

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

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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:** The research design is based on a cross-sectional on-line survey, using self-reported questionnaires. Linear regression was used to identify the predictors of 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, Chinese Center for Disease Control and Prevention, 2020; Onder, Rezza, & Brusaferro, 2020; Verity et al., 2020), many countries implemented strict quarantine measures. These unprecedented pandemic response measures had an overwhelming adverse impact on the ability of all students to cope during

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their studies, resulting in increased levels of stress, anxiety, and depression (Elmer, Mepham, & Stadtfeld, 2020; Wang et al., 2020; Wang & Zhao, 2020).

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, all 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, & Shahrou, 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. 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). Fears related to COVID-19 were prevalent amongst all 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 further intensified during the COVID-19 pandemic 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. This high level of stress and anxiety had a negative impact on the academic and personal student lives resulting in academic failure, as well as dismissal due to fear of disease and the inability to complete the course workload (Fitzgerald & Konrad, 2021). The heightened levels of stress and fear resulted in the development of mental health problems such as PTSD, insomnia, and depression (Savitsky, Findling, Ereli, & Hendel, 2020). Furthermore, the limited availability of clinical placement and the lack of access to on-campus resources resulted in incomplete coursework, an inability for student nurses to progress in the nursing program, and to graduate in a timely manner.

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 amongst nursing students in the United States ranged between 21% to 31%, whereas normal levels for stress, anxiety, and depression ranged between 60% and 67%. Chen et al. (2015) also reported a prepandemic prevalence of minimal depression amongst 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).

Approximately more than a billion students were affected during the pandemic (United Nations Educational, Scientific and Cultural Organization (UNESCO), 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). These types of crises seem to cause an additional burden to the already stressed nursing students which begins at the entrance to the nursing program (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).

This study is focused on identifying the demographic characteristics as well as the coping and support mechanisms that are statistically significant predictors of stress, anxiety, and depression among undergraduate nursing students, during the COVID-19 pandemic, in a predominantly Hispanic-serving public University in South Texas. We are particularly interested in determining which coping mechanisms and student characteristics actively contributed towards the reduction of students' stress, anxiety, and depression and whether support by the nursing faculty had an instrumental role towards that end. The 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).

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.

We considered the support mechanisms of faculty support, resilience, family functioning, and spiritual well-being as possible predictors of reduced stress, anxiety, and depression in a predominantly Hispanic nursing student cohort at the tail-end of the COVID-19 lockdowns. 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 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. 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 contributed to the reduced stress, anxiety, and depression of the nursing students in this cohort.

Methods

Study design and data collection

The research design is a cross-sectional online survey using self-reported questionnaires that were conducted using the Qualtrics XM platform via the University's website. With permission from each course coordinator, all undergraduate nursing students attending the Fall 2021 semester at a public university in South Texas were sent a recruitment script via the Blackboard learning management system. The recruitment script assured students that their participation in the study is confidential and voluntary and, furthermore, that participation or lack thereof would not affect their course grades or relationship with the school. The 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.

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.

Study survey

The study survey collected several types of background information on each respondent including demographic data, detailed information about family life and the professional status of the respondent, whether the respondent was infected with COVID-19 during their stay at the university, and whether the respondent was vaccinated against COVID-19. 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 professional 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 are the dependent variables. The corresponding possible predictor variables consist 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 based on the additional information collected by the study questionnaire.

Measures used in the study survey

The Perceived Stress Scale (PSS 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 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 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*.

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.

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.

The 10-item Connor-Davidson Resilience Scale (CD-RISC-10 scale) asks respondents to assess their 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 Adaptation Partnership Growth Affection Reflection scale (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 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.

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.

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 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 by minimizing the Akaike Information Criterion. The linear regression assumptions were checked for the simplified models by calculating the global test statistic, skewness, kurtosis, link function, and heteroscedasticity (Pena & Slate, 2006), and outliers were identified using QQ-plots and removed, when necessary. Multicollinearity was ruled out in the simplified models by calculating the variance inflation factors (VIF) for the predictor variables and confirming that $VIF < 1/(1 - R^2)$, with R^2 the adjusted R-squared of the respective model. The p -value threshold $p < 0.05$ is used to establish statistical significance.

All statistical calculations were conducted with R version 4.1.3 (R Core Team, 2022). The *Epicalc* package (Chongsuvivatwong, 2021) was utilized for the reporting of the results of linear regressions, and the *GVLMA* package (Pena & Slate, 2019) was used to run the diagnostics on the statistical assumptions underlying the linear regressions. Outliers were identified using the base plot function available in R. The variance inflation factors were calculated using the *CAR* package (Fox

& Weisberg, 2019). The Cronbach alpha and its 95% confidence interval were calculated using the LTM package (Rizopoulos, 2006).

Results

Sample description

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% 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 paper for the measures corresponding to faculty support, resilience, and spiritual well-being. For all other scores, 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 scores. 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 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, GAD-7, PHQ-9, SPFSS, CD-RISC-10, APGAR, and SIWB scales. To calculate the 95% confidence intervals for the Cronbach alpha, 1,000,000 bootstrap samples were used, iterated 5 times. The number of bootstrap samples was determined empirically in order to stabilize the 95% confidence interval. 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 scores the Cronbach alpha exceeded 0.7, we confirmed that all assessment instruments used were internally consistent.

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 scale (stress)			
No perceived stress	PSS = 0	0	0.0
Low perceived stress	$1 \leq \text{PSS} \leq 13$	23	31.1
Moderate perceived stress	$14 \leq \text{PSS} \leq 26$	44	59.5
High perceived stress	$27 \leq \text{PSS} \leq 40$	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
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 (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
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.

Table 4

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

Ordinal covariates	r_τ (p)		
	PSS (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)
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 (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 (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 measures of stress, anxiety, and depression

Table 4 shows the bivariate Kendall tau correlations between the mental health measures (PSS scale, GAD-7 scale, and PHQ-9 scale) and the support mechanism measures (SPFSS scale, CD-RISC-10 scale, APGAR scale, SIWB scale), 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.

Higher resilience, family functioning, and spiritual well-being were negatively correlated with higher stress, anxiety, and depression, with spiritual well-being showing the strongest and most statistically significant correlation, followed by family functioning, and then by resilience ($p < 0.05$). Higher faculty support had a statistically significant negative correlation with higher stress ($r_\tau = -0.186$; $p = 0.03$). Although there was also a weak signal of negative correlation between higher faculty support with higher anxiety and with higher depression, both correlations failed to be statistically significant but tended towards significance with $p = 0.061$ and $p = 0.69$ correspondingly. Considering the faculty support subscales, corresponding to psychological support vs. functional support, shows that only psychological faculty support has a statistically significant negative correlation with higher stress ($r_\tau = -0.199$; $p = 0.02$).

With respect to the demographic variables, higher stress had statistically significant negative correlations with increasing age group ($r_\tau = -0.247$; $p = 0.01$), being married ($r_\tau = -0.272$;

$p = 0.006$), having a father born in the United States ($r_\tau = -0.21$; $p = 0.033$), and statistically significant positive correlation with having been infected with COVID-19 ($r_\tau = 0.242$; $p = 0.014$) during the respondents stay at the University. Higher anxiety also had a statistically significant negative correlation with increasing age group ($r_\tau = -0.2$; $p = 0.038$) and working as a salaried worker in a healthcare facility ($r_\tau = -0.205$; $p = 0.039$). Depression had statistically significant negative correlation with being married ($r_\tau = -0.2$; $p = 0.043$) and working as a salaried worker in a healthcare facility ($r_\tau = -0.268$; $p = 0.007$).

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 measures for poor mental health (stress, anxiety, and depression). Among those three demographic 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 5 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.

Linear regression model for predictors of 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 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 predictor variables was used to determine simplified linear models that best fit the data by minimizing the Akaike Information Criterion. For each of the 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 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 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 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 scale (stress) linear regression model. If the SPFSS faculty support scale is replaced with the psychological faculty support subscale in the construction of the PSS scale (stress) preliminary linear regression model (not shown), then the SPFSS 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, retaining them results in a more optimal model, in terms of optimal Akaike Information Criterion. Indeed, the confidence

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 (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
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
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
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, GAD-7, PHQ-9, SPFSS, CD-RISC-10, 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.

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.

The interpretation of the diagnostic tests shown on Table 9 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 are acceptable when the p -value of the corresponding test exceeds the 0.05 threshold for statistical significance. Table 9, shows that all linear regression assumptions are satisfied by our finalized linear regression models.

Higher resilience was a statistically significant predictor of reduced stress ($\beta =$

Table 8

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

	β	95% CI	p	VIF
Model for the PSS (stress) scale ($n = 63$)				
CD-RISC-10 (resilience) rescaled score	-0.2	(-0.39,-0.01)	0.038	1.17
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
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, GAD-7, PHQ-9, CD-RISC-10, 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 $1/(1 - R^2) = 1.79$.

-0.2; CI:(-0.39, -0.01); $p = 0.038$), anxiety ($\beta = -0.59$; CI:(-0.97, -0.2); $p = 0.004$), and depression ($\beta = -0.35$; CI:(-0.63, -0.08); $p = 0.012$). Higher family functioning was a statistically significant predictor of reduced stress ($\beta = -0.26$; CI:(-0.38, -0.15); $p < 0.001$). Higher spiritual well-being was a statistically significant predictor of reduced stress ($\beta = -0.31$; CI:(-0.47, -0.14); $p < 0.001$), reduced anxiety ($\beta = -0.51$; CI:(-0.86, -0.15); $p = 0.006$), and reduced depression ($\beta = -0.51$; CI:(-0.74, -0.27); $p < 0.001$). Having gone through a COVID-19 infection was a statistically significant predictor of increased stress ($\beta = 0.33$; CI:(0.08, 0.58); $p = 0.01$). Working as a salaried worker in a healthcare facility was a statistically significant predictor of reduced depression ($\beta = -0.63$; CI:(-1.2, -0.07); $p = 0.028$). It could also be a strong predictor of reduced anxiety ($\beta = -0.78$; CI:(-1.58, 0.02); $p = 0.056$), however there was a borderline failure to achieve statistical significance.

The finalized model included the following non-significant predictors, because retaining them resulted in a more optimal linear fit: (a) having a father born in the United States had a weak association with reduced stress with weak tendency towards significance ($\beta = -0.18$; CI:(-0.42, 0.05); $p = 0.118$); (b) working as a salaried worker in a healthcare facility had a strong association with reduced anxiety with strong tendency towards statistical significance ($\beta = -0.78$; CI:(-1.58, 0.02); $p = 0.056$); (c) higher family functioning had a weak association with reduced depression with weak tendency towards significance ($\beta = -0.13$; CI:(-0.29, 0.04); $p = 0.134$). A future study should explore whether these predictors may achieve statistical significance, with a larger sample size than the dataset used in our study.

Comparing the adjusted linear regression coefficients for each linear regression model shows

Table 9

Diagnostics for finalized linear regression models reported on Table 8

Diagnostic	Value	p-value	Decision
Diagnostics for the PSS (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

the following: Higher resilience, family functioning and spiritual well-being contributed almost equally towards the reduction of stress. Likewise, resilience and spiritual well-being contributed almost equally towards the reduction of anxiety. However, with regards to reducing depression, spiritual well-being made the strongest contribution followed by increasingly weaker contributions by resilience and then by family functioning.

Discussion

Summary of findings

The main finding of our cross-sectional analysis is that resilience and spiritual well-being were statistically significant predictors of reduced stress, anxiety, and depression, in our population of nursing students in a Hispanic-serving public university in South Texas. Family functioning was a statistically significant predictor of reduced stress, contributing equally to that tendency as resilience and spiritual well-being. Family functioning was also a weak predictor of reduced depression, that was not statistically significant even though it did tend towards statistical significance. Although family functioning had a statistically significant correlation with reduced anxiety, it was not a statistically significant predictor of reduced anxiety after adjusting for all other covariates.

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. From the other covariates, nursing students being employed as salaried healthcare workers was shown to have a statistically significant association with reduced depression, as well as an association with reduced anxiety which was not statistically significant but tended towards significance. Second, a weak association between reduced stress and having a father that was born in the United States was found, which was not statistically significant but tended towards significance. These variables were not considered as possible predictors by S. Kim et al. (2021).

It is also worth highlighting that a linear dependence between improved mental health and the corresponding statistically significant predictors has been established and confirmed by the appropriate statistical diagnostic analysis, whereas S. Kim et al. (2021) did not attempt to conduct a multiple linear regression analysis; instead they used cut-off thresholds to dichotomize the mental health scales and support mechanisms scales and to then conduct a logistic regression, which could make their results sensitive to the multidimensional choice of several cut-off thresholds. It is not necessary to dichotomize the mental health and support mechanism measures because the respective associations were shown to be governed by linear models that satisfy the assumptions of multiple linear regression 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.

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.

Although faculty support was not found to be a statistically significant predictor of reduced stress amongst nursing students, it did have a statistically significant negative correlation with stress. In particular, 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).

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.

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. There is also good reason to be concerned about selection bias due to the low response rate. 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 SPSS score and the PSS 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.

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 particular 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.

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

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