Research Article

OJED
OPEN JOURNALS IN EDUCATION

© *Journal of International Students*
Volume 12, Issue 1 (2022), pp. 101-122
ISSN: 2162-3104 (Print), 2166-3750 (Online)
doi: 10.32674/jis.v12i1.2914
ojed.org/jis

Biopsychosocial Factors Associated with Depression Among U.S. Undergraduate International Students

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ABSTRACT

Using a biopsychosocial framework, our study examines the biological, psychological, and sociocultural factors associated with depression among a cross-sectional sample of undergraduate international students (N = 712) attending 28 U.S. colleges and universities. Consistent with hypotheses, regression analysis reveals that self-esteem, life satisfaction, and coping self-efficacy are negatively associated with depressive symptoms, and that ethnic minority status, perceived discrimination, and financial concerns are positively associated with depressive symptoms. Contrary to predictions, age, optimism, friendships, and school belonging are not significant predictors, and perseverance predicted increased depression in this sample. The novel findings highlight adaptation issues among international undergraduate students and suggest preventive measures and interventions against depression for university administrators and counselors.

Keywords: biopsychosocial model, depression, international students, United States

Globally, college students are at risk of developing and maintaining mental disorders (Auerbach et al., 2018). Most high-prevalence mental disorders (e.g., mood, substance use) have onsets during adolescence and early adulthood (de Girolamo et al., 2012). Thirty-five percent of a global college student sample screened positive for at least one common lifetime disorder, and depression was the most prevalent mental disorder assessed (Auerbach et al., 2018). In the United States, 46% of college students surveyed felt "so depressed that it is difficult to function" (American College Health Association [ACHA], 2019). Depression is a prolonged state of sadness, lethargy, self-worthlessness, guilt, or related symptoms on significant levels (Comer & Comer, 2018) and has been linked with a variety of negative outcomes in college students, including impaired academic performance (Hysenbegasi et al., 2005), damaged social relationships (Alonso et al., 2018), alcohol-related problems (Martens et al., 2008), unwanted sexual encounters (Mackenzie et al., 2011), and suicidal thoughts and behaviors (Mortier et al., 2018). College student depression warrants more attention, as suicide is the second leading cause of death among adolescents and young adults, and suicide mortality rate increased by 31% from 2001 to 2017 in the United States (Center for Disease Control, 2019).

Despite the plentitude of depression research on U.S. college students, depression among the 431,930 international students (i.e., students with an F-1 or J-1 visa; Institute of International Education [IIE], 2019) is relatively understudied. International students have reported more depressive symptoms than their domestic counterparts and are not always aware of campus mental health services (Acharya et al., 2018; Han et al., 2013). Depression was the most reported symptom among international students attending university counseling, and depression severity appears to be more acute for undergraduate compared with graduate international students (Kim et al., 2019; Wei et al., 2008). Similarly, undergraduate international students' socioemotional outcomes differ from their graduate counterparts in that undergraduate students experienced lower belonging, well-being, and social access (Brunsting et al., 2019; S. Han et al., 2017). Thus, there is the need to identify factors associated with depression for undergraduate international students.

Prior literature on depression among international students in U.S. institutions of higher education has examined a range of predictors: individual-level factors, including biological (e.g., gender), behavioral (e.g., exercise), cognitive (e.g., self-esteem), and affective factors (e.g., homesickness), as well as contextual-level factors, including cultural, interpersonal, and school factors (Brunsting et al., 2018b). However, there are a number of factors associated with depression in prior research that have not been examined in samples of international students, including age (e.g., Kim et al., 2019), coping self-efficacy (e.g., Kwasky & Groh, 2014), perseverance (e.g., Sharkey et al., 2018), life satisfaction (e.g., Seo et al., 2018), ethnic minority status (Bailey et al., 2019), friendship (e.g., Liu et al., 2019), and school belonging (e.g., Gummadam et al., 2016). To better understand depression in international students, it is important to examine a wide array of potential factors including both novel factors and those with documented relationships.

Researchers providing initial forays into understanding international student depression have typically examined factors of depression in convenience samples from one college or university (Brunsting et al., 2018b), which limits generalizability of results. Prior studies have typically examined two to four potential correlates of depression. Although this makes an important contribution to the field, there is the need to examine a larger number of factors simultaneously to better understand which key factors are associated strongly with depression for undergraduate international students, and which factors' relationships with depression are attenuated by inclusion of other variables. Such information is critical to researchers and would allow practitioners to better use limited resources to support undergraduate international students' mental health.

To address this gap by enhancing generalizability of findings and identifying key factors associated with depression, we conducted a secondary data analysis of a national sample of undergraduate international students (n = 712) from 28 higher education institutions in the United States using the biopsychosocial model (Engel, 1977) to examine whether 12 biological, psychological, and sociocultural factors (including novel factors: age, coping self-efficacy, perseverance, life satisfaction, ethnic minority status, friendships, and school belonging) are associated with depression.

LITERATURE REVIEW

Biological Factors

Female gender and younger age are associated with higher depressive symptoms in international students (Acharya et al., 2018; Kim et al., 2019; Li et al., 2013), and our study aimed to extend the findings to a larger sample.

In a diverse sample of international students, female students suffered a higher degree of depression than their male counterparts (Kim et al., 2019). A recent study with both domestic and international students found that female students and international students exhibited greater depressive symptoms than male and domestic students, respectively (Acharya et al., 2018). Female students also experienced higher levels of stress across events than males, suggesting a heightened stress reactivity and depression risk (Acharya et al., 2018).

Further, undergraduate international students experience a greater amount of stress and depression than their graduate counterparts during the acculturation process (Kim et al., 2019; Li et al., 2013). These studies indicate that undergraduate international students, who are on average younger than masters' and doctoral students, are more vulnerable to depression symptoms. Likewise, older undergraduate international students might be more psychologically mature, more acculturated, have a more extensive social network, and develop better coping strategies, which helps them through times of stress and difficulty, whereas younger students more recently graduated high school, separated from family and friends, moved to a foreign country, and probably experienced acculturative stress for the first time in their lives (Kim et al., 2019; Li et al., 2013). Therefore, we

predicted young age and female gender to be risk factors for depression in undergraduate international students.

Psychological Factors

Research has found coping to be a significant predictor of depression in international students (Areba et al., 2018; Jackson et al., 2013). However, the results about the directionality of this association have been mixed. A recent study of Somali international students documented that positive religious coping (e.g., religious forgiveness) was linked with a decrease in depressive symptoms (Areba et al., 2018). However, another study surprisingly found that, for international students, both adaptive coping (e.g., positive coping, humor) and maladaptive coping (e.g., substance use, denial) were associated with more depressive symptoms (Jackson et al., 2013). These findings indicate that the effectiveness of a particular coping style may vary among individuals and situations, and that depressed individuals may use coping more frequently than healthy individuals.

Given the documented relationship between use of coping strategies (either positive or negative coping) and depression, we chose to focus on coping self-efficacy (i.e., an individual's perceived ability to effectively cope with difficulties), rather than the style or frequency of coping, as the former might be a more useful predictor of depression. Coping self-efficacy mediated the impact of ecological risks on depression in urban African American youth (Prelow et al., 2006), indicating coping self-efficacy may be a key construct. Hence, we expected that coping self-efficacy would buffer depression among undergraduate international students.

Low self-esteem and less optimism appeared to be risk factors of depression in international students (Jackson et al., 2013). Perseverance or grit was negatively associated with anxious and depressive symptoms and positively associated with emotional well-being in college students with chronic medical conditions (Sharkey et al., 2018). In a meta-study of grit literature, perseverance of effort explained a significant amount of the variance in academic performance even after controlling for conscientiousness (Credé et al., 2017). Recent research found immigrant-origin Black students outperformed their U.S. origin counterparts in academic achievement and college persistence (Jenkins et al., 2004; Tauriac & Liem, 2012). As international students also seek educational and occupational opportunities in the United States, it is possible they may also have high perseverance, which is predictive of well-being.

Another protective factor is life satisfaction, a trait-like construct that has been associated with a range of positive life events (Luhmann et al., 2013), including a lower risk of depression for Korean college students (Seo et al., 2018). Taken together, we expected self-esteem, optimism, perseverance, and life satisfaction to be protective factors against depression in a larger and more representative sample of undergraduate international students.

Sociocultural Factors

Findings from a recent review highlighted that a range of risk factors, including racial discrimination, linguistic and cultural barriers, cultural insensitivity and biases of providers, patients' mistrust of providers, and social stigmas surrounding mental health, appeared to contribute to disparities in diagnosis and treatment of depression in ethnic minority communities in the United States (Bailey et al., 2019). It is not surprising then that Latinx and African international students at U.S. institutions had greater depression than other ethnic groups, suggesting ethnic minority status as a risk factor for depression among undergraduate international students as well (Constantine et al., 2004; Sümer et al., 2008).

More social support has been linked with fewer depressive symptoms and less difficulty with sociocultural adjustment among international students (Jackson et al., 2013; Meghani & Harvey, 2016; Shadowen et al., 2019; Sümer et al., 2008), but less is known about the role of friendship in international student depression. High-quality friendship seems to be a protective factor against depression, as evidenced in youth samples (Burke et al., 2017; Liu et al., 2019). School belonging was associated with lower levels of depression in a cohort of undergraduate ethnic minority students (Gummadam et al., 2016). International student studies showed that students with a greater sense of campus belonging had decreased suicidal ideation (Servaty-Seib et al., 2016) and increased psychological well-being (Brunsting et al., 2021), further suggesting the potential protective effect of school belonging against depression. Perceived discrimination was associated with depressive symptoms (Shadowen et al., 2019; Wei et al., 2008), while fewer financial concerns predicted lower depression in international students (Meghani & Harvey, 2016). Therefore, we predicted that friendships and school belonging would be positive factors, whereas perceived discrimination and financial concerns would be risk factors for depression among undergraduate international students.

Our literature review reflected a knowledge gap for variables associated with depression among international students on U.S. college campuses. Of the 20 identified studies investigating international student depression in the United States, half only recruited students from one institution, 12 studies primarily examined graduate student samples, and 12 studies exclusively included students from Asian origins. The number of factors in these studies was limited to two to four, due to their relatively small sample sizes. With the large, multi-institutional sample in our study, we sought to enhance the literature by (a) extending prior research by examining novel factors for depression as yet untested for international students; (b) examining a total of 12 novel and prior factors simultaneously in one analysis to understand the relative contributions of key factors to depression; and (c) increasing the generalizability of previous research on undergraduate international students.

Hypotheses

We proposed the following hypotheses:

1. Biological factors: Younger age and female gender would predict higher levels of depression.
2. Psychological factors: Higher levels of life satisfaction, self-esteem, optimism, perseverance, and coping self-efficacy would predict lower levels of depression.
3. Sociocultural factors: Ethnic minority status, weaker friendships, lower school belonging, more financial concerns, and greater perceived discrimination would predict higher levels of depression.

METHOD

We conducted analyses on data from the Wellbeing Assessment ("The Wellbeing Assessment," 2019), which is a national sample of undergraduate student well-being produced annually. The Wellbeing Assessment provides a multidimensional view of student well-being alongside student demographic, institutional setting, and civic engagement measures. The subset of data used in the study was collected in Spring 2019.

Participants

The Wellbeing Assessment was administered to undergraduate students at 28 four-year colleges and universities across the United States via Qualtrics. Incentives ranged by institutions. The Wellbeing Assessment research team reviewed all school incentive plans for alignment with Institutional Review Board protocols. A total of 94,819 students were invited to participate; 13,287 (14.01%) consented, and the final sample size was 11,923 after removing blank cases. To obtain the dataset for this study, we selected cases of participants studying in the United States on an F-1 visa, which yielded 712 participants (see Table 1 for sample demographics).

Table 1: **Participant Demographic Information**

Participants	*n*	%
Gender		
Male	210	29.49
Female	494	69.38
Other	8	1.12

Participants	*n*	%
Race/ethnicity		
Hispanic/Latino of any race	110	15.45
American Indian/Alaska Native	1	0.14
Asian	276	38.76
Black/African American	59	8.29
Native Hawaiian/Other Pacific Islander	1	0.14
White	238	33.43
Two or more races	14	1.97
Missing	13	1.80
	M	*SD*
Age	20.51	2.57

Measures

The Wellbeing Assessment

The Wellbeing Assessment underwent four rounds of cognitive interviewing studies and two pilot administrations and is in its fourth national administration. The *Engine of Well-being* model (Jayawickreme et al., 2012) provides the theoretical underpinnings of the Wellbeing Assessment, which measures 18 dimensions of well-being for students, from which we selected 10 for this study, based on prior research, as well as two biographical variables. Additional dimensions not of interest to this study (e.g., work plans, civic orientation activities) were excluded from our analysis. Data for this study are from the 2019 assessment, which incorporated a planned missing data design (Little & Rhemtulla, 2013) to decrease response fatigue and increase item response rate. Planned missing design yielded item-level missing completely at random [MCAR] rates of roughly 33%. Missingness above MCAR at the item level averaged 7.86% (range: 1.82%–13.88%) for items of constructs included in this study.

The Wellbeing Assessment constructs have demonstrated good model fit, validity, and high reliability (Brocato & Jayawickreme, 2017). For the data analyzed in this study, a confirmatory factor analysis model conducted in *lavaan* (Rosseel, 2012) with all 18 dimensions listed above and with the full sample fit the data well ($N = 11{,}923$; $\chi^2 = 7041.20$, $df = 1386$, $p < .01$; root mean square error of approximation [RMSEA] =.02; comparative fit index [CFI] =.98; standardized root means square residual [SRMR] =.17). Standardized item-factor loadings (i.e., pattern coefficients) ranged from .71 to .96 for the constructs included in this

study. Reliability estimates were calculated with *semTools* (Jorgensen et al., 2019) and demonstrated good reliability (α =.81–.96; ω =.81–.95).

Using the 18-factor confirmatory model with the entire sample, factor scores were extracted for measures of depression, life satisfaction, self-esteem, optimism, perseverance, coping self-efficacy, belonging, and friendship, using the Bartlett method, which allows for a better estimate of the "true score" by including only shared factors to impact factor scores (DiStefano et al., 2009). These factor scores were used in subsequent analyses. Life satisfaction, self-esteem, optimism, perseverance, coping self-efficacy, belonging, and friendship were assessed by levels of agreement: response options were on a 6-point Likert-type scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*).

Life satisfaction. Life satisfaction was measured with a three-item scale to provide a score of participants' feelings of contentment with their life and future outlook. An example item was "I am satisfied with the direction my life is going."

Self-esteem. Self-esteem was a three-item measure designed to capture the degree to which participants liked and thought positively of themselves. An example item was "I feel that I have a number of good qualities."

Optimism. Optimism was a three-item scale of participants' positive outlook and perspective. One item was "Overall, I expect more good things to happen to me than bad."

Perseverance. Perseverance was a three-item scale that captured participants' commitment to completing projects and goals despite difficulty. An example item was "I keep working on my tasks, even if I feel like quitting."

Coping self-efficacy. Coping self-efficacy was a three-item measure of students' evaluation of their ability to navigate difficult times in their lives. An example item was "I have a hard time making it through stressful events."

School belonging. School belonging was a three-item measure of students' sense of connectedness and feeling included within their college or university. One item was "I feel accepted at my school."

Friendships. Friendships was a three-item scale that assessed the degree to which students felt they had friends at their school who supported and cared about them. An example item was "I have friends at my school who accept me the way I am."

Financial concerns. Financial concerns was a three-item measure of the frequency at which students' thoughts and decisions were impacted by their finances during the current academic year. An example item was "During the current academic year, I have considered dropping out of college because of financial concerns." The response options were ordered: 1 (*never*), 2 (*seldom*), 3 (*sometimes*), 4 (*often*), and 5 (*very often*).

Perceived discrimination. Perceived discrimination was measured using a seven-item checklist to capture whether students felt "excluded from activities or being the target of disparaging jokes, slurs, or comments" during the current academic year due to, for example, their sexual orientation or their religious affiliation. Response options were binary: yes or no.

Depression. Depression was a three-item scale designed to assess frequency of experiencing certain feelings consistent with depression within the past two

weeks. An example item was "thinking that others would be better off without you." Response options varied on a 5-point Likert-type scale: 1 (*not at all*), 2 (*several days*), 3 (*half the days*), 4 (*over half the days*), and 5 (*nearly every day*).

Demographic information. Of demographic information collected, the current study included age, gender, and minority status. Participants reported age numerically. For gender, participants were selected from female, male, and other. Participants also reported their race/ethnicity, which was converted into a binary variable to represent whether students were considered to be from an ethnic minority (e.g., non-White) group within the United States.

Data Analysis

To prepare the data for ordinary least squares regression, we assessed variables for departures for univariate and multivariate normality (i.e., skewness ± 2, kurtosis ± 5; Ware et al., 2013). Age was skewed (3.55) and leptokurtic (21.52). We created a transformed age variable that reduced any age above 26 (n = 16) to 26 and ran two regression equations with all variables—one with age, the other with the transformed age—and there was no difference in significant associations in the equation; thus, we retained the original age variable. We flagged 13 multivariate outliers with Mahalanobis values with p <.001. We ran separate regression analyses with them included and excluded. Given differences were negligible, we retained the multivariate outliers in our analysis. Because students were clustered within colleges or universities, we calculated an intraclass correlation coefficient to examine the variance in depression accounted for by institution. Institution accounted for 2.56% of the variance, well below the 5%–10% recommendation for multilevel regression (LeBreton & Senter, 2008). We calculated variance inflation factors (VIFs) to test for multicollinearity. Optimism had a VIF > 6. Caution is recommended with variables with VIFs > 5; however, large sample sizes and high R^2 regression values such as those in the current study reduce the potential influence of multicollinearity (O'Brien, 2007). To account for testing 12 factors for significance, we included a Bonferroni correction to the p <.05 significance level (e.g., the factor with lowest p value was considered significant if p <.0042 [.05/12], the factor with the second lowest p value was considered significant if p <.0045 [.05/11], and so on).

RESULTS

Correlations

We estimated Pearson correlation coefficients for continuous variables and Spearman correlation coefficients for dichotomous variables (see Table 2). All factors, except for age and female gender, were significantly correlated with depression. Life satisfaction, self-esteem, optimism, coping self-efficacy, perseverance, friendships, and school belonging were negatively correlated with depression. Perceived discrimination, financial concerns, and ethnic minority status were positively correlated with depression.

Table 2: Zero-Order Bivariate Correlations Among Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	M	SD
1. Dep.	1													50.32	9.31
2. Age	−0.05	1												20.51	2.57
3. Fem.	.03	−0.07	1											0.69	0.46
4. Sat.	−0.77***	.03	.06	1										49.36	9.65
5. Est.	−0.80***	.05	−0.02	.81***	1									49.68	9.56
6. Opt.	−0.76***	.07	.02	.84***	.86***	1								49.82	9.06
7. Per.	−0.41***	.05	.06	.55***	.52***	.66***	1							49.21	9.50
8. Cop.	−0.60***	.02	−0.13***	.46***	.48***	.49***	.29***	1						49.86	8.93
9. Eth.	.09*	−0.07	.01	−0.11**	−0.01	−0.03	−0.06	−0.06	1					0.67	0.47
10. Fri.	−0.38***	−0.04	.11**	.49***	.41***	.43***	.30***	.21***	−0.11**	1				50.23	8.65
11. Sch.	−0.51***	−0.01	.08*	.61***	.51***	.59***	.39***	.29***	−0.06	.64***	1			49.68	9.19
12. Dis.	.28***	−0.06	.00	−0.19***	−0.20***	−0.22***	−0.13**	−0.18***	.05	−0.18***	−0.32***	1		0.11	0.17
13. Fin.	.24***	.05	−0.02	−0.17***	−0.14***	−0.15***	−0.04	−0.13**	−0.02	−0.11**	−0.15***	.17***	1	2.05	1.00

Note: N = 712. Dep. = depression; Fem. = female gender; Sat. = life satisfaction; Est. = self-esteem; Opt. = optimism; Per. = perseverance; Cop. = coping self-efficacy; Eth. = ethnic minority status; Fri. = friendships; Sch. = school belonging; Dis. = perceived discrimination; Fin. = financial concerns. Pearson's *r* used for continuous x continuous variable correlations. Spearman's *r* used for dichotomous variable correlations (i.e., female gender and ethnic minority status).
*$p < .05$. **$p < .01$. ***$p < .001$.

Multiple Regression

Age, female gender, life satisfaction, self-esteem, perseverance, coping self-efficacy, ethnic minority status, optimism, friendships, school belonging, perceived discrimination, and financial concerns were simultaneously entered into a multiple linear regression model predicting depression for undergraduate international students (see Table 3). The overall model fit was significant, in which seven significant predictors emerged out of the 12 tested variables, $R^2 = .75$, $F(12, 604) = 154.48$, $p < .001$. No biological factors were significant. In terms of psychological and sociocultural variables, life satisfaction ($\beta = -.24$, $p < .001$), self-esteem ($\beta = -.43$, $p < .001$), coping self-efficacy ($\beta = -.21$, $p < .001$), financial concerns ($\beta = .08$, $p < .001$), perceived discrimination ($\beta = .08$, $p < .001$), perseverance ($\beta = .09$, $p = .001$), and ethnic minority status ($\beta = .06$, $p = .005$)

significantly predicted depression. Optimism, friendships, and school belonging did not reach the levels of significance. The unique variances explained by each factor as indicated by their squared semi-partial correlations (Meyers et al., 2016) were: life satisfaction 1.38%, self-esteem 4.24%, perseverance 0.50%, coping self-efficacy 3.20%, ethnic minority status 0.33%, perceived discrimination 0.53%, and financial concerns 0.60%. Among these variables, life satisfaction, perseverance, coping self-efficacy, and ethnic minority status were novel variables of depression that appeared significant in our large, diverse sample.

Table 3: Regression Analysis Predicting Depression

	B	*SE*	95% CI	β	*t*	*p*	sr^2 (%)
Constant	93.91	2.32	[89.36, 98.47]		40.53	.000*	
Age	−0.10	0.08	[−0.26, 0.05]	−.03	−1.32	.188	0.07
Female gender	−0.05	0.42	[−0.87, .78]	.00	−0.12	.907	0.00
Life satisfaction	−0.23	0.04	[−0.30, −0.15]	−.24	−5.83	.000*	1.38
Self-esteem	−0.42	0.04	[−0.50, −0.34]	−.43	−10.21	.000*	4.24
Optimism	−0.12	0.05	[−0.22, −0.02]	−.12	−2.36	.019	0.23
Perseverance	0.09	0.03	[0.04, 0.14]	.09	3.50	.001*	0.50
Coping self-efficacy	−0.21	0.02	[−0.26, −0.17]	−.21	−8.87	.000*	3.20
Ethnic minority	1.15	0.40	[0.36, 1.94]	.06	2.85	.005*	0.33
Friendships	0.02	0.03	[−0.03, 0.08]	.02	0.88	.379	0.03
School belonging	−0.02	0.03	[−0.08, 0.03]	−.03	−0.82	.411	0.03
Perceived discrimination	4.20	1.16	[1.92, 6.48]	.08	3.62	.000*	0.53
Financial concerns	0.74	0.19	[0.36, 1.12]	.08	3.83	.000*	0.60
R^2	.75						
F	154.48***						

Note: $n = 712$. sr^2 is the squared semi-partial correlation (squared part correlation).

*p value significance using Bonferroni correction (initial value = .05/12) to account for multiple comparisons.

***$p < .001$.

DISCUSSION

The current study examined predictors of depression among undergraduate international students in a multi-institutional dataset. Informed by the

biopsychosocial paradigm and prior literature, we identified associations of biological, psychological, and sociocultural factors and the severity of depression in this relatively understudied population.

First, we hypothesized that our biological factors (i.e., younger age and female gender) would predict greater depressive symptoms among undergraduate international students. Neither age nor gender was significant predictors of depression in our full model, disconfirming this hypothesis. Prior literature (Kim et al., 2019; Li et al., 2013) found that international undergraduates reported higher stress and depression than graduates, leading us to speculate that biological age might be a contributor to depression. But age fell out of the model when including other factors. With respect to gender and depression, results have been mixed. The current study contrasted results of Kim and colleagues (2019) and supported prior findings by Acharya and colleagues (2018) in that gender is not a key factor for depression. Put together, these results indicate that biological factors of age and gender do not distinguish the severity of depression in undergraduate international students in the United States.

Second, we hypothesized that our psychological factors would predict lower levels of depressive symptoms. As anticipated, high self-esteem, life satisfaction, and coping self-efficacy were associated with lower depression. Yet, perseverance positively predicted depression, and optimism did not predict depression.

Consistent with prior results among international students (Jackson et al., 2013), self-esteem was a protective factor against depression. The finding that life satisfaction was a buffer against depression in Korean college students also generalized to U.S. international students (Seo et al., 2018). The association between high coping self-efficacy and low depression echoed the few studies conducted among other populations (Kwasky & Groh, 2014; Prelow et al., 2006; P. Singh & Bussey, 2011). These patterns of findings suggest that one way to potentially mitigate feelings of depression among international students is to boost levels of self-esteem and overall satisfaction with life and to improve students' efficacy in terms of coping. Perhaps the types of coping strategies that students use are less important than the perceived effectiveness of one's coping strategies.

Surprisingly, high perseverance was associated with high depressive symptoms in contrast with a previous study (Sharkey et al., 2018). It is possible that perseverance may not predict well-being reliably across cultures (Disabato et al., 2019). Although perseverance or grit has been linked with higher life satisfaction, happiness, positive affect, and lower distress in subjective well-being research (Salles et al., 2014; K. Singh & Jha, 2008; Vainio & Daukantaitė, 2016), the examination of grit construct has been limited to "WEIRD" (Western, Educated, Industrialized, Rich, Democratic) participants. Further, hope theory suggests that unsuccessful goal attainment leads to negative emotions, and the self-concordance model proposes that extrinsic, long-term goals unaligned with one's values may not contribute to positive well-being (Sheldon & Elliot, 1999; Snyder, 2002). These theories and findings imply that perseverance by itself is not a protective factor against depression for this population, and it might backfire if students are not intrinsically motivated or have been unsuccessful in goal pursuits.

Last, we hypothesized that sociocultural factors, specifically ethnic minority status, weaker friendships, lower school belonging, perceived discrimination, and financial concerns, would predict greater depressive symptoms. Although these variables shared a small to medium correlation with depression, only ethnic minority status, perceived discrimination, and financial concerns were found to positively predict depression. The finding of ethnic minority status as a risk factor of depression increased support for prior studies identifying Lantinx and African students with greater vulnerability to depression and generalized the finding to other ethnic minority groups (Constantine et al., 2004; Sümer et al., 2008). The findings of perceived discrimination and financial concerns as risk factors of depression replicated prior literature (Meghani & Harvey, 2016; Shadowen et al., 2019). The nonsignificant findings of friendships and school belonging contrasted prior work inferring the effects of social support and school belonging in buffering against depression and promoting psychological well-being (Brunsting et al., 2019; Gummadam et al., 2016; Shadowen et al., 2019). However, this should not be taken as evidence countering that feeling included on campus and supported by one's social network contribute to one's positive well-being; in our study, friendships and school belonging shared strong negative correlations with depression. Rather, support and perceived campus inclusion may be supportive factors that mediate linkages between other factors and depression.

Implications for Research

Within the biopsychosocial model of psychopathology, the biological model emphasizes anatomical or biochemical abnormalities, the psychological model points to cognitive schemas and behavioral patterns, and the sociocultural model focuses on influences from social roles, connections, family, cultural values, and pressures (Comer & Comer, 2018). In our study, we found the relative importance of psychological and sociocultural factors in predicting depression among undergraduate international students. The predictive value of the significant variables (in descending order: self-esteem, coping self-efficacy, life satisfaction, financial concerns, perceived discrimination, perseverance, and ethnic minority status) suggests that cognitive and behavioral patterns are especially important in influencing and predicting affective outcomes. Given the interrelatedness of these constructs in individuals' lives, future research could investigate more nuanced mediating effects of, for example, social factors in the relationships between psychological factors and depressive symptoms.

Overall, the present study supports the applicability of biopsychosocial model across groups, cultures, and nationalities. The lack of significance for age and gender in predicting depression suggests the importance of integrating more biological predictors supported in the broader field of depression research. Recent research identified parental psychopathology and other 12-month mental disorders (e.g., generalized anxiety disorder) to be risk factors of depression among first-year college students (Ebert et al., 2019). A study of Chinese international students revealed the associations of self-reported poor current health and low exercise regimen with the prevalence of depressive symptoms

(X. Han et al., 2013). Therefore, future research should expand the biological model by incorporating factors targeting genetic vulnerabilities and current health behaviors. The unexpected finding of perseverance as a risk factor for undergraduate international students provides interesting insights into how this construct may be perceived variably by people with divergent values and goals, resulting in a range of well-being outcomes. Future research could investigate whether goal-related variables, such as academic goal motivation and perceived goal attainment, are mediators in the relationship between perseverance and depression or mental well-being in the international student population.

Future research should also consider integrating more sociocultural factors to build a more culture-sensitive psychopathology model. Acculturative stress and self-rated English proficiency have been predictors of depression across studies (Jackson et al., 2013; Kim et al., 2019; Sümer et al., 2008; Shadowen et al., 2019). It could also be informative to more fully explore the impact of discrimination itself on student adjustment. For example, prior work on minoritized youth points to possible varied effects depending on the perceived perpetrators of bias (e.g., peers vs. teachers/adults; Benner & Graham, 2013; Gonzalez et al., 2014). The impact of more subtle forms of discrimination reflected through microaggressions and stereotypes related to objectification as a perceived foreigner (Armenta et al., 2013) could be also especially salient to the experiences of international students.

Limitations

The findings of this study should be interpreted in light of several limitations. First, the cross-sectional nature of the study prevents causal inferences between the factors and depression. The original model appeared to include multicollinearity, as correlations between life satisfaction, optimism, and self-esteem were over .80. In prior literature, these three variables have been correlated from .40 to .60 (Diener & Diener, 1995; Hutz et al., 2014; Wong & Lim, 2009), suggesting that the multicollinearity issue in the present study may be particular to our sample, and perhaps there is an actual population or cultural difference in how these variables are correlated. Next, the number of biological factors tested in the model is limited, diminishing ability to support the biological model. The survey is not designed to include nationality, language discrimination, or length of stay in the United States, which could have increased the precision of our model. Although the majority of international students attend U.S. universities on F-1 visas, it is possible that some held other visas at the time of survey and were thus unintentionally omitted from our study. Last, we did not account for the nested nature of the sample, due to low intraclass correlation coefficient (<.1) between institution and race/ethnicity for depression.

Implications for Practice

Although the current study is limited by its cross-sectional nature, it tests variables previously found associated with international student depression. If confirmed by future longitudinal studies, findings could support university

administrators to initiate targeted preventive interventions for mental health needs of ethnic minority international students. If aligned with other research, university counseling center providers could consider employing cognitive-behavioral approaches to improve undergraduate international students' self-esteem, boost their life satisfaction levels, increase their perceived self-effectiveness to solve problems, and mitigate their feelings of perceived discrimination, perhaps by encouraging them to cognitively reappraise stressors they encounter in academic settings, interpersonal relationships, and public spheres. Although perseverance could be potentially harmful for international students' mental health, endorsing the "shift-and-persist" strategy (reappraising or shifting attention from uncontrollable stressors and maintaining hope for the future) may offer protecting effects against depressive symptoms in ethnic minorities (Christophe et al., 2019). Since social support from domestic students and faculty is linked with international students' psychological well-being (Brunsting et al., 2019), university administrators could organize campus-wide events that bring students together to engage in conversations on mental health awareness and the divergent experiences of mental health issues across ethnic, racial, and cultural groups on campus. Further, collaborations between counselors and faculty teaching first-year experience courses or international student adjustment courses may be fruitful for increasing social support for international students. Prior research has linked first-year academic courses focused on international student adjustment with belonging, social support, and confidence interacting with students of other cultures (Brunsting et al., 2018a; Kovtun, 2011).

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