other categories remained to act as dummy variables in the multivariate regression analysis. Hence, we created two dummy variables for sleep duration. The normality of the residuals was confirmed using Q-Q plots. Multicollinearity was investigated by computing tolerance (<0.20) and variance inflation factor values (>10) for each predictor in the regression model [24]. The lowest tolerance value in the model was 0.63 and the highest variance inflation factor value was 1.58, suggesting that multicollinearity was not present in this study. A post-hoc power analysis was performed by setting the effect size $f^2 = 0.15$, alpha error probability = 0.05, total sample size = 402, and the number of predictors = 8 (G*Power, version 3.1.9.2; Düsseldorf University, Düsseldorf, Germany) [19]. The power of the study was 1.00 and sufficient for the multiple regression analysis.

3. Results

3.1. Participant characteristics

Tables 1, 2, and 3 show the sociodemographic and COVID-19-related characteristics of the study sample. The mean age of the students was 21.29 ± 2.29 years (range = 18–39). Most of the students were female (74.6%), unmarried (99.0%), not working (96.5%), and were staying with their families (94.0%). Of our sample, 12.7% reported sleeping less than 7 hours per night, and 42.0% had sleep problems. The majority of the students (73.1%) rated their health as good (Table 1).

Table 1. Descriptions of sociodemographic characteristics of the study sample and comparison of the Perceived Stress Scale scores by these characteristics (N = 402).

Variables	n (%)	PSS		
		M (SD)	t ^a , z ^b or F ^c	p
Gender				
Female	300 (74.6)	33.10 (7.45)	t = 0.73	0.466
Male	102 (25.4)	32.50 (7.01)		
Marital status				
Married	4 (1.0)	28.50 (5.20)	z = -1.31	0.190
Unmarried	398 (99.0)	32.99 (7.35)		
Field of study				
Medicine	141 (35.1)	32.60 (7.76)	F = 0.56	0.690
Nursing	87 (21.6)	32.55 (6.68)		
Physical medicine and rehabilitation	77 (19.2)	33.92 (7.18)		
Nutrition and dietetics	65 (16.2)	32.74 (7.43)		
Health management	32 (8.0)	33.63 (7.49)		

Continued on next page

Variables	n (%)	PSS		
		M (SD)	t ^a , z ^b or F ^c	p
University year				
1st year	155 (38.6)	32.90 (7.25)	F = 4.43	0.002
2nd year	94 (23.4)	33.37 (7.21)		
3rd year	83 (20.6)	34.95 (7.24)		
4th year	45 (11.2)	29.93 (6.85)		
5th year	25 (6.2)	30.40 (7.56)		
Employment status				
Working	14 (3.5)	31.79 (5.42)	z = -0.78	0.435
Not working	388 (96.5)	32.99 (7.40)		
Place of residence				
Urban area	379 (94.3)	32.82 (7.34)	t = -1.48	0.150
Rural area	23 (5.7)	35.09 (7.12)		
Income level of family				
Income higher than expenses	97 (24.1)	32.33 (7.16)	F = 2.78	0.063
Income equal to expenses	227 (56.5)	32.61 (7.21)		
Income less than expenses	78 (19.4)	34.68 (7.75)		
Living arrangement				
Living with family	378 (94.0)	33.03 (7.30)	t = 0.90	0.375
Living alone	24 (6.0)	31.54 (7.88)		
Sleep duration per night				
≤ 6 hours	51 (12.7)	35.96 (7.18)	F = 6.47	0.002
7–8 hours	193 (48.0)	31.92 (7.14)		
≥ 9 hours	158 (39.3)	33.22 (7.38)		
Sleep problems				
Present	169 (42.0)	35.80 (7.46)	t = 6.88	< 0.001
Absent	233 (58.0)	30.88 (6.52)		
Chronic disease				
Present	56 (13.9)	34.09 (7.07)	t = 1.30	0.198
Absent	346 (86.1)	32.76 (7.37)		
Self-rated health				
Good	294 (73.1)	31.71 (7.00)	t = -5.71	< 0.001
Poor	108 (26.9)	36.31 (7.20)		

Note: ^a Student's t-test was used to calculate p values. ^b Mann-Whitney U test was used to calculate p values. ^c One-way analysis of variance with the Tukey post-hoc test was used to calculate p values.

As shown in Table 2, 13 students (3.2%) were admitted to the hospital because of suspicion of COVID-19, and 12 (3.0%) were tested for COVID-19. A total of three students (0.7%) were confirmed to be infected by COVID-19, and the COVID-19 test results of four students (1.0%) were unclear. About 14.0% of the students had relatives diagnosed with COVID-19, 4.5% had relatives

who died of COVID-19, and 38.1% were quarantined because of potential exposure. In the prior two weeks, five students (1.2%) had close contact with a confirmed patient of COVID-19, and 14 students (3.5%) had indirect contact with confirmed patients. Eleven students (2.7%) had direct contact with suspected COVID-19 patients or infected materials in the past 14 days. The frequency of following the news on the COVID-19 pandemic was reported as “always” (30.6%, $n = 123$), “often” (47.3%, $n = 190$), “sometimes” (17.4%, $n = 70$), “seldom” (4.2%, $n = 17$), and “never” (0.5%, $n = 2$). As seen in Table 3, the mean frequency of following the news about the COVID-19 pandemic of the participants was 4.03 ± 0.83 (range = 1–5).

Table 2. Descriptions of COVID-19-related characteristics of the study sample and comparison of the Perceived Stress Scale scores by these characteristics (N = 402).

Variables	n (%)	PSS		
		M (SD)	z^a or t^b	p
Have you been admitted to the hospital because of suspicion of COVID-19?				
Yes	13 (3.2)	34.85 (5.91)	$z = -0.87$	0.383
No	389 (96.8)	32.88 (7.38)		
Have you taken a test because of suspicion of COVID-19?				
Yes	12 (3.0)	35.33 (5.90)	$z = -1.12$	0.264
No	390 (97.0)	32.87 (7.37)		
Have you been diagnosed with COVID-19?				
Yes / The test was not finalized yet.	7 (1.7)	30.14 (7.69)	$z = -1.35$	0.177
No	395 (98.3)	32.99 (7.33)		
Do you have any relatives diagnosed with COVID-19?				
Yes	56 (13.9)	35.98 (7.96)	$t = 3.12$	0.003
No	346 (86.1)	32.45 (7.12)		
Do you have any relatives who died of COVID-19?				
Yes	18 (4.5)	37.89 (7.76)	$z = -2.52$	0.012
No	384 (95.5)	32.71 (7.24)		
Have you been quarantined because of COVID-19?				
Yes	153 (38.1)	34.35 (7.53)	$t = 3.00$	0.003
No	249 (61.9)	32.08 (7.09)		
Have you had close contact with anyone who had a positive COVID-19 diagnostic test in the past 14 days?				
Yes	5 (1.2)	40.20 (4.27)	$z = -2.41$	0.016
No	397 (98.8)	32.85 (7.32)		
Have you had indirect contact with anyone who had a positive COVID-19 diagnostic test in the past 14 days?				
Yes	14 (3.5)	36.50 (6.62)	$z = -2.02$	0.044
No	388 (96.5)	32.82 (7.34)		
Have you had direct contact with anyone who is suspected of having COVID-19 or infected materials in the past 14 days?				
Yes	11 (2.7)	39.09 (5.09)	$z = -2.97$	0.003
No	391 (97.3)	32.77 (7.32)		

Note: ^a Mann-Whitney U test was used to calculate p values. ^b Student's t-test was used to calculate p values.

3.2. Perceived stress, life satisfaction, and coping strategies

The PSS mean score of the students was 32.95 ± 7.34 (range = 13–50), which is higher than the moderate level of perceived stress (midpoint of the scale: 30). The total PSS scores were categorized into three levels, including mild (1–17), moderate (18–33), and high (34–50). The findings of the study revealed that 1.8% of the students ($n = 7$) had a mild level of stress, 53.2% ($n = 214$) had a moderate level of stress, and 45.0% ($n = 181$) had a high level of stress.

The descriptive statistics of the CLAS and the WCI scores are seen in Table 3. The CLAS mean score of the participants was 19.65 ± 6.87 (range = 5–35). The WCI subscale scores were summed and divided by the total number of items in each subscale to obtain an item mean score. The self-confident approach had the highest mean subscale score (1.94 ± 0.56), followed by the optimistic approach (1.73 ± 0.60), the seeking of social support approach (1.72 ± 0.59), and the helpless approach (1.54 ± 0.62), while the submissive approach had the lowest mean subscale score (1.13 ± 0.50).

Table 3. Means, standard deviations, ranges, medians, and comparison of the Perceived Stress Scale scores by various parameters (N = 402).

Variables	M (SD)	Range	Median	PSS	
				r ^a	p
Age (years)	21.29 (2.29)	18–39	21.00	–0.13	0.010
Frequency of following the news about COVID-19	4.03 (0.83)	1–5	4.00	0.10	0.046
CLAS	19.65 (6.87)	5–35	20.00	–0.62	< 0.001
WCI					
Self-confident approach	1.94 (0.56)	0–3	2.00	–0.47	< 0.001
Optimistic approach	1.73 (0.60)	0–3	1.80	–0.56	< 0.001
Seeking of social support	1.72 (0.59)	0–3	1.75	–0.27	< 0.001
Helpless approach	1.54 (0.62)	0–3	1.50	0.58	< 0.001
Submissive approach	1.13 (0.50)	0–3	1.17	0.17	< 0.001

Note: CLAS: Contentment with Life Assessment Scale; WCI: Ways of Coping Inventory. ^a Pearson's correlation coefficient was used to calculate p values, except for the frequency of following the news about COVID-19 (Spearman's correlation coefficient, r).

3.3. Comparison of perceived stress by participant characteristics, life satisfaction, and coping strategies

As shown in Tables 1 and 2, the Mann-Whitney U test, the Student's t-test, and the one-way analysis of variance were used to compare differences in the PSS scores by characteristics of the participants. We found a statistically significant difference in the mean scores according to university year ($F = 4.43$, $p = 0.002$). A Tukey post-hoc test revealed significant pairwise differences between third-year and fourth-year, with an average difference of 5.02 score ($p = 0.002$) and between third-year and fifth-year, with an average difference of 4.55 score ($p = 0.047$). The PSS score of third-year students was higher than that of fourth-year (95% confidence interval [CI: 1.36, 8.68]), and fifth-year

students (95% CI [0.04, 9.06]). There was also a significant difference between the PSS scores of the students by sleep duration ($F = 6.47$, $p = 0.002$). The PSS score of students who reported sleeping less than 7 hours per night was found to be significantly higher than that of students who reported sleeping 7 to 8 hours (95% CI [1.36, 6.72], $p = 0.001$). The PSS scores were higher in the students who had sleep problems ($t = 6.88$, $p < 0.001$), and those with poor SRH ($t = -5.71$, $p < 0.001$).

As shown in Table 2, the results of the analysis indicated that the PSS scores were higher in the students who had relatives diagnosed with COVID-19 ($z = -2.52$, $p = 0.012$), those whose relatives died of COVID-19 ($t = 2.77$, $p = 0.012$), those who had been quarantined because of COVID-19 ($t = 3.00$, $p = 0.003$), those who had close contact with confirmed COVID-19 patients ($z = -2.41$, $p = 0.016$), those who had indirect contact with confirmed COVID-19 patients ($z = -2.02$, $p = 0.044$) and the students who had direct contact with suspected COVID-19 patients or infected materials in the past 14 days ($z = -2.97$, $p = 0.003$).

As seen in Table 3, Pearson's correlation coefficients demonstrated significant negative correlations between the PSS score and age ($r = -0.13$, $p = 0.010$), the CLAS score ($r = -0.62$, $p < 0.001$), the self-confident approach ($r = -0.47$, $p < 0.001$), the optimistic approach ($r = -0.56$, $p < 0.001$), and the seeking of social support approach scores ($r = -0.27$, $p < 0.001$), as well as positive correlations the helpless approach ($r = 0.58$, $p < 0.001$) and the submissive approach scores ($r = 0.17$, $p < 0.001$). Spearman's correlation coefficient revealed that the PSS score was positively correlated with the frequency of following the news about the COVID-19 pandemic ($r = 0.10$, $p = 0.046$).

3.4. Determinants of perceived stress

Multivariate linear regression analysis with backward elimination was used to assess the associations between perceived stress and independent variables. As shown in Table 4, the final regression model indicated that the associated factors with perceived stress were age (unstandardized $\beta = -0.23$, 95% CI [-0.44, -0.02], $p = 0.035$), SRH (unstandardized $\beta = 1.60$, 95% CI [0.48, 2.73], $p = 0.005$), the presence of sleep problems (unstandardized $\beta = 1.22$, 95% CI [0.19, 2.24], $p = 0.021$), the history of direct contact with suspected COVID-19 patients or infected materials in the past 14 days (unstandardized $\beta = 5.82$, 95% CI [2.86, 8.77], $p < 0.001$), the frequency of following the news about the COVID-19 pandemic (unstandardized $\beta = 0.60$, 95% CI [0.03, 1.17], $p = 0.041$), the CLAS score (unstandardized $\beta = -0.32$, 95% CI [-0.40, -0.23], $p < 0.001$), and the WCI subscale scores, including the optimistic approach (unstandardized $\beta = -3.24$, 95% CI [-4.17, -2.31], $p < 0.001$), and the helpless approach (unstandardized $\beta = 3.31$, 95% CI [2.39, 4.23], $p < 0.001$), after controlling for specific variables. The final regression model explained 57.6% of the variance in perceived stress ($R^2 = 0.576$).

Table 4. Effects of various variables on perceived stress of health professional students based on multivariate linear regression analysis (N = 402).

Variables ^a	β	SE	95% CI	p
Younger age	-0.23	0.11	(-0.44, -0.02)	0.035
Poor self-rated health	1.60	0.57	(0.48, 2.73)	0.005
Presence of sleep problems	1.22	0.52	(0.19, 2.24)	0.021
History of direct contact with suspected COVID-19 patients or infected materials	5.82	1.50	(2.86, 8.77)	< 0.001
Following the news about the pandemic closely	0.60	0.29	(0.03, 1.17)	0.041
Lower living satisfaction	-0.32	0.04	(-0.40, -0.23)	< 0.001
Lower optimistic coping	-3.24	0.47	(-4.17, -2.31)	< 0.001
Higher helpless coping	3.31	0.47	(2.39, 4.23)	< 0.001

Note: SE: Standard Error; CI: Confidence Interval. ^a Includes only the final model as determined by the multivariate linear regression analysis with backward elimination.

4. Discussion

To the best of our knowledge, this study is the first to comprehensively assess the determinants of perceived stress among Turkish health professional students during the COVID-19 pandemic. An important finding of this study is that nearly all of the students have moderate-to-high levels of perceived stress. Another notable finding is that significant determinants of perceived stress are age, SRH, sleep problems, personal history of contact, the frequency of following the news, life satisfaction, and coping strategies.

Our results show that, overall, 98.2% of students reported moderate (53.2%) to high levels (45.0%) of perceived stress. We believe that our findings are very interesting at this point. This may be due to several reasons, such as the fear of not meeting their expectations about academic, occupational, social, and economic because of the pandemic, the fear of potential exposure to patients with COVID-19, infecting others, or getting infected by the COVID-19, being quarantined, self-isolation, and uncertainty about returning to normal [15,16,25]. We also performed the study during the period when all examinations were postponed by the university due to the pandemic, which may have been a negative effect on the psychological status of our sample. Similar results were recently found in health professional students in Iran (99.5%, moderate-to-extremely severe stress) [16] and China (48.7%, high stress) [14] during the COVID-19 pandemic. In contrast, a study conducted in Indian obtained a very low percentage of medical students with moderate-to-extremely severe stress (11.5%) [12]. Some studies have also shown that the majority of university students (61.6–85.0%) during the pandemic had moderate-to-high levels of perceived stress [8,9,11], whereas others have indicated much lower percentages (20.98–28.14%) [10,13]. Many factors, including the characteristics of the participants, the methodology of the study (study design, the timing of the study, the survey measurement tool, etc.), sample size, and settings may also have contributed to the observed differences related to stress. Further research is required to determine the causes of the perceived stress.

In this study, younger students were more likely to have higher stress. The available evidence suggests age-related differences in the level of perceived stress. This may be particularly relevant in

developmental reasons and experiences. A longitudinal study reported that, with increasing age, there is a change in the characteristic of stress from episodic to chronic, which in turn affects the appraisal of stress and coping strategies [26]. Our finding supports the results of previous studies revealing that the psychological impact of the COVID-19 pandemic decreased with increasing age among university students [8,17,27] and the general population [25,28]. In contrast, other studies conducted during the pandemic did not find any such relationship between age and mental health problems in health professional students [14], other university students [10,29], and the general population [30]. Further research is required to elucidate these findings.

Supporting our expectations, the students with poor SRH tended to perceive higher stress. Similar to our findings, a China study demonstrated that keeping good health was related to perceived stress in health professional students [14]. Furthermore, a study from Poland indicated that university students with bad health perceptions during the COVID-19 pandemic had higher levels of perceived stress [11]. Recent studies showed that poor SRH was associated with a greater psychological impact of the pandemic and higher levels of stress in the general population in China [30], Australia [31], and Austria [32]. It may be possible that many psychobiological pathways play role in the inverse association between stress and SRH [33].

The students with sleep problems in the present study were more likely to have higher stress. This result is congruent with Ye et al.'s [14] study, reporting that the prevalence of insomnia is higher in health professional students with high levels of stress during the COVID-19 pandemic. Our finding is also supported by studies highlighting the relationship between stress and sleep quality among university students [8,12]. Tang et al. [29] have shown that short sleep duration was a risk factor for psychological distress in university students. This may be attributable to the fact that there is a dynamic, complex, and dysbiotic relationship between stress and sleep, in which exposure to major life stress impairs normal sleep function, resulting in difficulty falling and staying asleep, and that, in turn, can lead to further stress in daily life. Myriad factors such as event appraisal, stressor chronicity, coping strategies used, the cognitive, emotional, and psychological status of individuals may also impact the risk of and severity of sleep disturbance following a stressor [34,35]. Further research is required to determine the causes of this association.

We found that the students who had direct contact with suspected COVID-19 patients or infected materials in the past 14 days were more likely to perceive higher stress. In line with our results, Traummüller et al. [32] reported that the history of contact with a person with suspected infection and potentially infectious material was associated with higher stress in the general population. Conversely, Wang et al. [30] found that the history of contact with a suspected COVID-19 patient or infected materials in the general population was associated with anxiety, but not stress. Further study is needed to explore the reasons for this finding.

The students who followed the news about the COVID-19 pandemic very closely tended to perceive higher stress. Information related to COVID-19 in media has been spread more quickly and widely than other pandemics, which may exacerbate stress and panic in society [36]. Higher levels of stress may also lead to an increase in the frequency of following the news to get more information on the pandemic [32]. According to the WHO, one of the challenges facing society is the overabundance of information related to COVID-19, which some of that may be false and detrimental [37]. It is, therefore, very important to get information from trusted sources. Our finding is consistent with other studies suggesting that both medical and non-medical students [10,38], as well as the general population [32,39], have experienced higher levels of the psychological impact of

the pandemic and psychological distress (anxiety, stress, and depression) with increasing time of exposure to information about COVID-19. In contrast, Kecowich et al. [18] reported that the time spent looking for information about the pandemic did not affect perceived stress in university students. Further research is needed to explore this difference in perceptions.

The results showed that our hypotheses were supported. We found that low life satisfaction was associated with greater levels of stress in students. The students who used higher levels of helpless coping behaviors had greater levels of perceived stress, while the optimistic coping strategy was protective against stressors. Generally, optimists are better able to cope with stress since they can adjust their coping strategies depending on the controllability of the stressor [40]. Our results support the study of Saleh et al. [41], who found that life satisfaction and optimism were predictors of stress among French college students. A study from Israel noted that optimism decreased psychological distress among young people during the COVID-19 pandemic [42]. A Chinese study demonstrated that helplessness was more common among health professional students with high levels of stress during this crisis period [14]. A recent study conducted on Polish university students also showed negative relationships between perceived stress and life satisfaction and task-oriented coping style (cognitive restructuring and problem-solving attempts, etc.), as well as positive relationships with emotion- and avoidance-oriented coping styles [11]. It is, therefore, required to determine the coping strategies used by students.

The results of this study should be interpreted in light of potential limitations, such as its cross-sectional design, precluding the establishment of causal or temporal relationships between the study variables, the use of a convenience sample, which may not represent all Turkish health professional students and the use of self-reported data that could be subject to recall bias. Therefore, the results of this study cannot be generalized to the entire population.

5. Conclusions

The results of this study indicated that stress is a prevalent and serious problem among Turkish undergraduate health professional students during the COVID-19 pandemic. Younger students, those with poor SRH and sleep problems, those who had direct contact with suspected COVID-19 patients or infected materials, those who followed the news about the pandemic frequently, those with lower life satisfaction, and students who used lower levels of optimistic coping but greater levels of helpless coping were more likely to have higher stress. Evaluation and management of stress in this population should, therefore, be integral components of the student-centered support approaches. Psychological support programs should be designed to reduce perceived stress related to the COVID-19 pandemic and encourage effective coping strategies. A better understanding of perceived stress and its determinants could contribute to design more effective interventions that improve mental health and well-being in this population. Longitudinal studies are necessary to confirm our results and to explain the causal mechanisms behind outcomes.

Acknowledgments

The author thanks all the students for their participation in the study.

Funding

The author has not received any grant support or other funding.

Conflict of interest

The author declares no conflicts of interest.

References

1. World Health Organization: Rolling updates on Coronavirus disease (COVID-19), 2020. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>
2. United Nations Educational, Scientific and Cultural Organization: COVID-19 impact on education, 2020. Available from: <https://en.unesco.org/covid19/educationresponse>
3. World Health Organization: WHO Coronavirus disease (COVID-19) dashboard, 2021. Available from: <https://www.who.int>
4. Ministry of Health Project Management Support Unit: COVID-19 Emergency Health Project, 2020. Available from: <https://pydb.saglik.gov.tr/EN,68690/covid-19-emergency-health-project.html>
5. Higher Education Information Management System: Number of Students by Education Level (2019-2020), 2020. Available from: <https://istatistik.yok.gov.tr/> (in Turkish)
6. Chew QH, Wei KC, Vasoo S, et al. (2020) Narrative synthesis of psychological and coping responses towards emerging infectious disease outbreaks in the general population: practical considerations for the COVID-19 pandemic. *Singapore Med J* 61: 350–356.
7. Grubic N, Badovinac S, Johri AM (2020) Student mental health in the midst of the Covid-19 pandemic: a call for further research and immediate solutions. *Int J Soc Psychiatry* 66: 517–518.
8. Du C, Zan MCH, Cho MJ, et al. (2020) Increased resilience weakens the relationship between perceived stress and anxiety on sleep quality: a moderated mediation analysis of higher education students from 7 countries. *Clocks Sleep* 2: 334–353.
9. Husky MM, Kovess-Masfety V, Swendsen JD (2020) Stress and anxiety among university students in France during COVID-19 mandatory confinement. *Compr Psychiatry* 102: 152191.
10. Khan AH, Sultana MS, Hossain S, et al. (2020) The impact of COVID-19 pandemic on mental health & wellbeing among home-quarantined Bangladeshi students: a cross-sectional pilot study. *J Affect Disord* 277: 121–128.
11. Rogowska AM, Kuśnierz C, Bokszczanin A (2020) Examining anxiety, life satisfaction, general health, stress and coping styles during COVID-19 pandemic in Polish sample of university students. *Psychol Res Behav Manag* 13: 797–811.
12. Saraswathi I, Saikarthik J, Kumar KS, et al. (2020) Impact of COVID-19 outbreak on the mental health status of undergraduate medical students in a COVID-19 treating medical college: a prospective longitudinal study. *Peer J* 8: e10164.
13. Odriozola-González P, Planchuelo-Gómez Á, Iruña MJ, et al. (2020) Psychological effects of the COVID-19 outbreak and lockdown among students and workers of a Spanish university. *Psychiatry Res* 290: 113108.

14. Ye W, Ye X, Liu Y, et al. (2020) Effect of the novel coronavirus pneumonia pandemic on medical students' psychological stress and its influencing factors. *Front Psychol* 11: 548506.
15. Lyons Z, Wilcox H, Leung L, et al. (2020) COVID-19 and the mental well-being of Australian medical students: Impact, concerns and coping strategies used. *Australas Psychiatry* 28: 649–652.
16. Vahedian-Azimi A, Moayed MS, Rahimibashar F, et al. (2020) Comparison of the severity of psychological distress among four groups of an Iranian population regarding COVID-19 pandemic. *BMC Psychiatry* 20: 402.
17. Debowska A, Horeczy B, Boduszek D, et al. (2020) A repeated cross-sectional survey assessing university students' stress, depression, anxiety, and suicidality in the early stages of the COVID-19 pandemic in Poland. *Psychol Med*, 1–4.
18. Kecojevic A, Basch CH, Sullivan M, et al. (2020) The impact of the COVID-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study. *PLoS One* 15: e0239696.
19. Faul F, Erdfelder E, Lang AG, et al. (2007) G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods* 39: 175–191.
20. Cohen J, Cohen P, West SG, et al. (2013) *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. Mahwah, NJ: Lawrence Erlbaum Associates.
21. Erci B (2006) Reliability and validity of the Turkish version of the Perceived Stress Scale. *J Atatürk Univ Sch Nurs* 9: 58–63. (in Turkish)
22. Akın A, Yalnız A (2015) Turkish version of Contentment with Life Assessment Scale (CLAS): the study of validity and reliability. *Electron J Soc Sci* 14: 95–102. (in Turkish)
23. Şahin NH, Durak A (1995) A Brief Coping Styles Inventory for university students. *Turkish J Psychol* 10: 56–73. (in Turkish)
24. Kara B (2018) Health beliefs related to salt-restricted diet and associated factors in Turkish patients on hemodialysis. *J Transcult Nurs* 29: 155–164.
25. Nwachukwu I, Nkire N, Shalaby R, et al. (2020) COVID-19 pandemic: Age-related differences in measures of stress, anxiety and depression in Canada. *Int J Environ Res Public Health* 17: 6366.
26. Aldwin CM, Sutton KJ, Chiara G, et al. (1996) Age differences in stress, coping, and appraisal: Findings from the normative aging study. *J Gerontol B Psychol Sci Soc Sci* 51: P179–188.
27. Al-Tammemi AB, Akour A, Alfalah L (2020) Is it just about physical health? An online cross-sectional study exploring the psychological distress among university students in Jordan in the midst of COVID-19 pandemic. *Front Psychol* 11: 562213.
28. Ozamiz-Etxebarria N, Dosil-Santamaria M, Picaza-Gorrochategui M, et al. (2020) Stress, anxiety, and depression levels in the initial stage of the COVID-19 outbreak in a population sample in the northern Spain. *Cad Saúde Pública* 36: e00054020.
29. Tang W, Hu T, Hu B, et al. (2020) Prevalence and correlates of PTSD and depressive symptoms one month after the outbreak of the COVID-19 epidemic in a sample of home-quarantined Chinese university students. *J Affect Disord* 274: 1–7.
30. Wang C, Pan R, Wan X, et al. (2020) Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health* 17: 1729.

31. Newby JM, O'Moore K, Tang S, et al. (2020) Acute mental health responses during the COVID-19 pandemic in Australia. *PLoS One* 15: e0236562.
32. Traummüller C, Stefitz R, Gaisbachgrabner K, et al. (2020) Psychological correlates of COVID-19 pandemic in the Austrian population. *BMC Public Health* 20: 1395.
33. Halford C, Anderzén I, Arnetz B (2003) Endocrine measures of stress and self-rated health. *J Psychosom Res* 55: 317–320.
34. Kalmbach DA, Anderson JR, Drake CL (2018) The impact of stress on sleep: Pathogenic sleep reactivity as a vulnerability to insomnia and circadian disorders. *J Sleep Res* 27: e12710.
35. Pillai V, Roth T, Mullins HM, et al. (2014) Moderators and mediators of the relationship between stress and insomnia: Stressor chronicity, cognitive intrusion, and coping. *Sleep* 37: 1199–1208.
36. Temsah MH, Al-Sohime F, Alamro N, et al. (2020) The psychological impact of COVID-19 pandemic on health care workers in a MERS-CoV endemic country. *J Infect Public Health* 13: 877–882.
37. World Health Organization: How to report misinformation online?, 2021. Available from: https://www.who.int/campaigns/connecting-the-world-to-combat-coronavirus/how-to-report-misinformation-online?gclid=CjwKCAiAtej9BRAvEiwA0UAWXkgWSdcVZAg6j0_HEo6iZfFKXwqxhQldowVCTpT8uSzdR8KWay8a3xoCqywQAvD_BwE
38. Xie L, Luo H, Li M, et al. (2020) The immediate psychological effects of Coronavirus disease 2019 on medical and non-medical students in China. *Int J Public Health* 65: 1445–1453.
39. Gao J, Zheng P, Jia Y, et al. (2020) Mental health problems and social media exposure during COVID-19 outbreak. *PLoS One* 15: e0231924.
40. Nes LS, Segerstrom SC (2006) Dispositional optimism and coping: a meta-analytic review. *Pers Soc Psychol Rev* 10: 235–251.
41. Saleh D, Camart N, Romo L (2017) Predictors of stress in college students. *Front Psychol* 8: 19.
42. Achdut N, Refaeli T (2020) Unemployment and psychological distress among young people during the COVID-19 pandemic: psychological resources and risk factors. *Int J Environ Res Public Health* 17: 7163.



AIMS Press

© 2021 the Author(s), licensee AIMS Press. This is an open access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>)