

Predictors of nursing students' stress, anxiety, and depression during the COVID-19 pandemic in a Hispanic-serving University in South Texas: a cross-sectional study

Maria I. Diaz¹, Eleftherios Gkioulekas², and Nancy Nadeau¹

¹School of Nursing, University of Texas Rio Grande Valley, Edinburg TX 78539, USA

²School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, Edinburg TX 78539, USA

Abstract

Background: In nursing education, there have been several studies on the impact of the COVID-19 pandemic on the ability of nursing students to cope while in nursing school. **Purpose Statement:** The goal of this study is to assess undergraduate nursing students' support mechanisms as predictors of stress, anxiety, and depression during the COVID-19 pandemic within a Hispanic-serving institution in South Texas. **Methods:** A cross-sectional design was used in this study. An online survey using self-reported questionnaires was used to gather data from an undergraduate nursing student cohort during the Fall 2021 semester. Linear regression was used to identify the predictors of student mental health. **Results:** Higher resilience and spiritual well-being were associated with reduced perceived stress, anxiety, and depression. Higher family functioning was associated with reduced perceived stress, and student employment as a salaried worker in a healthcare facility was associated with reduced depression. Finally, recovering from a symptomatic COVID-19 infection was associated with increased perceived stress. **Conclusions:** The COVID-19 pandemic had a detrimental effect on nursing students' mental health, exacerbated by the transition to virtual learning. Fostering resilience and spiritual well-being in addition to targeted faculty support to nursing students that recovered from COVID-19 may promote improved mental health in a pandemic context, for nursing students immersed in the predominantly Hispanic-American culture of South Texas.

Keywords: COVID-19; nursing education; anxiety; stress; depression; coping mechanism; resilience; spiritual well-being; family functioning

Introduction

The World Health Organization (WHO) declared COVID-19 a pandemic on 11 March 2020 (World Health Organization, 2020). Due to the international spread of the disease and high mortality rate (Epidemiology Group of Emergency Response Mechanism of New Coronavirus Pneumonia,

Corresponding author: Eleftherios Gkioulekas, School of Mathematical and Statistical Sciences, University of Texas Rio Grande Valley, 1201 West University Drive, Edinburg, TX 78539-2909.
Email: eleftherios.gkioulekas@utrgv.edu

Chinese Center for Disease Control and Prevention, 2020; Onder, Rezza, & Brusaferro, 2020; Verity et al., 2020), many countries implemented strict quarantine measures. More than 1.6 billion students and youth at all levels were affected globally by school and university closures (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2020). These unprecedented pandemic response measures also had an overwhelming adverse impact on the ability of students to cope during their studies, resulting in increased levels of stress, anxiety, and depression (Elmer, Mepham, & Stadtfeld, 2020; Wang et al., 2020; Wang & Zhao, 2020).

The focus of this study is to understand the determinant factors of poor mental health for undergraduate nursing students during this pandemic context. Several measures of support mechanisms and a wide range of demographic characteristics were investigated as possible contributing factors towards increased or decreased stress, anxiety, and depression among nursing students in a Hispanic-serving institution located in South Texas, during the mid-phase of the COVID-19 pandemic, at the end of Year 2021. In light of the escalating shortage of nurses, which was already a concern prior to the onset of the COVID-19 pandemic (Marc, Bartosiewicz, Burzynska, Chmiel, & Januszewicz, 2019), continuing the successful training of student nurses, even under the unprecedented conditions of the worldwide pandemic, is of the outmost importance. The goal of this study is to gain insights that can be used to guide strategies for further supporting nursing students, in the event that the world is confronted with another similar pandemic event. In particular, the study's findings were used as a guide for proposing broad strategies for curricular revisions, provision of student support resources, and targeted faculty support that could have helped to mitigate the challenges confronted by nursing students during the COVID-19 pandemic.

Literature review

The COVID-19 pandemic and the pandemic response measures had a particularly profound impact on the mental health of nursing students. At the onset of the pandemic, some college students were concerned about academic delays preventing them from completing their education, economic stressors, and adverse effects of the pandemic response on their daily life (Cao et al., 2020). Indeed, some researchers reported that nursing students' stress was also associated with on-line learning during the pandemic, due to heavy academic workloads, workload assignments, ineffective distance learning strategies and a lack of resources as well as environmental distractions (Masha'al, Rababa, & Shahrour, 2020). However, as was noted by Dewart, Corcoran, Thirsk, and Petrovic (2020), nursing students were not only impacted by the transition to online learning but, more importantly, the cancellation of clinical practicums for a period of time. The limited availability of clinical placement and the lack of access to on-campus resources in some programs resulted in incomplete coursework, an inability for some student nurses to progress in the nursing program, and to graduate in a timely manner. When nursing students were able to attend clinical practicums again, they were afraid of getting infected with the SARS-COV-2 virus and endangering their own health and the health of elderly family members (Cao et al., 2020; Fitzgerald & Konrad, 2021). A survey of nursing students in the United States reported that all students experienced some anxiety related to COVID-19, of which 80% were anxious about their academic success, 84% were afraid of a loved one contracting COVID-19, and more than half were anxious about contracting COVID-19 themselves and about their ability to meet their academic and personal responsibilities (Fitzgerald & Konrad, 2021). Fears related to COVID-19 were prevalent among nursing students, regardless of cohort, which tended to discourage them from continuing their education in the area of nursing (Santos, Labrague, & Falguera, 2022). These stressors were exacerbated because many hospitals internationally did not allow students to be placed in hospital facilities for fear of contamination (Jones, Hein, & James, 2021). The fact that clinical placement was limited created a huge stressor for students who were hoping to graduate from nursing. Similar heightened levels of stress and fear of infection during the previous SARS epidemic resulted in the development of mental health problems such as PTSD, insomnia, and depression in approximately 1 out of 3 of nurses practicing in Taiwan (Su and colleagues as cited in Savitsky, Findling, Erel, and Hendel (2020)).

These fears have been an additional emotional burden, on top of the known pre-pandemic concerns of nursing students about their academic performance, the pressure to succeed, and securing post-graduation employment (Beiter et al., 2015). Prior to the COVID-19 pandemic, Magnavita and Chiorri (2018) conducted a descriptive comparison of nursing students against healthcare workers, and observed that nursing students experienced higher levels of job strain and work impairment, resulting from clinical and personal stressors, and lower levels of social support and decision making autonomy on the job. A comparison of United States prepandemic nursing students by Bartlett, Taylor, and Nelson (2016) against the general student body shows that nursing students have an increased prevalence of stress, anxiety, sleep disturbances, and stress related illnesses. Furthermore, Bartlett et al. (2016) highlighted that although 7% of the general student body reported experiencing no stress during the past 12 months, every nursing student reported experiencing some stress over the same time period. Both Beiter et al. (2015) and Chernomas and Shapiro (2013) reported that the prepandemic prevalence of moderate or worse levels of stress, anxiety and depression among nursing students in the United States ranged between 21% to 31%, whereas normal levels for stress, anxiety, and depression ranged between 60% and 67%. C.-J. Chen et al. (2015) also reported a prepandemic prevalence of minimal depression among nursing students from Taiwan at 67%, consistently with nursing students in the United States; however, they also reported a lower level of prevalence of moderate or worse depression at 9%, approximately 1/2 of that reported for United States nursing students, highlighting a possible confounding effect of differing cultural backgrounds and contexts. During their on-site clinical training, nursing students are faced with many adversities such as long training hours, working with suffering and the death of their assigned clients as well as the risk of acquiring a contagious disease (Gimenez-Espert, Prado-Gasco, & Soto-Rubio, 2020).

There have been several studies in different areas of the world investigating the psychological effects caused by pandemics prior to COVID-19 in other areas of the world, such as the Middle East Respiratory Syndrome (MERS) outbreak in Korea (Jeong et al., 2016), and the Severe Acute Respiratory Syndrome (SARS) in Canada (Labrague, McEnroe-Petitte, Amri, Fronda, & Obeidat, 2018; Maunder et al., 2006). The pre-existing psychological burden of nursing students, which begins from their entrance to a nursing program, intensifies in times of such concurrent crises (S. Kim, Sloan, Montejano, & Quiban, 2021). Fernandez et al. (2020) called for supportive measures for nurses, including working as team members, acknowledging personal and family safety concerns, and addressing their fears and psychological issues. This process would also be an asset during a pandemic or epidemic crisis in a school of nursing because the unstructured and unexpected transition to virtual curriculum resulted in feelings of confusion and uncertainty for student nurses (M. Kim, Kang, & Gagne, 2021).

Research questions

This study was guided by the following research questions. First, which support mechanisms and student characteristics actively contributed towards the reduction of students' stress, anxiety, and depression? Second, were the nursing faculty instrumental in supporting the nursing students' well-being in these three areas during the COVID-19 pandemic?

The participants in this study were a cohort of undergraduate nursing students in a Hispanic serving public university in South Texas. This student population is part of a unique demographic in the United States, characterized by a predominantly Hispanic population, high levels of poverty, and a significant proportion of first-generation students and students with foreign-born parents that immigrated to the United States from Latin American countries. Acquiring knowledge regarding the experiences of Hispanic nursing students during the COVID-19 pandemic would allow for an analysis and understanding of the student's experience and needed actions to improve student support during the epidemic. These identified actions could be implemented for future outbreaks to support students and decrease stress and fear (Collado-Boira et al., 2020; Pearman, Hughes, Smith, & Neupert, 2020; Xiong et al., 2020).

Similar studies

A previous study by S. Kim et al. (2021) considered the impact of coping mechanisms on student mental health during the COVID-19 lockdown for a cohort of 173 nursing students in California, United States of higher socioeconomic status who attended a private university during the Spring 2020 semester. However, their results may not necessarily be generalizable to nursing students in South Texas who are predominantly Hispanic (more than 90%), experience a unique blend of Hispanic-American culture, have on average lower socioeconomic status, and attend a public university. Castaneda et al. (2024) studied how student mental health was impacted by online course modalities (synchronous vs asynchronous) and student preferences regarding course modalities during the COVID-19 pandemic, for a cohort of 245 biomedical students in South Texas. They also took an inventory of the coping mechanisms employed by the same student cohort; however, they did not consider the question of identifying the coping and support mechanisms that are statistically significant predictors of student stress, anxiety, and depression. A recently published study by Stubin, Ruth-Sahd, and Dahan (2024) used a post-pandemic national survey of 989 undergraduate nursing students to investigate the role of faculty support, resilience, age, and race/ethnicity as predictors of student stress, anxiety, and depression. However, they did not include in their study family functioning and spiritual well-being as possible predictors.

Choice of variables used in this study

For this study, we have used measures of stress, anxiety, and depression as the dependent variables, corresponding to three important aspects of student mental health. We have used measures of support mechanisms, which include perceived faculty support, resilience, family functioning, and spiritual well-being as the primary predictor variables. Several additional covariates have also been considered as possible predictor variables, as detailed in the Methods section.

The rationale guiding the choice of the primary predictor variables is as follows. Resilience relates to protective factors that help individuals recover from stress (Reyes, Andrusyszyn, Iwasiw, Forchuk, & Babenko-Mould, 2015; Urban, Smith, Wilson, & Cipher, 2021). Labrague (2022) found that resilience was associated with reduced stress and anxiety and improved mental health and psychological well-being. A systematic review by Z. Li and Hasson (2020) highlighted the importance of developing resilience skills in nursing students to enable them to better cope with stress and improve their psychological well-being. Moreover, Labrague (2022) found that spiritual well-being was also associated with lower stress and increased psychological well-being and mental health (Labrague, 2022). Savitsky et al. (2020) identified mental disengagement (i.e. using excessive eating, alcohol, or sedatives as a coping strategy) and resilience as predictors of moderate or severe anxiety, and found that mental disengagement was in turn associated with secular religiosity and “not married” family status. Liu et al. (2023) conducted a longitudinal study of 13,462 college students in China and showed that having a severely dysfunctional family causes increased prevalence of anxiety and depression. This result is consistent with several other cross-sectional studies on undergraduate students from China (B. Chen, Wang, & Yang, 2023; Zhao, Kadir, & Razak, 2024), Ecuador (Estrella-Proano et al., 2024), and the United States (Berryhill, Harless, & Kean, 2018; S. Kim et al., 2021). These studies have motivated our interest in investigating resilience, family functioning, and spiritual well-being as possible predictor variables. Finally, Yuksel and Bahadir-Yilmaz (2019) found that, prior to the COVID-19 pandemic, mentoring programs had a positive effect on both the academic and social adjustment of nursing students to the university environment, which in turn contributed to their ability to cope with stress and to have a psychological sense of self-efficacy and belonging. It is, therefore, reasonable to also explore whether perceived faculty support may have contributed to the reduced stress, anxiety, and depression of the nursing students in this cohort.

Methods

A cross-sectional design was used in this study.

Sample

All undergraduate nursing students attending the Fall 2021 semester at a public university in South Texas were included in the invitation to participate in this study. Participants that did not respond to the invitation were not included in our data set. Participants that submitted only demographic information without completing at least one of the instruments measuring the mental health or support mechanisms were excluded. Participants either completed the entire survey with very few missing responses or provided only demographic data and did not continue with the rest of the survey. The remaining participants formed our dataset.

Sample size was solely limited by the total number of enrolled students majoring in nursing at a Hispanic serving institution in South Texas during the Fall 2021 semester and by the response rate to the survey.

Study survey

The study survey collected several types of background information on each respondent including demographic data, detailed information about family life and the employment and student status of the respondent, whether the respondent was infected with COVID-19 during their stay at the university, whether the respondent was vaccinated against COVID-19, and to rate the extent to which they were concerned about their health on a 5-point Likert scale. The collected demographic information included the respondent's age group, gender, whether the respondent is a first-generation student, race, and whether the respondent's ethnicity is Hispanic. With regards to gender, respondents were asked "to which gender identity do you most identify" and given the choices of male or female. Collected family life information included the respondent's marital status, whether the respondent had children, whether the father or mother of the respondent were born in the United States correspondingly, and, for respondents that were single, whether they were living alone, or with their parents, or with older relatives. Collected information on the employment and student status of the respondents included whether they were non-traditional second degree BSN students, whether they worked during nursing school as salaried workers in a healthcare facility or in a field unrelated to nursing.

The study survey also used well-established valid and reliable instruments to measure the stress (Cohen, Kamarck, & Mermelstein, 1983), anxiety (Spitzer, Kroenke, Williams, & Lowe, 2006), depression (Kroenke, Spitzer, & Williams, 2001), faculty support (Mariveles, 2019; Shelton, 2003), resilience (Campbell-Sills & Stein, 2007), family functioning (Smilkstein, Ashworth, & Montano, 1982), and spiritual well-being (Daaleman & Frey, 2004) of the respondents. The details of these measures are given in the next subsection.

In this study, the scales measuring stress, anxiety, and depression were the dependent variables. The corresponding possible predictor variables consisted of the scales that measure the respondent's support mechanisms, including faculty support, resilience, family functioning, spiritual well-being, in addition to all other covariates available from the additional information collected by the study questionnaire.

Measures used as dependent variables

PSS-10 scale – Stress

The Perceived Stress Scale (PSS-10 scale) was designed to measure the respondents perceived stress in response to life situations that have occurred during the last month (Cohen et al., 1983). As such, it stands in contrast with alternative measures based on tracking objective measures of stressful events. It consists of 10 questions on a 5-point Likert scale ranging from 0 ("never") to 4 ("very often"). Responses to questions 4, 5, 7, 8 need to be inverted. The total score ranges from 0 to 40 and increasing score corresponds to increased perceived stress. The standard interpretation of the PSS-10 scale is that *low perceived stress* corresponds to scores between 0 and 13, *moderate*

perceived stress corresponds to scores between 14 and 26, and *high perceived stress* corresponds to scores between 27 and 40. For the purpose of descriptive statistics reporting this study deviated from the standard interpretation by designating score 0 to correspond to *no perceived stress* and scores 1 to 13 to correspond to *low perceived stress*.

The Cronbach alpha for this scale was originally reported as 0.84, 0.85, and 0.86 over three distinct samples (Cohen et al., 1983). The Cronbach alpha of the PSS-10 scale in this study was 0.809 with 95% confidence interval (0.723, 0.865). The reliability of this scale was also supported with test-retest correlations ($r = 0.85$) within a short time period of two days (Cohen et al., 1983). The validity of the scale was established by demonstrating that the scale is correlated with a life-event impact score and is a predictor of stress-related health outcomes (Cohen et al., 1983). The reliability and validity of this instrument has been confirmed by further studies reviewed by Lee (2012). The PSS-10 scale was used in this study with permission from MAPI Trust.

GAD-7 scale – Anxiety

The General Anxiety Disorder 7 scale (GAD-7 scale) measures the severity of general anxiety disorder (Spitzer et al., 2006). It consists of 7 questions on a 4-point Likert scale ranging from 0 (“not at all”) to 3 (“nearly every day”). The total score ranges from 0 to 21 with increasing score corresponding to increased severity. The standard interpretation of the GAD-7 scale is that *minimal anxiety* corresponds to scores between 0 and 4, *mild anxiety* corresponds to scores between 5 and 9, *moderate anxiety* corresponds to scores between 10 and 14, and *severe anxiety* corresponds to scores between 15 and 21. For the purpose of descriptive statistics reporting, this study deviated from the standard interpretation by designating score 0 to correspond to *no anxiety* and scores between 1 and 4 to correspond to *minimal anxiety*.

Spitzer et al. (2006) reported 0.92 Cronbach alpha for this scale. Internal consistency was further supported by Lowe et al. (2008), who reported 0.89 Cronbach alpha, and for this study the Cronbach alpha was 0.930 with 95% confidence interval (0.895, 0.952). The reliability of the GAD-7 scale was confirmed via test-retest correlations ($r = 0.83$). The validity of the scale was established by comparison of the scale against the independent diagnosis of anxiety by mental health professionals. Furthermore, the scale was compared against measures of several domains of functional impairment, disability days, healthcare use, and symptom-related difficulty in activities and relationships. The GAD-7 scale is made available from <https://www.phqscreeners.com> and may be used for research without permission.

PHQ-9 scale – Depression

The Patient Health Questionnaire 9 scale (PHQ-9 scale) measures depression severity (Kroenke et al., 2001). It consists of 9 questions on a 4-point Likert scale ranging from 0 (“not at all”) to 3 (“nearly every day”) which measure the 9 DSM-IV criteria, self-reported over the last 2 weeks. The total score ranges from 0 to 27 with increasing scores corresponding to increasing severity of depression. The standard interpretation of the PHQ-9 scale is that *minimal depression* corresponds to scores between 1 and 4, *mild depression* corresponds to scores between 5 and 9, *moderate depression* corresponds to scores between 10 and 14, *moderately severe depression* corresponds to scores between 15 and 19, and *severe depression* corresponds to scores between 20 and 27.

Kroenke et al. (2001) reported 0.89 and 0.86 Cronbach alpha for this scale from two distinct samples and excellent test-retest reliability ($r = 0.84$). Validity was confirmed via comparison with blinded independent assessment of the participants by mental health professionals. Sun, Kong, Song, Liu, and Wang (2022) confirmed the reliability of the PHQ-9 scale and reported a Cronbach alpha of 0.839. For this study the Cronbach alpha was 0.892 with 95% confidence interval (0.845, 0.923). The PHQ-9 scale is made available from <https://www.phqscreeners.com> and may be used for research without permission.

Measures used as predictor variables

SPFSS scale – Faculty support

The Shelton's Perceived Faculty Support Scale (SPFSS scale) (Mariveles, 2019; Shelton, 2003) measures students' perceptions of faculty support using two subscales, which include functional and psychological support. It consists of 24 questions on a 5-point Likert scale ranging from 0 ("Strongly disagree") to 4 ("Strongly agree"). The total score ranges from 0 to 96, with increasing score corresponding to increase in faculty support. The scale combines 14 questions that measure psychological faculty support and 10 questions that measure functional faculty support. There is no standard interpretation of the SPFSS scale, however for the purpose of descriptive statistics reporting *minimal faculty support* was defined to correspond to scores between 0 and 18, *weak faculty support* to correspond to scores between 19 and 37, *moderate faculty support* to correspond to scores between 38 and 56, *moderately strong faculty support* to correspond to scores between 57 and 75, and *strong faculty support* to correspond to scores between 76 and 96.

Shelton (2003) reported a Cronbach alpha of 0.96 indicating excellent internal validity. For this study, the Cronbach alpha was 0.961 with 95% confidence interval (0.942, 0.974). Review of the scale by three experienced nurse educators was used to establish the content validity of the instrument. Factor analysis and item to total correlations were also used to further support the validity of the scale. Permission was obtained by SLACK Incorporated for the one-time use of the SPFSS scale in this study.

CD-RISC-10 scale – Resilience

The 10-item Connor-Davidson Resilience Scale (CD-RISC-10 scale) asks respondents to assess their resilience, which is defined by this instrument as adaptability in challenging situations and the ability to bounce back (Campbell-Sills & Stein, 2007). It is an abbreviated version of the original CD-RISC-25 scale by Connor and Davidson (Connor & Davidson, 2003) and it consists of 10 questions on a 5-point Likert scale ranging from 0 ("not true at all") to 4 ("true nearly all the time"). The total score ranges from 0 to 40. Increasing score corresponds to increasing resilience. There is no standard interpretation of the CD-RISC-10 scale, however for the purpose of descriptive statistics reporting, *minimal resilience* was defined to correspond to scores between 0 and 7, *weak resilience* to correspond to scores between 8 and 15, *moderate resilience* to correspond to scores between 16 and 23, *moderately strong resilience* to correspond to scores between 24 and 31, and *strong resilience* to correspond to scores between 32 and 40.

The Cronbach alpha for this scale reported by Connor and Davidson (2003) was 0.89. A Cronbach alpha of 0.924 was reported by Galanis et al. (2023) over a sample of nurses and a Cronbach alpha of 0.81 was reported by Aloba, Olabisi, and Aloba (2016) for a sample of student nurses. The Cronbach alpha for this study was 0.876 with 95% confidence interval (0.814, 0.913). The reliability of the scale was established with test-retest correlation ($r = 0.87$) (Connor et al 2003). The validity of the scale was established with comparisons against other measures of perceived stress and stress vulnerability and by showing that it can differentiate between the general population and patients with anxiety disorder (Connor & Davidson, 2003). The CD-RISC-10 scale was used with permission from Dr. Davidson.

Family APGAR scale – Family functioning

The Adaptation Partnership Growth Affection Reflection scale (Family APGAR scale) measures family functioning (Smilkstein et al., 1982) and it consists of 5 questions measuring adaptation, partnership, growth, affection, and reflection on a 3-point Likert scale ranging from 0 ("Hardly ever") to 2 ("almost always"). The total score ranges from 0 to 10, with increasing score corresponding to increasing family functioning. The standard interpretation of the Family APGAR scale is that

dysfunctional family corresponds to scores between 0 and 3, *moderately dysfunctional family* corresponds to scores between 4 and 6, and *highly functional family* corresponds to scores between 7 and 10.

Smilkstein et al. (1982) reported a Cronbach alpha of 0.80 for this scale. The reliability of the instrument was supported by test-retest correlation ($r = 0.83$). The validity of the instrument was shown by demonstrating that it can differentiate between adopted and biological children, students that live with their parents vs students separated from their parents, and “adjusted” vs “maladjusted” students (age 10 to 13). Subsequent studies reported a Cronbach alpha of 0.788 (Castilla, Caycho, Shimabukuro, & Valdivia, 2014) and 0.819 (Campo-Arias & Caballero-Dominguez, 2021). For this study, the Cronbach alpha was 0.853 with 95% confidence interval (0.783, 0.904). The Family APGAR scale is in the public domain and may be used without permission (International Family Nursing Association, 2023).

SIWB scale – Spiritual well-being

The Spirituality Index of Well-Being scale (SIWB scale) measures the respondent's perceived spiritual quality of life and is divided into a self-efficacy subscale and a life-scheme subscale (Daaleman & Frey, 2004). It consists of 12 questions on a 5-point Likert scale ranging from 0 (“Strongly Agree”) to 4 (“Strongly Disagree”). The score ranges from 0 to 48, with increasing scores representing increasing spiritual well-being. There is no standard interpretation of the SIWB scale, however for the purpose of descriptive statistics reporting, *very poor spiritual well-being* was defined to correspond to scores between 0 and 8, *poor spiritual well-being* to correspond to scores between 9 and 17, *moderately poor spiritual well-being* to correspond to scores between 18 and 27, *moderately good spiritual well-being* to correspond to scores between 27 and 35, and *good spiritual well-being* to correspond to scores between 36 and 48.

Daaleman and Frey (2004) reported a Cronbach alpha of 0.91 for this scale. The reliability of the scale was confirmed via test-retest correlation ($r = 0.79$). The validity of the scale was confirmed by comparison with five other measures of subjective well-being and spirituality. For this study, the Cronbach alpha was 0.923 with 95% confidence interval (0.886, 0.946). Dr. Daaleman has informed us that the SIWB scale may be freely used without permission.

Data collection procedure

Data was gathered via an online survey self-reported questionnaire. The survey was administered using the Qualtrics XM platform via the University's website. With permission from each course coordinator, students were recruited for this survey via a recruitment script that was distributed using the Blackboard learning management system. The recruitment script assured students that their participation in the study was confidential and voluntary and furthermore that participation or lack thereof would not affect their course grades or relationship with the School of Nursing. To avoid the appearance of coercion to participate in the study and to allay any student fears of retaliation, data gathering was initiated on December 10, 2021, after the submission of student grades for the Fall 2021 semester. The administration of the survey was conducted by a third-party, and the collected data were de-identified and communicated to the corresponding author (EG) who did not have an instructional relationship with the participants. To encourage student participation in the survey, a random selection of students that completed the entire survey were eligible for a limited number of raffle awards. The student selection for the raffle awards was also conducted by a third party. Data gathering was concluded on January 17, 2022 before the start of the Spring 2022 semester.

Ethical considerations

The study was approved by the Institutional Review Board of the University of Texas Rio Grande Valley (IRB #21-0511 on 12/10/2021). Informed consent was provided by all participants

through their response to the first question of the online survey.

Data analysis

The internal consistency of the measures used in this study was confirmed by calculating the Cronbach alpha. Kendall tau correlations were used to identify potential correlations between the dependent variables and the measures of support mechanisms and all other ordinal or dichotomous demographic covariates. For non-dichotomous unordered categorical covariates, the Kruskal-Wallis test was used to determine whether they correlate with the dependent variables. Any such covariates that were found to have statistically significant correlation with a dependent variable were then dichotomized and Kendall tau correlations were used to investigate potential statistically significant correlations with the dependent variable.

Separate preliminary linear regression models for the PSS-10 scale (stress), GAD-7 scale (anxiety), and PHQ-9 scale (depression) were calculated using all predictor variables that had a statistically significant correlation with the corresponding dependent variable. Stepwise removal/addition of covariates was then used to identify the simplified linear regression models that best fit the data. The Akaike Information Criterion (Akaike, 1974) was used to compare several model simplifications and identify the most parsimonious model for each dependent variable that best fits the data. For each of these simplified models, we confirmed the validity of the corresponding linear regression by calculating the diagnostics proposed by Pena and Slate (2006). Outliers were identified with QQ plots and removed, when necessary. Multicollinearity was ruled out in each of the simplified models by calculating the variance inflation factor (VIF) for each of the corresponding predictor variables, to ensure that it is not necessary to treat any one of the predictor variables as a separate dependent variable instead (Hair, Anderson, Tatham, & Black, 1998). The p -value threshold $p < 0.05$ is used to establish statistical significance.

Software

All statistical calculations were conducted with R version 4.1.3 (R Core Team, 2022). We acknowledge using the following R packages: The Epicalc package (Chongsuvivatwong, 2021) was utilized for the reporting of the results of linear regressions. The GVLMA package (Pena & Slate, 2019) was used to calculate the linear regression diagnostics proposed by Pena and Slate (2006). The CAR package (Fox & Weisberg, 2019) was used to calculate the variance inflation factors for the predictor variables in each linear regression model. The LTM package (Rizopoulos, 2006) was used to calculate the Cronbach alpha for each instrument used in this study.

Results

Sample description

The survey recruitment script was sent to 260 undergraduate nursing students, of which 82 students responded to the survey and 8 out of the 82 students submitted only some demographic information without completing the rest of the survey. The other 74 students completed the survey, forming our data set.

Table 1 shows the demographic characteristics of the respondents. The majority of the respondents were female (79.7%), identifying as Hispanic (95.9%), in the 20-to-25 year age bracket (78.4%), single living with parents (73%), and did not have children (83.8%). One of the students identified as Hispanic but declared his/her race as Asian, which can also be inferred from the descriptive statistics; we are aware that a very small proportion of the students that were originally invited to participate in this study were biracial. None of the respondents was an international student, however 60.8% reported that their mother was not born in the United States and 58.1% reported that their father was not born in the United States. A significant proportion of our cohort (40.5%) reported that they were first-generation students. With respect to health, 27%

Table 1

Demographic data for the students that completed the survey (N = 74)

Characteristic	Yes		No	
	N	%	N	%
Dichotomous characteristics				
Gender: Male	15	20.3	59	79.7
First generation student	30	40.5	44	59.5
Hispanic	71	95.9	3	4.1
International student	0	0.0	74	100
Mother is US born	29	39.2	45	60.8
Father is US born	31	41.9	43	58.1
Has children	12	16.2	62	83.8
Was infected with COVID-19	20	27	54	73
Received the COVID-19 vaccine	74	100	0	0.0
Second Degree BSN student	15	20.3	59	79.7
Salaried worker in healthcare facility	6	8.1	68	91.9
Race				
Race: White/Caucasian	70	94.6		
Race: Asian	4	5.4		
Age by group				
20 to 25 years	58	78.4		
26 to 30 years	5	6.8		
31 to 40 years	9	12.2		
41 to 50 years	2	2.7		
51 years and older	0	0.0		
Marital status				
Marital status: Married	13	17.6		
Single living alone	6	8.1		
Single living with parents	54	73		
Single living with old relatives	1	1.4		
Currently concerned about health				
Extremely unconcerned	2	2.7		
Somewhat unconcerned	8	10.8		
Neither concerned nor unconcerned	17	23		
Somewhat concerned	36	48.6		
Extremely concerned	11	14.9		
Field of work				
Works in a field unrelated to nursing	17	23		
Works in a field related to nursing	22	29.7		
Does not work in any field	35	47.3		

Table 2

Distribution of measures of mental health and support mechanisms across categories (N = 74)

Measures	Range	Yes	
		N	%
PSS-10 scale (stress)			
No perceived stress	PSS-10 = 0	0	0.0
Low perceived stress	$1 \leq \text{PSS-10} \leq 13$	23	31.1
Moderate perceived stress	$14 \leq \text{PSS-10} \leq 26$	44	59.5
High perceived stress	$27 \leq \text{PSS-10} \leq 40$	6	8.1
No response		1	1.4
GAD-7 scale (anxiety)			
No anxiety	GAD-7 = 0	8	10.8
Minimal anxiety	$1 \leq \text{GAD-7} \leq 4$	18	24.3
Mild anxiety	$5 \leq \text{GAD-7} \leq 9$	24	32.4
Moderate anxiety	$10 \leq \text{GAD-7} \leq 14$	11	14.9
Severe anxiety	$15 \leq \text{GAD-7} \leq 21$	12	16.2
No response		1	1.4
PHQ-9 scale (depression)			
No depression	PHQ-9 = 0	9	12.2
Minimal depression	$1 \leq \text{PHQ-9} \leq 4$	24	32.4
Mild depression	$5 \leq \text{PHQ-9} \leq 9$	21	28.4
Moderate depression	$10 \leq \text{PHQ-9} \leq 14$	14	18.9
Moderately severe depression	$15 \leq \text{PHQ-9} \leq 19$	5	6.8
Severe depression	$20 \leq \text{PHQ-9} \leq 27$	1	1.4
SPFSS scale (faculty support)			
Minimal faculty support	$0 \leq \text{SPFSS} \leq 18$	0	0.0
Weak faculty support	$19 \leq \text{SPFSS} \leq 37$	3	4.1
Moderate faculty support	$38 \leq \text{SPFSS} \leq 56$	15	20.3
Moderately strong faculty support	$57 \leq \text{SPFSS} \leq 75$	28	37.8
Strong faculty support	$76 \leq \text{SPFSS} \leq 96$	22	29.7
No response		6	8.1
CD-RISC-10 scale (resilience)			
Minimal resilience	$0 \leq \text{CD-RISC-10} \leq 7$	0	0.0
Weak resilience	$8 \leq \text{CD-RISC-10} \leq 15$	2	2.7
Moderate resilience	$16 \leq \text{CD-RISC-10} \leq 23$	9	12.2
Moderately strong resilience	$24 \leq \text{CD-RISC-10} \leq 31$	38	51.4
Strong resilience	$32 \leq \text{CD-RISC-10} \leq 40$	23	31.1
No response		2	2.7
Family APGAR scale (family functioning)			
Dysfunctional family	$0 \leq \text{APGAR} \leq 3$	4	5.4
Moderately dysfunctional family	$4 \leq \text{APGAR} \leq 6$	17	23
Highly functional family	$7 \leq \text{APGAR} \leq 10$	53	71.6
SIWB scale (spiritual well-being)			
Very poor spiritual well-being	$0 \leq \text{SIWB} \leq 8$	1	1.4
Poor spiritual well-being	$9 \leq \text{SIWB} \leq 17$	1	1.4
Moderately poor spiritual well-being	$18 \leq \text{SIWB} \leq 27$	8	10.8
Moderately good spiritual well-being	$27 \leq \text{SIWB} \leq 35$	26	35.1
Good spiritual well-being	$36 \leq \text{SIWB} \leq 48$	38	51.4
No response		2	2.7

Table 3

Cronbach alpha for all instruments included in our survey.

Scale	Cronbach alpha	95% CI	Sample	Questions
PSS-10 (stress)	0.809	(0.723–0.865)	73	10
GAD-7 (anxiety)	0.930	(0.895–0.952)	73	7
PHQ-9 (depression)	0.892	(0.845–0.923)	74	9
SPFSS (faculty support)	0.961	(0.942–0.974)	68	24
CD-RISC-10 (resilience)	0.876	(0.814–0.913)	72	10
Family APGAR (family functioning)	0.853	(0.783–0.904)	74	5
SIWB (Spiritual well-being)	0.923	(0.886–0.946)	72	12

* CI = confidence interval; Sample = number of responses to the respective survey instrument; Questions = number of questions comprising the survey instrument.

of the respondents were infected with COVID-19 during their stay at the University. Although all respondents received the COVID-19 vaccine, 63.5% of respondents reported being “somewhat concerned” or “extremely concerned” about their health. Professionally, 20.3% of the respondents were second degree BSN students, who already had a previous BS or BA degree in a different academic area. Approximately half of the respondents were not working in any field (47.3%), and the other half were evenly distributed between respondents working in a field related to nursing (29.7%) and respondents working in a field unrelated to nursing (23%). Furthermore, 8.1% of the respondents reported being employed in a nursing field as salaried workers in a healthcare facility.

Table 2 shows the categorical distribution of the mental health measures for stress, anxiety, and depression and of the support mechanism measures corresponding to faculty support, resilience, family functioning, and spiritual well-being. Non-standard categories were introduced in this article for the measures corresponding to faculty support, resilience, and spiritual well-being. For all other measures, standard categories were used, except that the introduction of the categories for *no perceived stress* and *no anxiety* also deviates from the standard definition of the categories for the corresponding instruments. Although stress and depression were limited up to moderate levels for a strong majority of respondents (91% for stress and 91.8% for depression), anxiety had a wider distribution with 16.2% of the respondents reporting severe anxiety. Furthermore, although 10.8% of the respondents reported no anxiety and 12.2% of respondents reported no depression, none of the respondents reported no perceived stress. With respect to the support mechanisms, a strong majority of the respondents reported moderate or above moderate faculty support (95.9%), resilience (97.3%), and moderately good or better spiritual well-being (86.5%). More concerning is that 28.4% of the respondents reported moderately dysfunctional or worse family functioning.

There are no missing data on the demographic questions reported on Table 1. For some of the measures reported on Table 2, complete responses are missing by one or two respondents. There are no missing responses for the Family APGAR scale, measuring family functioning. However, there is an unusual number of 6 missing responses to the SPFSS scale, measuring faculty support.

Table 3 shows the Cronbach alpha, on the second column, and its 95% confidence interval, on the third column, for the PSS-10, GAD-7, PHQ-9, SPFSS, CD-RISC-10, Family APGAR, and SIWB scales. The fourth column shows the number of responses without missing data that were used to calculate the corresponding Cronbach alpha. The fifth column shows the number of questions that comprise the corresponding questionnaire. Since for all scales the Cronbach alpha exceeded 0.7, we confirmed that all instruments used were internally consistent in this study.

Table 4

Kendall-tau correlations between measures of mental health and ordinal covariates.

Ordinal covariates	r_τ (p)		
	PSS-10 (stress)	GAD-7 (anxiety)	PHQ-9 (depression)
SPFSS (faculty support)	-0.186 (0.03)	-0.162 (0.061)	-0.156 (0.069)
SPFSS psychological support subscale	-0.199 (0.02)	-0.165 (0.055)	-0.144 (0.091)
SPFSS functional support subscale	-0.151 (0.073)	-0.164 (0.053)	-0.157 (0.064)
CD-RISC-10 (resilience)	-0.252 (0.003)	-0.277 (0.001)	-0.251 (0.003)
Family APGAR (family functioning)	-0.315 (10^{-4})	-0.217 (0.015)	-0.291 (10^{-4})
SIWB (Spiritual well-being)	-0.409 (10^{-6})	-0.384 (10^{-6})	-0.436 (10^{-7})
Currently concerned about health ^a	0.107 (0.239)	0.07 (0.445)	0.15 (0.102)
Age group ^b	-0.247 (0.01)	-0.2 (0.038)	-0.184 (0.056)
Gender (0=Female; 1=Male)	-0.033 (0.738)	-0.079 (0.427)	0.04 (0.686)
first-generation status (0=no, 1=yes)	0.126 (0.2)	0.093 (0.351)	0.122 (0.216)
is Hispanic (0=no, 1=yes)	-0.081 (0.412)	-0.025 (0.802)	-0.095 (0.336)
marital status (0=Single, 1=Married)	-0.272 (0.006)	-0.105 (0.291)	-0.2 (0.043)
Mother US born (0=no, 1=yes)	-0.048 (0.623)	-0.088 (0.375)	-0.136 (0.168)
Father US born (0=no, 1=yes)	-0.21 (0.033)	-0.071 (0.474)	-0.172 (0.082)
Salaried worker in healthcare facility (0=no, 1=yes)	-0.178 (0.07)	-0.205 (0.039)	-0.268 (0.007)
has children (0=no, 1=yes)	-0.139 (0.159)	-0.042 (0.671)	-0.047 (0.633)
Second Degree BSN student (0=no, 1=yes)	0.012 (0.9)	-0.07 (0.481)	0.003 (0.978)
Got COVID (0=no, 1=yes)	0.242 (0.014)	0.187 (0.059)	0.165 (0.096)

* r_τ = Kendall-tau correlation coefficient; p = p -value for rejecting the null hypothesis $r_\tau = 0$; statistically significant correlations with $p < 0.05$ are shown in bold font

^a 0 = extremely unconcerned; 1 = somewhat unconcerned; 2 = neither concerned nor unconcerned; 3 = somewhat concerned; 4 = extremely concerned

^b 0 = age 20-25 years; 1 = age 26-30 years; 2 = age 31-40 years; 3 = age 41-50 years; 4 = age > 50 years

Table 5

Kruskal-Wallis test p -values for correlations between mental health measures and categorical covariates

Categorical covariates	p -value		
	PSS-10 (stress)	GAD-7 (anxiety)	PHQ-9 (depression)
Race ^a	0.913	0.971	0.657
Marital status ^b	0.04	0.202	0.044
Field of work ^c	0.661	0.585	0.701

* p -values with $p < 0.05$ shown in bold font

^a Race: White/Caucasian, Asian

^b Marital status: Married, single living alone, living with parents, living with old relatives

^c Field of work: works in a field unrelated to nursing; works in a field related to nursing; does not work in any field.

Table 6

Kendall-tau correlations between measures of mental health and dichotomized responses about marital status when single

Dichotomous covariates	r_τ (p)		
	PSS-10 (stress)	GAD-7 (anxiety)	PHQ-9 (depression)
single living alone (0=no, 1=yes)	0.091 (0.355)	0.116 (0.243)	0.146 (0.139)
single living with parents (0=no, 1=yes)	0.19 (0.053)	0.058 (0.556)	0.121 (0.222)
single living with old relatives (0=no, 1=yes)	-0.049 (0.618)	-0.153 (0.122)	-0.151 (0.127)

* r_τ = Kendall-tau correlation coefficient; p = p -value for rejecting the null hypothesis $r_\tau = 0$

Correlations between predictors and dependent variables

Measures of stress (PSS-10 scale), anxiety (GAD-7 scale), depression (PHQ-9 scale) are the dependent variables in this study. All other variables that have a statistically significant correlation with the corresponding predictor variable are under consideration as possible predictor variables for that dependent variable.

Table 4 shows the bivariate Kendall tau correlations between the dependent variables (stress, anxiety, and depression) and the support mechanism measures (faculty support, resilience, family functioning, and spiritual well-being), and all other available ordinal or dichotomous demographic variables. Vaccination status is not included, because all respondents received the COVID-19 vaccine. Likewise, international student status is not included either, because none of the respondents was an international student.

Based on the correlations reported on Table 4, decreased stress had statistically significant correlations with faculty support (more specifically only with the psychological faculty support subscale), resilience, family functioning, spiritual well-being, increasing age bracket, marital status (being married), and having a US born father. Increased stress had a statistically significant correlation with having experienced a symptomatic COVID-19 infection. Although not statistically significant, decreased stress also correlated with salaried employment in a healthcare facility ($p = 0.07$).

Decreased anxiety had statistically significant correlations with resilience, family functioning, spiritual well-being, increasing age bracket, and employment as a salaried worker in a healthcare facility. Although not statistically significant, decreased anxiety also correlated with faculty support ($p = 0.061$) and increased anxiety correlated with having experienced a symptomatic COVID-19 infection ($p = 0.059$).

Decreased depression had statistically significant correlations with resilience, family functioning, spiritual well-being, marital status (being married), and employment as a salaried worker in a healthcare facility. Although not statistically significant, decreased depression was also correlated with faculty support ($p = 0.069$) and increasing age group ($p = 0.056$).

Table 5 shows the results of the Kruskal-Wallis test checking for the existence of statistically significant correlations between the unordered categorical demographic variables, queried by the survey, and the dependent variables. Only marital status showed a statistically significant correlation with stress ($p = 0.04$) and depression ($p = 0.044$), although the statistical significance was borderline. The marital status variable includes the categories: “married”, “single living alone”, “single living with parents”, and “single living with old relatives”. Table 4 already shows that being married negatively correlated with stress and depression, therefore Table 6 presents bivariate Kendall tau correlations to check whether the three non-married categories of marital status have a statistically significant correlation with the indicators for stress, anxiety, and depression. We found no statistically significant correlations between the non-married categories of family status and the

indicators for poor mental health. However, the category “single living with parents” had a weak positive correlation with increased stress that tended towards significance ($r_{\tau} = 0.19$; $p = 0.053$), but was not statistically significant.

Table 7

Preliminary linear regression models for measures of mental health using all covariates that have a statistically significant correlations with the corresponding dependent variables

	β	95% CI	p
Model for the PSS-10 (stress) scale ($n = 63$)			
SPFSS (faculty support) rescaled score	-0.02	(-0.21,0.18)	0.873
CD-RISC-10 (resilience) rescaled score	-0.23	(-0.48,0.01)	0.06
Family APGAR (family functioning) rescaled score	-0.24	(-0.39,-0.1)	0.001
SIWB (Spiritual well-being) rescaled score	-0.23	(-0.43,-0.03)	0.027
Age group ^a	-0.06	(-0.24,0.13)	0.549
Got COVID (0=no, 1=yes)	0.31	(0.01,0.61)	0.04
marital status (0=Single, 1=Married)	0.01	(-0.43,0.45)	0.966
Father US born (0=no, 1=yes)	-0.2	(-0.48,0.08)	0.152
Model for the GAD-7 (anxiety) scale ($n = 69$)			
CD-RISC-10 (resilience) rescaled score	-0.59	(-0.98,-0.19)	0.004
Family APGAR (family functioning) rescaled score	-0.12	(-0.36,0.12)	0.313
SIWB (Spiritual well-being) rescaled score	-0.46	(-0.82,-0.09)	0.014
Age group ^a	-0.07	(-0.35,0.21)	0.634
Salaried worker in healthcare facility (0=no, 1=yes)	-0.78	(-1.58,0.03)	0.059
Model for the PHQ-9 (depression) scale ($n = 70$)			
CD-RISC-10 (resilience) rescaled score	-0.39	(-0.67,-0.11)	0.006
Family APGAR (family functioning) rescaled score	-0.15	(-0.32,0.02)	0.078
SIWB (Spiritual well-being) rescaled score	-0.53	(-0.77,-0.3)	< 0.001
marital status (0=Single, 1=Married)	0.29	(-0.16,0.74)	0.203
Salaried worker in healthcare facility (0=no, 1=yes)	-0.72	(-1.3,-0.15)	0.015

* β = adjusted linear regression coefficient; CI = confidence interval; p = p -value for rejecting the null hypothesis $\beta = 0$; PSS-10, GAD-7, PHQ-9, SPFSS, CD-RISC-10, Family APGAR, SIWB scores have been normalized on a scale from 0 to 4; p -values with $p > 0.05$ are shown in bold font.

^a 0 = age 20-25 years; 1 = age 26-30 years; 2 = age 31-40 years; 3 = age 41-50 years; 4 = age > 50 years.

Construction of linear regression models for the measures of stress, anxiety, and depression

For the construction of the linear regression models, all scales measuring mental health or support mechanisms were linearly rescaled on a scale from 0 to 4, to make the linear regression coefficients comparable with each other and across models. The age group variable also scaled from 0 to 4 for the following five age groups: age 20-25 years; age 26-30 years; age 31-40 years; age 41-50 years; and age older than 50 years. All other variables were dichotomous and scaled from 0 to 1.

Table 7 shows the preliminary linear regression models constructed for the PSS-10 scale (stress), GAD-7 scale (anxiety), and PHQ-9 scale (depression), using as predictor variables all measures of support mechanisms and all demographic variables that were shown to have a statistically significant correlation with the corresponding dependent variable. Stepwise addition/removal of pre-

Table 8

Finalized linear regressions for measures of mental health with minimized Akaike Information Criterion

	β	95% CI	p	VIF
Model for the PSS-10 (stress) scale ($n = 63$)				
CD-RISC-10 (resilience) rescaled score	-0.2	(-0.39,-0.01)	0.038	1.17
Family APGAR (family functioning) rescaled score	-0.26	(-0.38,-0.15)	< 0.001	1.03
SIWB (Spiritual well-being) rescaled score	-0.31	(-0.47,-0.14)	< 0.001	1.30
Got COVID (0=no, 1=yes)	0.33	(0.08,0.58)	0.01	1.05
Father US born (0=no, 1=yes)	-0.18	(-0.42,0.05)	0.118	1.09
Model for the GAD-7 (anxiety) scale ($n = 69$)				
CD-RISC-10 (resilience) rescaled score	-0.59	(-0.97,-0.2)	0.004	1.21
SIWB (Spiritual well-being) rescaled score	-0.51	(-0.86,-0.15)	0.006	1.25
Salaried worker in healthcare facility (0=no, 1=yes)	-0.78	(-1.58,0.02)	0.056	1.06
Model for the PHQ-9 (depression) scale ($n = 70$)				
CD-RISC-10 (resilience) rescaled score	-0.35	(-0.63,-0.08)	0.012	1.22
Family APGAR (family functioning) rescaled score	-0.13	(-0.29,0.04)	0.134	1.04
SIWB (Spiritual well-being) rescaled score	-0.51	(-0.74,-0.27)	< 0.001	1.30
Salaried worker in healthcare facility (0=no, 1=yes)	-0.63	(-1.2,-0.07)	0.028	1.06

* β = adjusted linear regression coefficient; CI = confidence interval; p = p -value for rejecting the null hypothesis $\beta = 0$; VIF = variance inflation factor; PSS-10, GAD-7, PHQ-9, CD-RISC-10, Family APGAR, and SIWB scores have been normalized on a scale from 0 to 4; to satisfy linear regression diagnostics, 6 outliers were removed from the linear regression for the PSS score; p -values with $p > 0.05$ are shown in bold font. For the PSS model, adjusted $R^2 = 0.55$ and $1/(1 - R^2) = 2.22$. For the GAD-7 model, adjusted $R^2 = 0.324$ and $1/(1 - R^2) = 1.48$. For the PHQ-9 model, adjusted $R^2 = 0.442$ and $1/(1 - R^2) = 1.79$.

dictor variables was used to determine the most parsimonious linear models that best fit the data. Following Pena and Slate (2006), for each of these simplified models the global test statistic, the skewness directional test, the kurtosis directional test, and the heteroscedasticity directional test were used to determine whether the assumptions of linear regression were satisfied.

The interpretation of these tests is as follows: The global test statistic confirms that the dependent variable depends linearly on the predictor variables. The skewness and kurtosis directional tests confirm that the residuals are normally distributed. The link function directional test confirms that the dependent variable is continuous. The heteroscedasticity directional test confirms that the error variance is equally random across all values of the predictor variables. The assumptions assessed by these tests are acceptable when the p -value of the corresponding test exceeds the 0.05 threshold for statistical significance.

The simplified models for the GAD-7 scale (anxiety) and PHQ-9 scale (depression) readily satisfied all of these tests and they are thus also the finalized linear regression models reported on Table 8, with the corresponding model diagnostic test results reported on Table 9. The simplified linear regression model for the PSS-10 scale (stress) failed to satisfy the link function directional test, consequently 6 outlier points were identified and removed, thus resulting in the finalized linear regression model for the PSS-10 scale (stress) shown in Table 8, which satisfied all diagnostic tests, as shown on Table 9. The removal of the outliers did not affect the qualitative interpretation of the results for the PSS-10 scale (stress) linear regression model.

If the SPFFSS faculty support scale is replaced with the psychological faculty support subscale in the construction of the PSS-10 scale (stress) preliminary linear regression model (not shown),

Table 9

Diagnostics for finalized linear regression models reported on Table 8

Diagnostic	Value	p-value	Decision
Diagnostics for the PSS-10 (stress) score finalized linear regression model			
Global test statistic	4.9159	0.29604	Assumption acceptable
Skewness directional test	0.5963	0.43998	Assumption acceptable
Kurtosis directional test	0.3404	0.55962	Assumption acceptable
Link function directional test	3.6824	0.05499	Assumption acceptable
Heteroscedasticity directional test	0.2968	0.58591	Assumption acceptable
Diagnostics for the GAD-7 (anxiety) score finalized linear regression model			
Global test statistic	2.5796	0.6304	Assumption acceptable
Skewness directional test	1.6651	0.1969	Assumption acceptable
Kurtosis directional test	0.1060	0.7448	Assumption acceptable
Link function directional test	0.6916	0.4056	Assumption acceptable
Heteroscedasticity directional test	0.1170	0.7323	Assumption acceptable
Diagnostics for the PHQ-9 (depression) score finalized linear regression model			
Global test statistic	2.60060	0.6267	Assumption acceptable
Skewness directional test	1.68501	0.1943	Assumption acceptable
Kurtosis directional test	0.04592	0.8303	Assumption acceptable
Link Function directional test	0.42065	0.5166	Assumption acceptable
Heteroscedasticity directional test	0.44902	0.5028	Assumption acceptable

then the SPSS psychological support subscale is still a non-significant predictor in the resulting alternate preliminary model ($\beta = -0.04$; CI: $(-0.22, 0.14)$; $p = 0.673$), and subsequent stepwise addition/removal of predictor variables still simplifies to the same finalized model shown on Table 8. The finalized models retained some predictor variables that are not statistically significant because removing them decreases the quality of the model and increases unacceptably the risk of producing an underfitted model. Indeed, the confidence intervals for the non-significant predictors tend towards significance, and lack of significance is likely due to the small sample size of our dataset.

Variance inflation factors were calculated for each predictor variable in each finalized model to confirm that there is no multicollinearity in the finalized linear regression models, and they are shown on Table 8. For all finalized models, the variance inflation factor for each predictor variable was below the threshold $1/(1 - R^2)$, with R^2 the adjusted R-squared of the respective model, thus ruling out multicollinearity between the predictor variables of each model. One relevant consequence of this result is that it is not necessary to treat the measure of resilience as a separate dependent variable in our analysis. Instead, the lack of multicollinearity in our models for the measures of stress, anxiety, and depression implies that resilience is an independent predictor variable in and of itself. More precisely, the mutual independence of all included predictors is assured, which is a necessity to avoid biasing the regression coefficients.

Predictors for the measures of stress, anxiety, and depression

Table 7 shows the original linear regression models for the dependent variables (i.e. the measures of stress, anxiety, and depression) and Table 8 shows the reduced models, obtained after the stepwise removal/addition of predictors. A careful review of both tables shows the following.

The statistically significant predictors that are associated with reduced stress in the reduced model are resilience, family functioning, and spiritual well-being. Having experienced a COVID-19 infection is a statistically significant predictor for increased stress. It is worth noting that resilience,

as a predictor of reduced stress, has weakened statistical significance in the reduced model ($p = 0.038$) and it loses statistical significance in the original model ($p = 0.06$). The regression coefficients for resilience, family functioning, and prior COVID-19 infection are consistent between the original and the reduced model. There is a larger perturbation with the regression coefficient for spiritual well-being between the two models. However, in both models, resilience, family functioning, and spiritual well-being have approximately similar strength of association with reduction of stress. Finally, there is an association between reduced stress and having a US born father, which is not statistically significant; however, the 95% confidence interval for the regression coefficient (95%CI = $(-0.42, 0.05)$) suggests that it tends towards statistical significance and the corresponding regression coefficient is consistent between the original and reduced model.

The statistically significant predictors that are associated with reduced anxiety in the reduced model are resilience and spiritual well-being, both with strong statistical significance ($p < 0.006$). Salaried work in a healthcare facility is also a predictor of reduced anxiety; although not statistically significant, it tends towards significance with $p = 0.056$. The regression coefficients for both resilience and salaried employment in a healthcare facility are consistent between the original model and the reduced model. A larger perturbation is observed with the regression coefficient for spiritual well-being between the original model and the reduced model. However, in both models resilience and spiritual well-being have comparable strength of association with reduced anxiety, although resilience appears to have a somewhat increased weight relative to spiritual well-being.

The statistically significant predictors that are associated with reduced depression in the reduced model are resilience, spiritual well-being, and salaried employment in a healthcare facility. Family functioning is also a predictor variable with some tendency towards statistical significance, as evidenced by the corresponding regression coefficient confidence interval (95%CI = $(-0.29, 0.04)$). All four predictors have consistent coefficients between the original and reduced models with negligible perturbations. Spiritual well-being has a considerably stronger association with decreased depression, relative to resilience, making it the most important predictor. Likewise, resilience has a considerably stronger association with decreased depression, relative to family functioning. Salaried employment in a healthcare facility has comparable strength of association both with reduced anxiety and with reduced depression.

A plausible explanation for the noticeable perturbation of the regression coefficient for spiritual well-being between the original vs reduced regression models for stress and anxiety, which was not observed in the regression models for depression, is that it may be caused by the removal of age group as a predictor variable in the reduced models. That would imply that the age group variable could be slightly confounding the weight of spiritual well-being as a predictor variable in the regression models for stress and anxiety.

Discussion

Summary of findings

This study confirmed that both resilience and spiritual well-being are statistically significant predictors for reduced stress, anxiety, and depression, consistently with the extensive research literature reviewed in the Introduction section. Although this study also showed that these three fundamental measures of student mental health are correlated with several other variables, it is important to mitigate the possibility of confounding, where two variables may appear to be correlated only because they are indirectly connected through a third variable. To achieve this, we used linear regression models to identify all other statistically significant predictors of the mental health measures, while adjusting for both resilience and spiritual well-being.

One unexpected result of this study was that the variable of having a US born father was a predictor for reduced stress, although not statistically significant. However, because the correlation between this variable and reduced stress was statistically significant, it is reasonable to suspect that there may be a real signal here that was not captured because of the small sample size of our data.

The obvious question that follows is: why was having a US born mother not also a predictor for any of the dependent variables? It is plausible that this asymmetry may be related to the gender asymmetry in our sample which was approximately 80% female and 20% male.

Another unexpected result was that salaried employment in a healthcare facility was a statistically significant predictor of reduced depression and a predictor of reduced anxiety, with only borderline failure to achieve statistical significance. Because of the cross-sectional study design, the statistical analysis by itself is not sufficient to support an inductive inference of a causal relation between the predictors and the dependent variables. However, even if one hypothesizes that these associations are causal, the direction of causality is still not obvious. As it pertains to this finding, perhaps this type of employment has a positive impact on our nursing students' mental health, or perhaps only students with minimal depression and anxiety are inclined to pursue this type of employment. This is a question that requires further exploration in future studies.

One of the main results of this study is that family functioning is a statistically significant predictor for reduced stress, and has been identified as a weaker predictor of reduced depression, although not statistically significant. Given the important role of family in Hispanic culture, it is quite plausible to hypothesize that these associations may be causal, and that increased family dysfunction may be a cause of increase in both stress and depression. However, we stress again that this is not an inductive inference that can be supported solely on the basis of this study. This study has not established family functioning as a predictor of increased anxiety. However, the correlation between family functioning and anxiety was statistically significant.

S. Kim et al. (2021) studied the related question of identifying the coping mechanisms that predict improved nursing student mental health during the Spring 2020 semester, with a cohort of nursing students in the United States enrolled in a private university in California. Comparing the results is particularly relevant because our student population was predominantly Hispanic students of lower socioeconomic status, relative to the student cohort studied by S. Kim et al. (2021). Our results agree with S. Kim et al. (2021) in finding that resilience was a statistically significant predictor of reduced stress, anxiety, and depression. However, they differ in two ways: (a) S. Kim et al. (2021) found that family functioning was a statistically significant predictor for reduced stress, anxiety, and depression, whereas we found that, for our student cohort, it was only a statistically significant predictor for reduced stress; (b) S. Kim et al. (2021) found that spiritual well-being was a statistically significant predictor for reduced depression, whereas, for this university cohort, it was a statistically significant predictor for reduced stress, anxiety, and depression. Overall, a comparison shows that spiritual well-being may have had a more important role towards improved mental health for nursing students attending a public university from a predominantly Hispanic community, whereas for more privileged nursing students attending a private university it was family functioning that played the more important role towards improved mental health. S. Kim et al. (2021) did not consider the variables of salaried employment in a healthcare facility, having a US born mother, or a US born father as possible predictor variables in their analysis.

A particularly interesting result of this study is that having experienced a symptomatic COVID-19 infection was a statistically significant predictor for increased stress, but was not a statistically significant predictor for increase or decrease in anxiety or depression. There was a weak correlation between experiencing a symptomatic COVID-19 infection and increased anxiety and depression that was not statistically significant but did tend towards statistical significance. There are several plausible explanations for these associations. First, it is plausible that increased long-term stress could have resulted in immune suppression and been responsible for making it more likely for exposed nursing students to succumb to a symptomatic COVID-19 infection (Dhabhar, 2014). It is also plausible that the duration of the illness could have caused substantial disruption in the student's studies resulting in increased stress. Increased stress could also result from any long COVID sequelae from the illness (Davis, McCorkell, Vogel, & Topol, 2023) and the impact of the illness to elderly family members that are likely to have also contracted COVID-19 via at-home transmission (Lopez et al., 2024). Finally, because all students in our cohort received the COVID-

19 vaccine, it is plausible that if they have experienced a breakthrough infection in spite of being vaccinated, that would tend to result in increased fear of COVID-19, leading to increased perceived stress.

A surprising result of this study is that faculty support was not found to be a statistically significant predictor for improved stress, anxiety, and depression in the regression models, after adjusting for all other predictor variables. Nevertheless, increased faculty support did have a statistically significant correlation with reduced stress, and there were similar correlations with reduced anxiety and depression that were borderline not statistically significant, with $p = 0.061$ and $p = 0.069$. All three of these correlations were weakest in magnitude relative to correlations with other statistically significant plausible predictor variables. S. Kim et al. (2021) did not investigate faculty support as a possible predictor. Stubin et al. (2024) distinguished between psychological faculty support and functional faculty support and found that psychological faculty support was a statistically significant predictor of reduced anxiety and depression. They also found that functional faculty support was a statistically significant predictor only for reduced stress, and only tending towards significance as a predictor for reduced depression ($p = 0.059$) and anxiety ($p = 0.073$). This study found that increased psychological faculty support, but not functional faculty support, had a statistically significant correlation only with decreased stress. However, psychological faculty support was not a predictor for reduced stress after adjusting for other variables. The cohort by Stubin et al. (2024) had a higher prevalence of nursing students with severe or extremely severe stress, anxiety, and depression relative to the cohort of this study, which may have influenced the varying importance of faculty support in between the two studies. The larger sample size in Stubin et al. (2024) may have also contributed towards capturing the impact of psychological and functional faculty support on reduced stress, anxiety, and depression.

It is well known that COVID-19 is amenable to risk-stratification, with increasing mortality rates associated with increasing age (Epidemiology Group of Emergency Response Mechanism of New Coronavirus Pneumonia, Chinese Center for Disease Control and Prevention, 2020; Onder et al., 2020; Verity et al., 2020), so one would expect increased fear of COVID-19 in older students. However, statistically significant correlations were observed between increasing student age and decreasing measures of stress and anxiety. Moderate correlations between increasing student age and decreasing measures of depression were also observed that were not statistically significant but tended towards statistical significance ($p = 0.056$). S. Kim et al. (2021) observed similar correlations in their cohort, but they found that these correlations were not statistically significant. This study is consistent with S. Kim et al. (2021) in finding that neither age nor gender were predictors for nursing students' measures of stress, anxiety, and depression. Stubin et al. (2024) found that increasing age was a statistically significant predictor of reduced stress, anxiety, and depression, however the regression coefficients for these associations were very small relative to the regression coefficients for resilience, race/ethnicity, and faculty support. From these results, one may hypothesize that, despite the increased risk posed by COVID-19, older students are better equipped to psychologically cope with the combined burden of their academic responsibilities and the potential threat to their health.

Finally, the descriptive statistics confirm that the COVID-19 pandemic had a detrimental impact on the mental health of nursing students. Comparing this study's results with Castaneda et al. (2024) is particularly interesting because both studies were based on students majoring in health-related fields from South Texas. Furthermore, this study gathered data on the mental health of nursing students during the Fall 2021 semester, at which time COVID-19 vaccinations were available and a transition to on-campus teaching had begun, whereas Castaneda et al. (2024) gathered data on the mental health of biomedical students at the height of the pandemic, during the Fall 2020 semester, prior to the availability of COVID-19 vaccinations. The comparison shows a decrease in the prevalence of moderate or worse anxiety from 41.6%, during the Fall 2020 semester, to 32.5% during the Fall 2021 semester, and an increase in the prevalence of minimal anxiety from 21.5%, during the Fall 2020 semester to 35.1% during the Fall 2021 semester. A similar pattern is observed

with the prevalence of depression; moderate or worse depression decreased from 45.9% to 27.1% between the Fall 2020 and Fall 2021 semesters; minimal depression increased from 16.2% to 44.6% between the Fall 2020 and Fall 2021 semesters. Castaneda et al. (2024) did not measure the perceived stress of their student cohort.

Prior to the pandemic, the prevalence of moderate or worse depression reported by Beiter et al. (2015) and Chernomas and Shapiro (2013) was 23% and 21% respectively and the prevalence of minimal depression was 67% in both studies. Likewise, the prevalence of moderate or worse anxiety was 25% and 31% respectively and the prevalence of minimal anxiety was 60% and 61% respectively. The results by Beiter et al. (2015) were based on a cohort of undergraduate college students in the United States from all disciplines, whereas the results by Chernomas and Shapiro (2013) were based on a cohort of Canadian nursing students. Comparing these prepandemic results with our results clearly shows that the prevalence of minimal anxiety and depression had not fully recovered to prepandemic levels by the Fall 2021 semester; however, the prevalence of moderate or worse anxiety and depression were a lot closer to prepandemic levels, although not fully recovered either. A similar trend has been observed between this study's results and the prepandemic prevalence of anxiety.

Implications for Nursing Education

COVID-19 has caused nursing students to experience different psychological issues which have led to uncertainty about their education, virtual online classes, the need for isolation, and an increase in family conflict. This study points towards the following strategies for helping nursing students navigate through the difficulties that they have experienced during the pandemic crisis.

First, it is important to improve the effectiveness of virtual clinical instruction. Studies demonstrated that simulation is not equivalent to clinical practicum (M. Kim et al., 2021). Students in the study by M. Kim et al. (2021), stated that virtual simulation differed from the reality of working with clients in the clinical area. They felt that there was no way to demonstrate rapport with clients and that pressing buttons on a computer was different than communicating directly with clients as well as providing physical nursing care. Clinically professional modeling and critical thinking occur in clinical practice and when that became unavailable because of the pandemic, students became deficient in these areas. Y. Li, Au, Tong, Ng, and Wang (2022) reported that high-fidelity simulation (HFS) in undergraduate nursing education is superior in cultivating knowledge, skills, collaboration, caring, and learning interest of BSN students. Since the effect of HFS is equivalent to other teaching methods in cultivating undergraduate nursing students' critical thinking, self-confidence and learning satisfaction, nursing educators can choose the most appropriate methods to achieve the intended learning outcomes according to the actual situation.

This study's results suggest that nursing students' measures of stress, anxiety, and depression could be improved by promoting increased resilience and spiritual well-being. Hughes, Cologer, Swoboda, and Rushton (2021) identified self-efficacy, optimism, emotional intelligence, and self care, as the most important internal characteristics associated with increased resilience and proposed that these characteristics can be supported and cultivated by several strategies that include reflection, positive reframing, problem-based learning, and mindfulness. In addition, Aryuwat, Asp, Lovenmark, Radabutr, and Holmgren (2023) identified high self-confidence, commitment to nursing education, positive thinking, absence of childhood trauma, and academic accomplishment as additional intrapersonal characteristics associated with increased resilience; they proposed including resilience as a topic to the nursing curriculum, providing brief training sessions related to intrapersonal characteristics, and providing social support to nursing students during the entire course of their education.

Likewise, Jin (2023) found that spiritual health is essential for maintaining and promoting physical and mental health to achieve happiness, potential, meaning, and purpose of life even during a pandemic. Celano, Harris, Sawyer, and Hamilton (2022) recommended three strategies for promoting spiritual well-being in practicing nurses: (1) incorporating spirituality during new nurse orientation, with a focus on the soft skills needed for providing spiritual care for patients;

(2) developing and providing both brief and more structured interventions to support the spiritual well-being of nurses and to promote more empathy and nurse-patient interactions; (3) organizing streamlined explicit methods for the provision of spiritual care to patients by nurses. These strategies could also be adopted and implemented in the clinical practicums for nursing students close to graduation. Furthermore, a systematic review by Mthembu, Wegner, and Roman (2016) identified several concepts that can be incorporated into the content knowledge covered by undergraduate nursing curriculum throughout the nursing student's education. These include but are not limited to: (1) the foundational concepts of religion, spirituality, and spiritual well-being, and how they are mutually distinct; (2) theories of spirituality; (3) professional competency in spiritual assessment of patients and provision of spiritual care; (4) evidence-based studies on the positive health impact of spirituality and spiritual care; (5) principles and considerations of ethical spiritual care; (6) the role of cultural beliefs and values in delivering effective spiritual care to patients with diverse cultural or religious backgrounds; (7) self-awareness and self-discovery exercises.

Although faculty support was not found to be a statistically significant predictor of reduced stress among nursing students, it did have a statistically significant negative correlation with stress. Psychological faculty support had a more significant association with reduced stress relative to functional faculty support. Consequently, the authors recommend targeted additional faculty support and psychological support resources to nursing students that have recovered from COVID-19 (or future pandemic infection). The finding that COVID-19 symptomatic infection was a statistically significant predictor for increased stress indicates that providing this targeted support could aid in reducing perceived stress. Teacher and peer support were the main pedagogic resources to enhance nursing students' mental health and competence development (Utvaer, Torbergsen, Paulsby, & Haugan, 2022). Specific strategies for providing psychological support resources to nursing students that have been recently adopted in our institution include: (1) *access to counseling*: partnering with mental health professionals to provide free or local services to students and faculty; (2) *resilience building initiatives*: including sessions on stress management, mindfulness, and coping strategies as part of the curriculum; (3) *peer-to-peer mentoring*: establishing mentorship programs pairing students with upperclassmen or alumni for guidance and emotional support.

As we have currently transitioned to the post pandemic phase, nursing education should leverage the lessons learned during COVID-19. Suggestions for provision of functional faculty support to nursing students, which are broadly applicable and have been adopted in our institution both during and after the COVID-19 pandemic include: (1) training to integrate and maximize the use of hybrid or fully online teaching modalities, including the use of high-fidelity virtual simulation and telehealth modules to prepare students for remote care environments; (2) flexible curriculum delivery using hybrid models that accommodate diverse learning needs while balancing accessibility issues, including but not limited to asynchronous options, recorded lectures, and virtual labs; (3) incorporating interprofessional collaboration education (van Diggele, Roberts, Burgess, & Mellis, 2020) into curricula, teaching students to collaborate across disciplines, a key component of pandemic response teams; (4) establishing formal mentoring to help new and current faculty adapt to changes in teaching methodologies and student engagement.

Further suggestions for functional faculty support, applicable specifically for Hispanic nursing students, that were adopted by our institution during and after the COVID-19 pandemic include: (1) adopting culturally relevant curriculum that incorporates examples and case studies reflecting the cultural backgrounds of Hispanic communities; (2) providing bilingual resources and including bilingual course sections in the course schedule; (3) providing emergency financial aid for students disproportionately affected by economic hardships; (4) partnering with Hispanic serving organizations to provide students with clinical experiences resonating with their cultural identity, including collaboration with local community health clinics to offer clinical rotations focused on underserved Hispanic populations; (5) offering flexible schedules for students juggling family and job responsibilities particularly during crises.

Limitations

Because this is a cross-sectional study, we cannot necessarily infer a causal relationship between the metrics of mental health and the independent predictors that we have identified.

To avoid fatigue of the participants in completing several instruments, participants that completed the entire survey were eligible for raffle awards; nevertheless, the length of the survey may have influenced the response rate and introduced some bias in the results.

The use of linear regression analysis assumes that the chosen scoring instruments are measuring the corresponding mental health and support mechanisms in a linear fashion. Consequently, although it is not unreasonable to use the results of the statistical analysis to identify the statistically significant predictors of poor mental health and then, determine whether they have a positive or negative effect, the respective quantitative regression coefficients should be interpreted with caution.

There is some likelihood of selection bias due to 74 out of 260 undergraduate nursing students responding to the entire survey. This concern is mitigated, to some extent, by the bell-shaped distribution of the measures for stress, anxiety, and depression shown in Table 2. Furthermore, some of the predictors of poor mental health could have failed to achieve statistical significance due to the overall sample size being small itself, irrespective of the underlying response rate. Because more than 95% of the students identified as Hispanic, and our sample was obtained from a single academic institution, the results may not necessarily be generalizable to other racial minority groups or to the overall nursing student population of the United States. Finally, because the respondents are 79.7% female, the results may not necessarily be generalizable to student populations that are gender balanced or predominantly male.

The finding of this study that faculty support is not a statistically significant predictor for stress, after controlling for other predictors, in spite of the statistically significant correlation between the SPFSS score and the PSS-10 score, could be affected by the extent of missing data in the student responses to the survey. In all other measures of mental health and support mechanisms there are missing data in no more than 1 or 2 responses, however there are 6 students that did not respond to the faculty support questions. If students are afraid to negatively report about faculty support, that could introduce some bias that could affect the statistical significance of faculty support in our analysis. Two authors of this study (NN and MID) may have had an instructional relationship with some of the study's participants, which may have contributed to this bias, notwithstanding providing assurances to the contrary and timing the data gathering period after the submission of grades for the Fall 2021 semester and before the start of the Spring 2022 semester.

This study was conducted during the Fall 2021 semester, during which time the Delta variant was predominant in the United States, vaccinations were available, and a cautious transition to on-campus teaching had begun. Therefore, the results of the study may not be necessarily generalizable to the situation at the initial onset of the COVID-19 pandemic, during the Spring 2020 and Fall 2020 semesters.

Conclusions

Resilience and spiritual well-being were consistent predictors of reduced stress, anxiety, and depression for predominantly Hispanic nursing students, during the Fall 2021 semester in a public university in South Texas. Spiritual well-being appeared to have a more important role in improving the mental health of this population of nursing students relative to nursing students of presumably higher socioeconomic status that attended a private university in California. Higher stress was associated with experiencing a symptomatic COVID-19 infection and lower depression was associated with salaried employment in a healthcare facility.

In response to future pandemic situations, the authors propose improvements in the effectiveness of virtual clinical instruction, interventions identified in the research literature for promoting increased resilience and spiritual health, targeted faculty support to students that recovered from

COVID-19 (or respective future infection), to decrease stress and anxiety and the formation of mental problems such as PTSD, insomnia, or depression. The ultimate goal is to assist nursing students to continue their professional careers and meet their educational goals. Further research is needed on assessing the student support mechanisms as predictors of stress, anxiety, and depression with a larger population of Hispanic nursing students. This study's results indicated that 28.4% of the respondents reported moderately dysfunctional or worse family functioning. A specific study evaluating the different family issues may be of importance in helping nursing students work with their family to achieve their educational goals.

Acknowledgements

The authors would like to express their sincere gratitude to the two anonymous referees and the editor-in-chief for their meticulous and constructive comments, which have significantly improved the presentation of this study.

CRediT authorship contribution statement

Maria I. Diaz: Conceptualization, Investigation, Project Administration, Writing – original draft, Writing – Review & editing. **Eleftherios Gkioulekas:** Data Curation, Formal analysis, Methodology, Software, Visualisation, Writing – original draft, Writing – Review & editing. **Nancy Nadeau:** Conceptualization, Data Curation, Investigation, Supervision, Writing – Review & editing.

Declarations of interest

The authors declare no conflicts of interest with respect to the research and authorship of this article.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

Data availability statement

The data and computer code that was used for the statistical analysis reported in this article are available from the corresponding author upon request.

References

- Akaike, H. (1974). A new look at the statistical model identification. *IEEE Trans. Automat. Contr.*, 19(6), 716-723.
- Aloba, O., Olabisi, O., & Aloba, T. (2016). The 10-item Connor-Davidson Resilience Scale: Factorial structure, reliability, validity, and correlates among student nurses in Southwestern Nigeria. *J. Am. Psychiatr. Nurses Assoc.*, 22(1), 43-51.
- Aryuwat, P., Asp, M., Lovenmark, A., Radabutr, M., & Holmgren, J. (2023). An integrative review of resilience among nursing students in the context of nursing education. *Nurs. Open.*, 10(5), 2793-2818.
- Bartlett, M., Taylor, H., & Nelson, J. (2016). Comparison of mental health characteristics and stress between baccalaureate nursing students and non-nursing students. *J. Nurs. Educ.*, 55(2), 87-90.
- Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., & Sammut, S. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *J. Affect Disord.*, 173, 90-96.
- Berryhill, M., Harless, C., & Kean, P. (2018). College student cohesive-flexible family functioning and mental health: Examining gender differences and the mediation effects of positive family communication and self-compassion. *Fam. J.*, 26(4), 422-432.

- Campbell-Sills, L., & Stein, M. (2007). Psychometric analysis and refinement of the Connor-Davidson Resilience Scale (CD-RISC): Validation of a 10-item measure of resilience. *J. Trauma Stress*, 20(6), 1019-1028.
- Campo-Arias, A., & Caballero-Dominguez, C. (2021). Confirmatory factor analysis of the family APGAR questionnaire. *Rev. Colomb. Psiquiatr.*, 50(4), 234-237.
- Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., & Zheng, J. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res.*, 287, 112934.
- Castaneda, M., Vatcheva, K., Agular, A., Arevala, F., Areteaga, A., Bazan, H., ... Chew, S.-A. (2024). A study of mental health and the coping strategies of college students in a Hispanic-serving institution during the COVID-19 pandemic. *J. Lat. Educ.*, 23(1), 99-117.
- Castilla, H., Caycho, T., Shimabukuro, M., & Valdivia, A. (2014). Perception of family functioning: psychometric analysis of Family APGAR scale in adolescence in Lima. *Propos. Represent.*, 2(1), 49-78.
- Celano, T., Harris, S., Sawyer, A., & Hamilton, T. (2022). Promoting spiritual well-being among nurses. *Nurse Leader.*, 20(2), 188-192.
- Chen, B., Wang, W., & Yang, S. (2023). The impact of family functioning on depression in college students: A moderated mediation model. *J. Affect Disord.*, 340, 448-455.
- Chen, C.-J., Chen, Y.-C., Sung, H.-C., Hsieh, T.-C., Lee, M.-S., & Chang, C.-Y. (2015). The prevalence and related factors of depressive symptoms among junior college nursing students: A cross-sectional study. *J Psychiatr Ment Health Nurs*, 22(8), 590-598.
- Chernomas, W., & Shapiro, C. (2013). Stress, depression, and anxiety among undergraduate nursing students. *Int. J. Nurs. Educ. Scholarsh.*, 10(1), 255-266.
- Chongsuvivatwong, V. (2021). Epicalc: Epidemiological Calculator [Computer software manual]. Retrieved from <https://medipe.psu.ac.th/epicalc/> (R package version 3.5.2.2)
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *J. Health Soc. Behav.*, 24, 385-396.
- Collado-Boira, E., Ruiz-Palomino, E., Salas-Media, P., Folch-Ayora, A., Muriach, M., & Balino, P. (2020). The COVID-19 outbreak- An empirical phenomenological study on perceptions and psychosocial considerations surrounding the immediate incorporation of final-year Spanish nursing and medical students into the health system. *Nurse Educ. Today*, 92, 104504.
- Connor, K., & Davidson, J. (2003). Development of a new resilience scale: The Connor-Davidson Resilience Scale (cd-risc). *Depress. Anxiety*, 18, 76-82.
- Daaleman, T., & Frey, B. (2004). The Spirituality Index of Well-Being: A new instrument for health-related quality-of-life research. *Ann. Fam. Med.*, 2(5), 499-503.
- Davis, H., McCorkell, L., Vogel, J., & Topol, E. (2023). Long COVID: major findings, mechanisms and recommendations. *Nat. Rev. Microbiol.*, 21(3), 133-146.
- Dewart, G., Corcoran, L., Thirsk, L., & Petrovic, K. (2020). Nursing education in a pandemic: Academic challenges in response to COVID-19. *Nurse Educ. Today*, 92, 104471.
- Dhabhar, F. (2014). Effects of stress on immune function: the good, the bad, and the beautiful. *Immunol Res.*, 58(2-3), 193-210.
- Elmer, T., Mephram, K., & Stadtfeld, C. (2020). Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. *PLoS ONE*, 15, e0236337.
- Epidemiology Group of Emergency Response Mechanism of New Coronavirus Pneumonia, Chinese Center for Disease Control and Prevention. (2020). Analysis of epidemiological characteristics of new coronavirus pneumonia. *Chin. J. Epidemiol.*, 41, 145-151.
- Estrella-Proano, A., Rivadeneira, M., Alvarado, J., Murtagh, M., Guijarro, S., Alomoto, L., & Canarejo, G. (2024). Anxiety and depression in first-year university students: the role of family and social support. *Front. Psychol.*, 15, 10.3389/fpsyg.2024.1462948.
- Fernandez, R., Lord, H., Halcomb, E., Moxham, L., Middleton, R., Alananzeh, I., & Ellwood, L. (2020). Implications for COVID-19: A systematic review of nurses' experiences of working in acute care hospital settings during a respiratory pandemic. *Int. J. Nurs. Stud.*, 111, 103637.
- Fitzgerald, A., & Konrad, S. (2021). Transition in learning during COVID-19: Student nurse anxiety, stress, and resource support. *Nurs. Forum.*, 56(2), 298-304.
- Fox, J., & Weisberg, S. (2019). *An R companion to applied regression* (Third ed.). Thousand Oaks CA:

- Sage. Retrieved from <https://socialsciences.mcmaster.ca/jfox/Books/Companion/>
- Galanis, P., Psomiadi, M., Karagkounis, C., Manomenidis, P. L. . G., Panayiotou, G., & Bellali, T. (2023). Psychometric properties of the Greek version of the Connor-Davidson Resilience Scale (CD-RISC-10) in a sample of nurses. *Int. J. Environ. Res. Public Health.*, *20*, 6752.
- Gimenez-Espert, M., Prado-Gasco, V., & Soto-Rubio, A. (2020). Psychosocial risks, work engagement, and job satisfaction of nurses during COVID-19 pandemic. *Front. Public Health.*, *8*, 566896.
- Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). *Multivariate data analysis* (5th ed.). Prentice Hall.
- Hughes, V., Cologer, S., Swoboda, S., & Rushton, C. (2021). Strengthening internal resources to promote resilience among prelicensure nursing students. *J. Prof. Nurs.*, *37*(4), 777-783.
- International Family Nursing Association. (2023). *IFNA 2023 Family Measures Project*. (Available online: <https://internationalfamilynursing.org/resources-for-family-nursing/research/measurement-resources/> (accessed on February 2, 2025))
- Jeong, H., Yim, H., Song, Y., Ki, M., Min, J., Cho, J., & Chae, J. (2016). Mental health status of people isolated due to Middle East Respiratory Syndrome. *Epidemiol. Health.*, *38*, e2016048.
- Jin, J. (2023). Factors influencing spiritual health among nursing students in the prolonged COVID-19 situation. *Int. J. Environ. Res. Public Health.*, *20*, 3716.
- Jones, K., Hein, L., & James, L. (2021). A nursing leadership practicum in the time of COVID-19: A southeastern university experience. *Nurse Leader.*, *19*(2), 145-149.
- Kim, M., Kang, H., & Gagne, J. D. (2021). Nursing students' perceptions and experiences of using virtual simulation during the COVID-19 pandemic. *Clin. Simul. Nurs.*, *60*, 11-17.
- Kim, S., Sloan, C., Montejano, A., & Quiban, C. (2021). Impacts of coping mechanisms on nursing students' mental health during COVID-19 lockdown: A cross-sectional survey. *Nurs. Rep.*, *11*, 36-44.
- Kroenke, K., Spitzer, R., & Williams, J. (2001). The PHQ-9: Validity of a brief depression severity measure. *J. Gen. Intern. Med.*, *16*(9), 606-613.
- Labrague, L. (2022). Specific coping styles and its relationship with psychological distress, anxiety, mental health, and psychological well-being among student nurses during the second wave of the COVID-19 pandemic. *Perspect. Psychiatr. Care.*, *58*(4), 2707-2714.
- Labrague, L., McEnroe-Petitte, D., Amri, M. A., Fronda, D., & Obeidat, A. (2018). An integrative review on coping skills in nursing students: implications for policymaking. *Int. Nurs. Rev.*, *65* (2), 279-291.
- Lee, E.-H. (2012). Review of the psychometric evidence of the Perceived Stress Scale. *Asian Nurs. Res.*, *6*(4), 121-127.
- Li, Y., Au, M., Tong, L., Ng, W., & Wang, S. (2022). High-fidelity simulation in undergraduate nursing education: A meta-analysis. *Nurse Educ. Today*, *111*, 105291.
- Li, Z., & Hasson, F. (2020). Resilience, stress, and psychological well-being in nursing students: A systematic review. *Nurse Educ. Today*, *90*, 104440.
- Liu, L., Chen, J., Liang, S., Yang, W., Peng, X., Cai, C., . . . Zhao, J. (2023). Impact of family functioning on mental health problems of college students in China during COVID-19 pandemic and moderating role of coping style: a longitudinal study. *BMC Psychiatry*, *12*, 244.
- Lopez, J. S., Gomez, J. G., Ballesta-Ruiz, M., Garcia-Pina, R., Sanchez-Rodriguez, I., Bonilla-Escobar, B., . . . Chirlaque, M. (2024). COVID-19, social determinants of transmission in the home. A population-based study. *Eur. J. Public Health.*, doi:10.1093/eurpub/ckae016.
- Lowe, B., Decker, O., Muller, S., Brahler, E., Schellberg, D., Herzog, W., & Herzberg, P. (2008). Validation and standardization of the Generalized Anxiety Disorder screener (GAD-7) in the general population. *Med. Care*, *46*(3), 266-274.
- Magnavita, N., & Chiorri, C. (2018). Academic stress and active learning of nursing students: A cross-sectional study. *Nurse Educ. Today*, *68*, 128-133.
- Marc, M., Bartosiewicz, A., Burzynska, J., Chmiel, Z., & Januszewicz, P. (2019). A nursing shortage-a prospect of global and local policies. *Int. Nurs. Rev.*, *66*(1), 9-16.
- Mariveles, M. (2019). *Predictors of perceived faculty support in pre-licensure registered nursing students* (Unpublished doctoral dissertation). University of Texas at Arlington. ((Advisor: L.D. John))
- Masha'al, D., Rababa, M., & Shahrou, G. (2020). Distance learning-related stress among undergraduate nursing students during the COVID-19 pandemic. *J. Nurs. Educ.*, *59*(12), 666-674.
- Mauder, R., Lancee, W., Balderson, K., Bennett, J., Borgundvaag, B., Evans, S., . . . Wasylenki, D. (2006). Long-term psychological and occupational effects of providing hospital healthcare during

- SARS outbreak. *Emerg Infect Dis.*, 12(12), 1924-1932.
- Mthembu, T., Wegner, L., & Roman, N. (2016). Teaching spirituality and spiritual care in health sciences education: A systematic review. *Afr. J. Phys. Act. Health Sci.*, 22(41), 1036-1057.
- Onder, G., Rezza, G., & Brusaferro, S. (2020). Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. *JAMA*, 323, 1775-1776.
- Pearman, A., Hughes, M., Smith, E., & Neupert, S. (2020). Mental health challenges of United States healthcare professionals during COVID-19. *Front. Psychol.*, 11, 2065.
- Pena, E., & Slate, E. (2006). Global validation of linear model assumptions. *J. Amer. Statist. Assoc.*, 101(473), 341-354.
- Pena, E., & Slate, E. (2019). GVLMA: Global Validation of Linear Models Assumptions [Computer software manual]. Retrieved from <https://CRAN.R-project.org/package=gvlma> (R package version 1.0.0.3)
- R Core Team. (2022). R: A Language and Environment for Statistical Computing [Computer software manual]. Vienna, Austria. Retrieved from <https://www.R-project.org/>
- Reyes, A., Andrusyszyn, M.-A., Iwasiw, C., Forchuk, C., & Babenko-Mould, Y. (2015). Nursing students' understanding and enactment of resilience: a grounded theory study. *J. Adv. Nurs.*, 71(11), 2622-33.
- Rizopoulos, D. (2006). LTM: An R package for Latent Variable Modelling and Item Response Theory Analyses. *Journal of Statistical Software*, 17(5), 1-25.
- Santos, J. D. L., Labrague, L., & Falguera, C. (2022). Fear of COVID-19, poor quality of sleep, irritability, and intention to quit school among nursing students: A cross-sectional study. *Perspect. Psychiatr. Care.*, 58(1), 71-78.
- Savitsky, B., Findling, Y., Ereli, A., & Hendel, T. (2020). Anxiety and coping strategies among nursing students during the COVID-19 pandemic. *Nurse Educ. Pract.*, 46, 102809.
- Shelton, E. (2003). Faculty support and student retention. *J. Nurs. Educ.*, 42(2), 68-76.
- Smilkstein, G., Ashworth, C., & Montano, D. (1982). Validity and reliability of the family APGAR as a test of family function. *J. Fam. Pract.*, 15, 303-311.
- Spitzer, R., Kroenke, K., Williams, J., & Lowe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Arch. Intern. Med.*, 166, 1092-1097.
- Stubin, C., Ruth-Sahd, L., & Dahan, T. (2024). Promoting nursing student mental health wellness: The impact of resilience-building and faculty support. *Nurse Educ*, 49(3), 119-124.
- Sun, Y., Kong, Z., Song, Y., Liu, J., & Wang, X. (2022). The validity and reliability of the PHQ-9 on screening of depression in neurology: a cross sectional study. *BMC Psychiatry*, 22, 98.
- United Nations Educational, Scientific and Cultural Organization (UNESCO). (2020). *Covid-19 educational disruption and response*. (Available online: <https://en.unesco.org/covid19/educationresponse> (accessed on 10 July 2020))
- Urban, R., Smith, J., Wilson, S., & Cipher, D. (2021). Relationships among stress, resilience, and incivility in undergraduate nursing students and faculty during the COVID-19 pandemic: Policy implications for nurse leaders. *J. Prof. Nurs.*, 37(6), 1063-1070.
- Utvaer, B., Torbergsen, H., Paulsby, T., & Haugan, G. (2022). Nursing students' emotional state and perceived competence during the COVID-19 pandemic: The vital role of teacher and peer support. *Front. Psychol.*, 12, 793304.
- van Diggele, C., Roberts, C., Burgess, A., & Mellis, C. (2020). Interprofessional education: tips for design and implementation. *BMC Med. Educ.*, 20, 455.
- Verity, R., Okell, L., Dorigatti, I., Winskill, P., Whittaker, C., Imai, N., ... Ferguson, N. (2020). Estimates of the severity of coronavirus disease 2019: A model-based analysis. *Lancet Infect. Dis.*, 20, 669-677.
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C., & Ho, R. (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.
- Wang, C., & Zhao, H. (2020). The impact of COVID-19 on anxiety in Chinese university students. *Front. Psychol.*, 11, 1168.
- World Health Organization. (2020). *WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020*. (Available online: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-11-march-2020> (accessed on 10 March 2023))
- Xiong, J., Lipsitz, O., Nasri, F., Lui, L., Gill, H., Phan, L., ... McIntyre, R. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *J. Affect Disord.*, 277,

55-64.

- Yuksel, A., & Bahadir-Yilmaz, E. (2019). The effect of mentoring program on adjustment to university and ways of coping with stress in nursing students: A quasi-experimental study. *Nurse Educ. Today*, *80*, 52-58.
- Zhao, M., Kadir, N. A., & Razak, M. A. (2024). The relationship between family functioning, emotional intelligence, loneliness, social support, and depressive symptoms among undergraduate students. *Behav. Sci.*, *14*(9), 819.