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Understanding the Risk and Protective Factors Associated with Depressive Symptoms amongst International Students: A Systematic Review and Meta-Analysis

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ABSTRACT: *International students face unique challenges, placing them at high risk of experiencing mental disorders. A systematic review and meta-analysis were conducted to investigate 20 predetermined, modifiable exposures associated with depressive symptoms. The literature search included cross-sectional, case–control, and cohort studies in English. Eighty-four studies with 148,510 international tertiary students were included, 43 of which (12,721 participants) were meta-analyzed. Four exposures were significantly associated with depressive symptoms in international tertiary students: acculturative stress was most strongly associated (summary Pearson's correlation, r = 0.44, 95% CI = 0.39 to 0.49), followed by social support (r = -0.29, 95% CI = -0.35 to -0.22), social connectedness (r = -0.26, 95% CI -0.36 to -0.15), and language (r = -0.18, 95% CI = -0.23 to -0.11). To our knowledge, this systematic review and meta-analysis are the first to quantify associations between modifiable exposures and depressive symptoms, specifically in international tertiary students.*

Keywords: Acculturative stress, Depression, International students, Meta-analysis, Systematic review, Tertiary students

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INTRODUCTION

Most mental disorders have a peak onset during young adulthood between the ages of 18-25 years (Pedrelli et al., 2015). In a recent meta-analysis, the peak onset age for a mental disorder was 14.5 years of age (Solmi et al., 2022). An estimated 75% of those who will have a mental disorder would have had their first onset by the age of 25 years (Kessler et al., 2005). The prevalence of mental ill health is high among college and university students; they generally fall into this high-risk age group and face numerous additional academic pressures (Blanco et al., 2008).

Globally, more than 83% of international students are enrolled in Organisation for Economic Co-operation and Development (OECD) countries. Among these, international students represent a significant proportion of university and college students in English-speaking OECD countries such as the United States, the United Kingdom, and Australia (Beine et al., 2013). Above and beyond regular stressors of life, international students face unique challenges that place them at high risk of mental disorders such as depression, anxiety and general psychological distress (Alharbi & Smith, 2018). According to recent meta-analyses, the prevalence of depression among international students ranges from 22.6% to 45.3% (Saravanan & Subhashini, 2021), whereas in the general higher education population, the reported prevalence is 21.1% in Germany (Heumann et al., 2024). Compared with those of domestic students, rates of suicide are also elevated among international students (Choi et al., 2020; Hodgens, 2019; McKay et al., 2023). However, a recent meta-analysis reported a significant difference between the mental health of international and domestic students, where international students reported fewer symptoms of depression but worse well-being than their domestic peers (Xiong et al., 2024). Despite the increasing importance of understanding the uniqueness of mental health stressors in international students, to date, there has been limited research in this field.

Risk factors for mental health in international students

Several key risk factors associated with the mental health of international students have been identified. The first is acculturative stress, first conceptualized by Berry (1970; 2006), which is defined as stress related to transitioning and adapting to a new environment and includes linguistic challenges, pressures to

assimilate to local or dominant cultures, separation from family, discrimination, and intergenerational family conflicts arising from different generational norms across time (Ahmed et al., 2011). This stress results in feelings of marginalization and alienation, alleviated psychosomatic symptoms of depression and anxiety, and confusion of identity (Williams & Berry, 1991). A recent meta-analysis revealed relationships between acculturative stress and psychological outcomes and other outcomes, such as drinking behaviors (Soufi Amlashi et al., 2024). In addition to acculturative stress, other likely stressors in international students include mental health literacy, loneliness, and homesickness (Alam et al., 2021; Liu et al., 2016; Lu et al., 2014). These mental health challenges in international students are compounded given the challenges that are also shared between them and their domestic peers, including the academic stress associated with being a university student in higher education. International students report higher levels of stress due to financial challenges and adaptation difficulties than their domestic peers, who experience more stress due to academic workload (Kulmirzayeva, 2025). Understanding the factors that impact international students specifically would provide valuable information for developing strategies to prevent the negative effects of mental health among international students.

Protective factors of mental health in international students

Whilst the literature to date has focused mostly on risk factors, protective factors that bolster and improve mental health are also important (Cao et al., 2021). For example, it has been well established that the quality of social support that international students have has a direct buffering effect on experiences of psychological stress (Ma, 2021; Mallinckrodt & Leong, 1992). Consistent with this finding, Rosenthal and colleagues reported that social connectedness was also related to improved levels of wellbeing in international students (Rosenthal et al., 2007). Understanding the mechanisms behind these social support systems will better equip services to support the mental health of international students.

Accordingly, these risk and protective factors may comprise a spectrum of factors that positively or negatively influence mental health, depending on how the construct is measured and articulated. For example, while poor social adjustment can be seen as a risk factor, the presence of strong social adjustment on the opposite end of the spectrum could serve as a protective factor. Some risk and protective factors are the presence and/or absence of the factor (see Table 1). Thus, the exposures in this systematic review are termed ‘risk and protective factors’.

Cultural context of mental health in international students

Berry’s (2006) acculturative stress model accounts for both sociocultural factors, such as demographic factors and social support, and individual factors,

such as cognitive control and problem appraisal. This is in juxtaposition with the stress-coping model proposed by Lazarus and Folkman (1984), which posits that individual perception and coping determine stress outcomes. Motivated by Berry's acculturative stress model, the exposures considered for inclusion in this review focused on potentially modifiable risk and protective factors at the sociocultural level.

Given the multicultural diversity of international students, cultural values shape and influence exposures such as social connectedness. According to Hofstede's (1980) cultural dimensions theory the six cultural dimensions are: power distance, individualism/collectivism, masculinity/femininity, short/long-term orientation, indulgence/restraint, and uncertainty avoidance. For example, Asian students who score highly on collectivism may prioritize familial support over institutional resources (Major, 2005). A qualitative study of Chinese international students revealed that peers were their primary source of social support, with university resources such as tutors and counseling services only being accessed by a minority (Cao et al., 2021). This culturally informed perspective of sociocultural factors underscores the need to examine how modifiable psychosocial factors such as social connectedness influence depressive symptoms in international students.

The current systematic review and meta-analysis aimed to identify which potentially modifiable exposures (risk and protective factors) are associated with depression and depressive symptoms in international tertiary students.

METHOD

This systematic review and meta-analysis sought to explore the risk and protective factors for depression and depressive symptoms in international tertiary students. International tertiary students were defined as overseas students who came to another country for the sole purpose of studying at universities. This work adhered to PRISMA guidelines (Moher et al., 2009) and was prospectively registered with PROSPERO on 24 October 2022 (CRD42022359897).

Electronic search strategy

We searched MEDLINE, EMBASE, PsycINFO via OVID, and ERIC from inception through 9 September 2022 for observational studies examining the effects of 20 exposures (risk and protective factors) on depression and depressive symptoms in international tertiary students (Table 1). Search terms related to exposures and mental health outcomes were combined via Boolean logic (Higgins et al., 2019). The search was not limited by time, location, or year of publication; however, the articles were required to be written in English. The first author (SRT) conducted the initial search and screening of titles and abstracts. Three authors independently screened the full text of each potentially eligible article (SRT,

CDM, and JH). Discrepancies and disagreements regarding study eligibility were resolved by an independent expert in meta-analyses.

Study selection and eligibility criteria

Eligible studies reported at least one association measure between one of the 20 exposure variables in Table 1 and depression/depressive symptoms. There was no restriction on the study design, and both single-arm and controlled/comparison studies were eligible. All studies including cross-sectional, case-control, and cohort studies were eligible, except qualitative studies. Eligible participants were international tertiary students of any age who were exposed to any risk or protective factor(s). Eligible depression outcomes included self-reported and clinician-rated measures that were either validated or non-validated. Eligible control and comparison groups included individuals within the same country or geographical area (i.e., domestic students belonging to that home country and dominant culture). Cross-cultural comparison groups overseas were excluded (e.g., international students in another country or students of similar racial and ethnic backgrounds in other countries). Refugee students and undocumented students were excluded because they are recognized as being a distinct population in the literature (Smith & Khawaja, 2011).

Table 1
List of 20 exposures included in the systematic review

Index	Exposure	As a risk factor	As a protective factor
1	Acculturative stress	Presence of acculturative stress	Absence of acculturative stress
2	Mental health literacy	Low mental health literacy	High mental health literacy
3	Isolation, loneliness	High levels of isolation, high levels of loneliness	Low levels of isolation, low levels of loneliness
4	Homesickness	High levels of homesickness	Low levels of homesickness
5	Financial support, financial distress, financial difficulties	Low levels of financial support, high levels of financial distress, high levels of financial difficulties	High levels of financial support, low levels of financial distress, low levels of financial difficulties
6	Living with dependents	Presence/absence	Presence/absence

Index	Exposure	As a risk factor	As a protective factor
7	Language and language barriers	Low language proficiency (of dominant language used in host country), high language barriers	High language proficiency (of dominant language used in host country), low language barriers
8	Housing stability	Stable housing and accommodation	Unstable housing and accommodation
9	Perceived discrimination	High levels of perceived discrimination	Low levels of perceived discrimination
10	Adjustment difficulties	High levels of adjustment difficulties	Low levels of adjustment difficulties
11	Mental health stigma	High levels of mental health stigma	Low levels of mental health stigma
12	Self-reliance	High levels of self-reliance	Low levels of self-reliance
13	Social connectedness	Low levels of social connectedness	High levels of social connectedness
14	Family	Presence/absence	Presence/absence
15	Quality of social support systems	High quality of social support systems	Low quality of social support systems
16	Connection to campus and student culture	High levels of connection to campus and student culture	Low levels of connection to campus and student culture
17	Social capital	High levels of social capital	Low levels of social capital
18	Self-efficacy	High levels of self-efficacy	Low levels of self-efficacy
19	Mature age status	Yes/No	Yes/No
20	Life satisfaction	High life satisfaction	Low life satisfaction

Data collection and coding

The first author (SRT) extracted data independently via a standardized data extraction template.

Meta-analyses and measures of heterogeneity

The correlations between each exposure (Table 1) and the outcome of depression/depressive symptoms were analyzed via meta-analyses. Meta-analyses were conducted on five of the 20 exposures: acculturative stress, language, social support, social connectedness, and life satisfaction. These exposures were selected for analysis because they yielded at least five effect sizes. Both random effects meta-analyses and multilevel meta-analyses were employed. Among the studies, 9/47 (19.1%) reported multiple exposure and/or outcome measures using the same sample of participants; thus, the assumption of independent estimates for traditional meta-analysis was violated.

Multilevel meta-analyses were conducted to account for multiple outcomes per study. This approach enables the examination of heterogeneity both between and within studies. Multilevel meta-analyses were performed for the exposures of social connectedness and social support, as there were sufficient studies with multiple effect estimates (four of five studies and four of 20 studies, respectively) for estimating within-study heterogeneity.

Random-effects meta-analyses were performed for acculturative stress, language, and life satisfaction, yielding a single estimate of heterogeneity. There were insufficient data to estimate the within-study component of heterogeneity for the exposures of acculturative stress and language because almost all the selected studies reported single effect estimates (that is, 16 of 18 studies and 11 of 13 studies, respectively). In these cases, random effects meta-analyses were conducted using the most conservative (i.e., smallest) effect size from each study with multiple estimates, and a sensitivity analysis was performed to explore the impact of using the largest of those estimates instead. All the studies for the exposure of life satisfaction reported a single effect estimate.

Both types of meta-analyses were conducted via restricted maximum likelihood estimation (REML) via the metafor package in R, version 4.3.0 (Viechtbauer, 2010). The function rma.mv was used to fit meta-analytic multivariable multilevel and random/mixed-effects models with or without moderators.

Fisher's R-to-Z transformation was used to transform the extracted Pearson's r estimates to a suitable scale for analysis. Forest plots with prediction intervals were constructed, back-transformed summary estimates were calculated, and relative heterogeneity was estimated as I2 (Higgins & Thompson, 2002). Funnel plots were generated to investigate the potential presence of publication bias by

exposure (see Supplementary Material). Egger's regression test was conducted for meta-analyses with at least 10 studies (Sterne, 2017).

Meta-regression analyses

Random effects meta-analysis models with a single moderator term were fitted to Fisher's Z-transformed effect sizes using REML to explore whether patterns of heterogeneity could be explained by study location, study design, or study quality (moderators). The significance of each moderator in each meta-regression model was independently assessed usingvia the QM statistic (Viechtbauer, 2010).

Risk of bias and study quality assessment

Study quality was assessed using the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies (National Heart, Lung, and Blood Institute, 2021). Two assessors (SRT and HB) independently assessed 86 studies. Discussion occurred when there were conflicting scores for any of the 14 criteria. When a consensus was not reached, conflicts were resolved by an independent expert in meta-analyses. The risk of bias and study quality are reported in Table 2. Most studies were rated 'Good' (49/86), followed by 'Fair' (29/86) and 'Poor' (6/86; see Table 2 below). The 49 good-quality studies generally included clearly defined populations and validated exposure and outcome measures. As specified in the tool, the six studies rated as poor were evaluated with explicit reasoning provided by the assessors (see Table 2).

RESULTS

Study selection

The initial search identified 10,970 records, of which 2,957 were duplicates. A total of 8,013 records were screened based on title and abstract (see Figure 1). The full-text versions of 415 records were assessed. The first author (SRT) contacted the corresponding authors of six primary studies to request additional information and data for potential inclusion in the study. Data from two studies (Dong et al., 2022; Hirai, 2013) were successfully obtained. A total of 171 records reported outcomes related to mental health in international tertiary students. Of these, 84 articles reported at least one association between exposure and depressive symptoms as a mental health outcome.

Characteristics of the studies

Eighty-four studies were conducted in Australia, Canada, China, Germany, Hong Kong, Indonesia, Japan, Malaysia, the Netherlands, Norway, Singapore, South Korea, the United Kingdom, and the United States (US). The participants represented all six World Health Organization regions: the African Region, the Region of the Americas, the Southeast Asian Region, the European Region, the Eastern Mediterranean Region, and the Western Pacific Region. Students were at a range of educational levels (undergraduate degrees, honors, postgraduate coursework and postgraduate research). Because countries define these levels of education differently, reporting them was deemed unnecessary for analyses. The age range across the studies was 15--50+ years.

Among the studies, 80/84 (95%) used validated instruments. The outcome measure of depression and depressive symptoms was self-reported in all studies. As such, the outcome measure of depression and depressive symptoms will henceforth be referred to simply as depressive symptoms. Among the 84 selected studies, 43 reported at least one of the five exposures that were summarized via meta-analyses (n = 148,510 participants). The most commonly used instrument was the Center for Epidemiological Studies Depression scale (CES-D) (Radloff, 1977); two studies employed the Boston × 4 CES-D. Eleven studies used the Patient Health Questionnaire (PHQ), either the PHQ-4 or the PHQ-9 (Kroenke et al., 2001). Ten studies used the Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995), five used the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983) or a modified version. Four studies used the Beck Depression Inventory (BDI) or an adaptation of it (Beck et al., 1961), and three used the Zung Self-rating Depression Scale (Zung, 1965). The remaining studies used other scales, such as the Hopkins Symptom Checklist 58-item version (HSCL-58; Derogatis et al., 1974) and the Bell Global Psychopathology Scale (Bell et al., 1981).

Results of meta-analyses by exposure

Exposure 1: Acculturative stress.

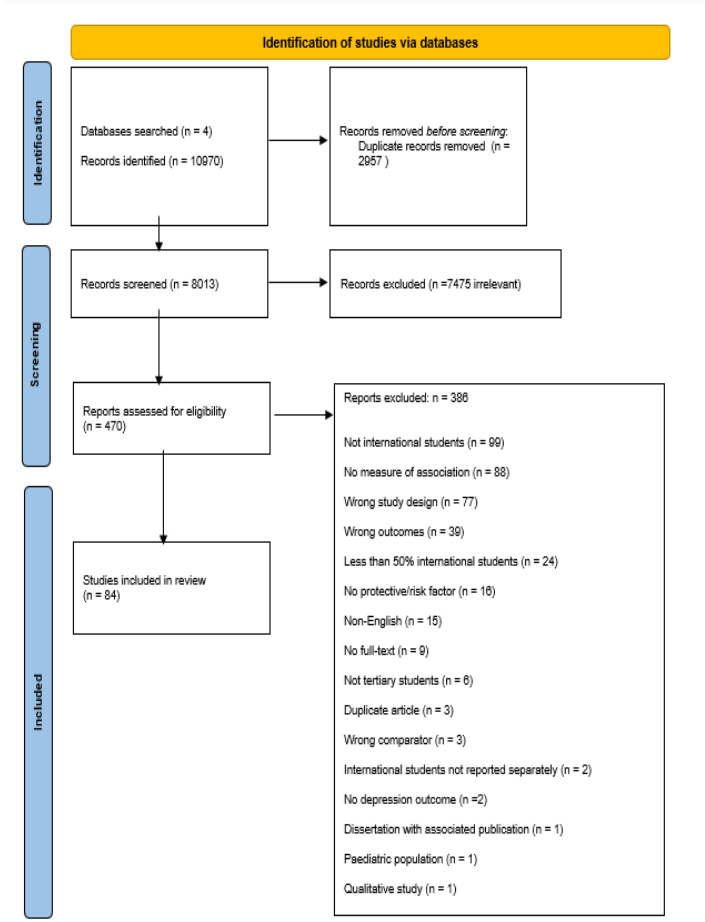
Across 20 effect sizes from 18 independent studies, exposure to acculturative stress revealed a significant positive summary effect size associated with depressive symptoms in international tertiary students (summary Pearson's correlation, r = 0.44, 95% CI = 0.39 to 0.49, p <.001). Fourteen of the 18 studies employed the Acculturative Stress Scale for International Students (ASSIS; (Sandhu & Asrabadi, 1998) to measure the exposure. All effect sizes obtained from the 18 independent studies reflected positive associations with depressive symptoms (see Figure 2).

According to the Cochrane Handbook for Systematic Reviews of Interventions, I2 = 88.94% indicated the presence of considerable heterogeneity. The results from the meta-regression analyses revealed that acculturative stress

was associated with all three study characteristics, namely, study location, design, and quality. For study location, the omnibus test of moderators was statistically significant for studies conducted in the U.S. compared with studies not conducted in the U.S.—namely, Australia, China, and Japan (QM = 33.43, df = 1, p < .0001). Significant associations were also observed for study design (QM = 5.72, df = 1,

Figure 1

PRISMA flow diagram of the included studies: Step 1 screenings (of titles and abstracts by 1 reviewer) and Step 2 screenings (of full-text articles selected in Step 1 by 2 independent reviewers.



p <.005) and for study quality (QM = 26.40, df = 1, p <.0001). This finding indicates that study location, study design, and study quality each explain a proportion of heterogeneity among effect sizes for the exposure to acculturative stress. Egger's test and contour-enhanced funnel plots did not reveal significant asymmetry (see Figures 1 and 7 in the Supplementary Results).

Exposure 2: Language ability.

Across 15 effect sizes from 13 independent studies, language demonstrated a significant negative association between language ability and depressive symptoms in international tertiary students (summary r = -0.18, 95% CI = -0.23 to -0.11, p <.001; Table 3). Nine of the studies employed scales related to English language proficiency to measure exposure, whereas the other language-related measures examined language competency, fluency, and confidence. Effect sizes obtained from 10 out of 13 independent studies reflected negative associations with depressive symptoms (see Figure 3).

The estimate of relative heterogeneity was I2 = 54.89%, indicating the substantial presence of heterogeneity. Meta-regressions revealed that language ability was significantly moderated by study location, whether studies were conducted in the US or not (QM = 75.84, df = 1, p <.0001), and study quality (QM = 4.53, df = 1, p <.005). However, study design was not found to be a significant moderator (QM = 0.04, df = 1, p = 0.83). Egger's test and contour-enhanced funnel plots did not reveal significant asymmetry (see Figures 2 and 8 in the Supplementary Results).

Exposure 3: Social connectedness.

The multilevel meta-analysis of 10 effect sizes from five independent studies demonstrated a negative summary association of social connectedness with depressive symptoms (summary r = -0.26, 95% CI -0.36 to -0.15, p <0.001; Table 3). Two studies used the same Social Connectedness Scale—Revised, SCS-R; (Lee et al., 2001)—to measure social connectedness. Eight effect sizes obtained from the five independent studies reflected negative associations with depressive symptoms (see Figure 4).

The estimate of relative heterogeneity within studies was I2 = 7.33%, whereas the estimated relative heterogeneity between studies was considerable, I2 = 77.84%. All effect sizes were gathered from studies conducted in the U.S., and the quality of all studies was rated as good, so neither location nor quality could be analyzed as potential moderators. Meta-regression revealed that the summary association of depressive symptoms with social connectedness was not moderated by study design (QM = 3.76, df = 1, p =0.05). Egger's test and the funnel plot showed significant asymmetry (see Figure 3 in the Supplementary Results), suggesting the presence of possible publication bias. However, upon

application of the trim-and-fill procedure (Duval & Tweedie, 2000), no studies were trimmed or imputed, showing that there was no asymmetry detected by this algorithm to shed light on the test results.

Exposure 4: Social support.

The multilevel meta-analysis of 25 effect sizes from 20 independent studies revealed a significant negative summary effect size associated with depressive symptoms (summary r = -0.29, 95% CI = -0.35 to -0.22, p <.001). Four studies used the Social Provisions Scale (Cutrona et al., 1986), and three studies used the Index of Social Support (Yang & Clum, 1995) to measure social support. Effect sizes obtained from 18 of the independent studies reflected negative associations with depressive symptoms (see Figure 5).

The estimate of relative heterogeneity within studies was I2 = 0.00%, and that for between-study heterogeneity was I2 = 87.24%. Meta-regression analysis revealed that exposure to social support was not moderated by study location (QM = 2.48, df = 1, p =0.12), study design (QM = 1.65, df = 1, p =0.20), or study quality (QM = 5.04, df = 2, p =0.08). This finding indicates that none of the a priori moderators accounts for the observed variation in effect sizes among studies for the exposure to social support. Furthermore, Egger's test and contour-enhanced funnel plots did not reveal evidence of asymmetry (see Figures 4 and 9 in the Supplementary Results).

Exposure 5: Life satisfaction.

Across eight studies, life satisfaction demonstrated a nonsignificant summary association with depressive symptoms (summary r = -.20, 95% CI = -0.53 to 0.18, p = 0.29). Five of the studies used the Satisfaction With Life Scale (Diener et al., 1985) to measure quality of life. Among the five independent studies, effect sizes from four reflected negative associations with depressive symptoms (see Figure 6).

The estimate of relative heterogeneity, I2 = 98.76%, indicated the presence of considerable heterogeneity. As there were only five independent studies, meta-regressions were not performed. A funnel plot revealed significant asymmetry, suggesting the presence of possible publication bias, although Egger's test was not performed because of the small number (<10) of studies (see Figure 5 in the Supplementary Results). The trim-and-fill procedure filled one additional study on the right-hand side of the funnel plot, which is further evidence of asymmetry but not necessarily publication bias (see Figure 6 in the Supplementary Results).

DISCUSSION

The aim of the current systematic review and meta-analysis was to identify which potentially modifiable exposures (risk and protective factors) are associated with depression and depressive symptoms in international tertiary students. Of the 20 exposure variables in the systematic review, five were meta-analyzed: acculturative stress, language, social connectedness, social support, and life satisfaction.

On the basis of findings from 43 independent studies, 93% of which were of either good or fair quality, with a total of 148,510 participants and 75 effect sizes, we found that four exposures were significantly associated with depressive symptoms in international tertiary students. Acculturative stress was found to be most strongly associated with depressive symptoms in international tertiary students, followed by social support, social connectedness, and language. These findings summarized a range of cross-sectional studies, some cohort studies, and one case–control comparator study.

Evidence from 18 studies suggests that acculturative stress is a risk factor for depressive symptoms in international tertiary students. Acculturative stress is characterized by a stress reaction due to life experiences that stem from the experience of having to assimilate into a different culture, especially a dominant culture that is different from one's original culture (Ahmed et al., 2011). Higher acculturative stress was associated with higher levels of depressive symptoms in international students. In the only case–control study (Hamamura & Laird, 2014), acculturative stress accounted for approximately 16% of the variance in the levels of depression among East Asian international students in the U.S. However, across studies, acculturative stress has been defined in various ways and captures a range of constructs, including financial concerns, language difficulties, perceived discrimination, cultural adjustments, academic pressure, resilience, positive perceptions of self and the future (Kim, 2017). The fact that acculturation stress has the largest effect size could be explained by Berry's acculturation stress model, which describes both group-level variables such as societal factors and individual-level variables such as stressors and moderators of stress that influence acculturative stress, which mediates mental health outcomes (Berry, 2006). These findings indicate that these other underlying factors influence acculturative stress and, subsequently, depressive symptoms, which should be further explored.

The evidence from 20 studies indicates that social support is a protective factor against depressive symptoms in international tertiary students. Higher levels of social support are associated with lower levels of depressive symptoms. Areas in which an international student can find social support include contacts with direct family, secondary family, old friends in the home country, new friends in the host country, churches, school organisations, campus international student centers and community activities (Sumer, 2009). Spousal support has also been shown to be a key form of social support (Yang & Clum, 1995). Three other tenets

of social support have been suggested: attachment, reliable alliances, and guidance (Kim, 2014). Akin to social connectedness, an international student can find social support from both the new host country and their own home country, and these forms of support have been shown to differ in the way they are associated with depressive symptoms (Bissram, 2016). These findings indicate that social support is nuanced and can be achieved in myriad ways.

Subtly distinct from the social support explained in the paragraph above, evidence from five studies has shown that social connectedness is also a protective factor against depressive symptoms in international tertiary students. Higher levels of social connectedness are associated with lower levels of depressive symptoms. International students can experience social connectedness through connecting with others from the host culture (Kegel, 2016; Wang et al., 2017; Zhang, 2011), such as via other domestic students and the host society. Another way in which international students can experience social connectedness is through connecting with others from their own or similar cultures while studying abroad (Sun et al., 2021; Wei et al., 2015). International students who have a stronger sense of connection with their ethnic community while studying abroad may feel less isolated, more understood, and more empathetic with others with respect to their experiences while studying abroad and, in turn, have less elevated levels of depressive symptoms (Sun et al., 2021).

The evidence from 14 studies suggests that language is a protective factor against depressive symptoms in international tertiary students. Higher levels of the dominant language in the host country (i.e., higher language ability in the same language as the host country) are associated with lower levels of depressive symptoms in international tertiary students. In this study, we examined language as a mono-dimensional construct. Notably, language proficiency (Sumer, 2009; Sumer et al., 2008) is not the same as language fluency (Fang, 2013). Similarly, sharing the same language as the dominant language of the host country is also different from having it as a first language, as it could be the international student's second or third language. This can be seen in a study where both English and Cantonese language proficiency were included as effect sizes of language proficiency in Hong Kong (Yu et al., 2019). Perceived comfort with using English (Ma, 2021) and language difficulties (Kim, 2017) have also been investigated. Therefore, arguably, these aspects of language should be investigated separately for their specific associations with depressive symptoms.

The evidence suggests that life satisfaction is neither a risk nor protective factor for depressive symptoms in international tertiary students. Although we did not observe significant associations between life satisfaction and depressive symptoms in international tertiary students, this exposure is still noteworthy. All five effect sizes from the five studies employed the SWLS (Diener et al., 1985), with four studies showing negative effect sizes and one (Shafaei et al., 2018) finding a positive association between life satisfaction and depressive symptoms.

This meta-analysis investigating life satisfaction included a small number of studies and, therefore, should be revisited when more published estimates become available.

Large relative heterogeneity

Of the four exposures that had significant associations with depressive symptoms, three produced high I2 values, which indicates substantial relative heterogeneity among the studies, suggesting that a relatively high proportion of the observed variation in effect sizes is likely due to true differences between studies, such as variations in study design, sample sizes, methodologies, or measurement tools, rather than random error (Quintana, 2015). To increase data quality and analysis, standardized measurement tools should be used. For example, to measure acculturative stress, ASSIS, which is currently adopted by a majority of studies, could be used as the gold standard to reduce measurement heterogeneity. Future studies measuring host country language could delineate language ability terms of proficiency (Sumer 2008), fluency (Fang, 2013), and competence/confidence (Ma, 2021) to standardize the way in which language ability is assessed.

Furthermore, considering that the studies involved research in different countries, the geographical setting in which they were conducted could also have potentially contributed to the observed heterogeneity. Sixty-one of the 75 effect sizes included in this study were obtained from studies conducted in the U.S., while there is an overrepresentation of Asian international students, accounting for 69.8% of international students in a prevalence study of depressive symptoms in international students (Shadowen et al., 2019). Furthermore, estimates of I2 are more likely biased when there are a small number of studies (von Hippel, 2015). Meta-regression analyses were performed to explore how the effects of three known study characteristics might moderate summary associations and therefore explain, to some degree, our estimates of high relative heterogeneity. Although it is important to describe, and ideally understand, the sources of heterogeneity, the coverages of presented prediction intervals, which show the predicted range of effects, incorporate heterogeneity and are substantively consistent with the coverages of 95% confidence intervals and inferences made concerning our summary estimates. Future research could aim to reduce heterogeneity by standardizing research methods among studies.

Strengths, limitations, and future research

To our knowledge, this systematic review and meta-analysis are the first to quantify the associations of depressive symptoms with modifiable risk and protective factors, specifically in international tertiary students. This study has

many strengths, including the use of multilevel meta-analyses, a large sample size, and the exclusion of studies that do not report specific modifiable risk and protective factors identified a priori. High relative heterogeneity demonstrated important variation among studies in the results, but there were not enough available published estimates to conduct meta-analyses for all 20 exposures, and a relatively low number of studies were analyzed in some cases (social connectedness, life satisfaction). These sources of heterogeneity were investigated extensively in detail via post hoc analyses.

A limitation of this review was the exclusion of non-English studies. Considering that most of the studies included in the review were conducted in the U.S., future studies could include studies in languages other than English (e.g., Chinese or Arabic) to reduce selection bias and capture studies conducted in underrepresented regions such as Africa or Latin America. As most studies included in this review were cross-sectional, future research needs to emphasize longitudinal designs (e.g., cohort studies, Hirai, 2013) to establish stronger inferences between exposures and depressive symptoms. The subgroup analyses revealed that most independent studies were conducted in the U.S., with relatively few studies conducted in other countries, such as Japan and China. Exploring the contribution of heterogeneity between these countries would be valuable. Should there be moderating effects of country on exposure, cultural or institutional differences such as differences in educational practices across countries could account for the heterogeneity observed, which could lead to important insights into what could be done to address depressive symptoms in international students. To do this, more studies outside of the US need to be conducted in the future. Further research could also collect data to test other potential moderators, such as the duration of stay and host country policies, such as visa restrictions or work permits, for subgroup analyses. In light of these contexts, the findings presented in this review are generalizable to a specific subset of international students but are recognized to be limited in representing the broader international student population globally, highlighting the need to extend research across broader contexts of culture, language, and geographical regions.

Implications of the findings

Tertiary education systems are responsible for safeguarding the mental wellbeing of international students. For example, in Australia, the Standard Six of the Education Services for Overseas Students Framework states that education providers must assist overseas students in adjusting to study and life in Australia (Department of Education Skills and Employment, 2021). Recently, OECD reports have reported that countries that attract the most students are geographically diverse, with factors such as language and culture playing a part (OECD, 2025). A recent protocol release aimed to evaluate the effects of interventions on the mental health and well-being of international students (Liu et

al., 2024). To better support international students, universities could adopt a host of targeted strategies to address each exposure. For example, to address the exposure of acculturative stress, workshops for international students to manage acculturative stress could be introduced. It has been shown that such workshops held with groups underrepresented in higher education can increase self-efficacy and sense of belonging (Mozley et al., 2020). Recent studies have also explored ways to assist international students in transitioning to universities abroad, where universities could introduce programs to allow for smoother transitions into higher education, such as via community-based learning (Fontaine & Todd, 2011), or implement reorientation programs that have been purported to increase self-advocacy skills and cultural capital in students transitioning to college life (Beard et al., 2023). Structured "buddy systems" or peer mentorship are some initiatives that could be implemented that are currently being explored (Carragher & McGaughey, 2016). In an attempt to support the mental well-being of international students, recent studies have provided recommendations for culturally sensitive approaches such as culturally aware counseling (Calder & Ho, 2024; Ben-Rejeb, 2025; Saha, 2025).

Given the major implications of depressive symptoms for international students, allocating funds appropriately remains a key avenue to reduce both the experience of and the risk of developing depression and depressive symptoms in international students. In particular, stakeholders should allocate funds to programs and societies that can reduce acculturative stress and increase social support and connectedness. Some cost-effective and scalable tools, such as digital mental health tools, have been proposed to provide opportunities for minority groups to access mental healthcare (Mucić, et al., 2025) or to overcome language barriers in healthcare (Kreienbrinck, 2025). These findings can inform and guide tertiary education stakeholder policies (e.g., via organisations such as universities and governments) on how to alleviate depressive symptoms and improve the mental health of international students.

CONCLUSION

The findings suggest that of the five exposures that were investigated via meta-analyses, four were significantly associated with depressive symptoms in international tertiary students. These effects were, in order of largest to smallest absolute effect size, as follows: acculturative stress, social support, social connectedness, and language. Some other potential exposures that did not yield a sufficient number of effect sizes for analysis identify areas requiring further research, such as isolation. Given the findings from this meta-analysis, future studies could also explore the nuance of concepts such as acculturative stress and language more deeply, particularly since these were identified as important factors in this review.

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- ■ *None*
- ☐ *Some sections, with minimal or no editing*
- ☐ *Some sections, with extensive editing*
- ☐ *Entire work, with minimal or no editing*
- ☐ *Entire work, with extensive editing*

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Table 2. Characteristics and study quality of the included studies with primary mental health outcomes of depressive symptoms.

Author, year, country where study was conducted, study design	Age range or mean age (years)	Gender (percent female unless otherwise specified)	Total sample size	Participants' country of origin, specific ethnicities (where applicable)[1]	Exposure(s)	Depression assessment tool	Study Quality[2]
Shoukat 2021, Indonesia, cross-sectional	Age ranges = <25, 25-30, >30	31.40%	86	Pakistani (n = 100%)	Homesickness; Mature age status	Questionnaire	Poor[3]
Yu 2019, Hong Kong, cross-sectional	Age range = 15-25 (81.1%)	61.57%	726	Asian countries (n= 532, 73.3%), Eastern Asia (n= 310, 42.7%), Southern Asia (n= 67, 9.2%), Southeastern Asia (n= 75, 10.3%), Central Asia (n= 1, 0.1%), Western Asia (n= 9, 1.2%), other Asian countries (n= 70, 9.6%). Europe (n= 128, 17.6%), North America (n=54, 7.4%), Australia and New Zealand (n= 13, 1.8%), Africa (n= 6, 0.8%), Central and South America (n= 4, 0.6%), others (n= 2, 6.7%).	Language (barriers, proficiency); Perceived discrimination; Quality of social support systems	CES-D	Good
Yang 2018, China, cross-sectional	Mean age = 21.87 (SD = 3.23)	52.17%	310	Asia/Africa/Europe/Other.	Acculturative Stress	BSI	Good
Thakar 2010, US, cohort study (baseline included)	Age range = 21.2-32, mean age = 24.3 at Time 1	35%	83	Indian (n = 100%)	Acculturative stress; Financial situation; Social connectedness; Family; Quality of social support systems	CES-D Boston x 4 CES-D	Good
Sumer 2009, US, cross-sectional	Age range= 17-50, mean age = 26.75 (SD = 5.66)	51%, 1% no response	204	Asian/Pacific Islander (n=38, 51%), White European (19%), Spanish/Hispanic/Latino/American (9%), Middle Eastern (4%), Black (7%), Others (9%), No response (1%)	Language (barriers, proficiency); Quality of social support systems; Mature age status	CES-D	Good

Author, year, country where study was conducted, study design	**Age range or mean age (years)**	**Gender (percent female unless otherwise specified)**	**Total sample size**	**Participants' country of origin, specific ethnicities (where applicable)[1]**	**Exposure(s)**	**Depression assessment tool**	**Study Quality[2]**
Smiljanic 2017, US, cross-sectional	Age range = 22-45, mean age = 28.88 (SD = 3.93)	50.50%	91	Out of the 91 participants, self-identified: Asian (n = 42, 46%), White (n = 35, 38%), Latino (n = 6, 7%), Other (n = 8, 9%). Participants were grouped into the following geographic regions: Europe (n = 35, 39%), China (n = 16, 18%), India (n = 14, 16%), Other Asian countries (n = 10, 11%), Middle East (n = 4, 4%), South America (n = 4, 4%), Canada (n = 3, 3%), Latin America (n = 3, 3%), Australia (n = 1, 1%), 236 Caribbean (n = 1, 1%).	Acculturative Stress; Language (barriers, proficiency)	CES-D	Fair
Shadowen 2019, US, cross-sectional	Mean age = 24.9 (SD= 4.28)	81.38%	490	Participants originated from nine different regions of the world, including Africa (2.0%), Central America and the Caribbean (2.4%), Central Asia (0.8%), East and Southeast Asia (69.8%), Europe (4.5%), North America (including Mexico; 0.6%), the Middle East (4.1%), South America (4.7%), and South Asia (11.0%).	Acculturative Stress; Language (barriers, proficiency); Perceived discrimination; Quality of social support systems	CES-D	Fair
Jackson 2013, US, cross-sectional	Mean age = 24.19	66.67%	70	Most participants were from Asia (47.1%); Europe (n = 15, 21.4%), with the remainder from South and Central America, North America, the Caribbean, Australia, Africa.	Acculturative Stress; Adjustment difficulties; Quality of social support systems	CES-D	Good
Imai 2019, Japan, cross-sectional	Age range = 19-42, mean age = 27	46%	143	Most participants were from the United States (n= 23, 16%), followed by China (n= 20, 14%), India (n= 12, 8%), Indonesia (n= 7, 5%), England, Korea, Singapore, Philippines (n = 6, 4%), Taiwan (n = 5, 3%), and other countries (n = 52)[4]	Isolation (loneliness)	CES-D	Good
Hou 2019, US, cross-sectional	Mean age = 26.09 (SD= 3.85)	39%	119	China (n = 41, 37%), India (n = 35, 31%), Other countries (32%)	Perceived discrimination	CES-D	Fair
Gebregergis 2019, China, cross-sectional	Mean age = 27.32	44%	506	Majority of the participants were from Asia (45%), and Africa (41%), and 14% were from the rest of the continents (Europe, Oceania, Latin America, and North America).	Acculturative Stress; Mature age status	CES-D	Good

Author, year, country where study was conducted, study design	Age range or mean age (years)	Gender (percent female unless otherwise specified)	Total sample size	Participants' country of origin, specific ethnicities (where applicable)[1]	Exposure(s)	Depression assessment tool	Study Quality[2]
Fang 2013, US, cross-sectional	Age range = 18-38, mean age = 24.71 (SD = 4.72)	63%	135	Participants from China comprised 43.7% (n = 59), South Korea represented 11.1% (n = 15), Taiwan made up 42.2% (n = 57), and Japan accounted for 3% (n = 4) of the sample.	Financial situation; Language (barriers, proficiency); Family; Quality of social support systems; Connection to campus and student culture; Mature age status	CES-D	Good
Dutta 2017, Singapore, cross-sectional	Age ranges = 21-25 (62.1%), 26-30 (35.9%), 31-35 (1.9%)	45.63%	103	Self-reported ethnic identification of the participants was n = 66 (64.1%) Indian, n = 16 (15.5%) Chinese, n = 7 (6.8%) Asian (other), n = 5 (4.9%) Caucasian and n = 1 (1%) African.	Isolation (loneliness)	Depressive Attributions Questionnaire	Good
*deMoissac 2020, Canada, cross-sectional	Domestic mean age = 21.2 (SD = 5.0); International mean age = 23.9 (SD = 6.1)	Female domestics: USB[5]: 79.8%, BU[6]: 78.6%. Female internationals: USB: 42.7%, BU: 54.1%. Few participants reported gender identification as other.	934	Uni 1 USB IS predominantly from Africa (88%), although some were from Europe (7%) or the Americas (5%) and uni 2 BU IS from Africa (40%), Asia (34%), the Americas (23%), or Europe (3%).	Housing stability and accommodation; Social connectedness; Family; Quality of social support systems; Quality of life (life satisfaction, academic satisfaction)	Unspecified depression mental health indicator	Fair
**Cho 1988, US, cross-sectional	Not reported	Not reported	245	Korea, Arab Nations (Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Saudi Arabia, Sudan, Syria, Tunisia, Yemen), Nigeria.	Financial situation; Language (barriers, proficiency); Social connectedness	Depression Adjective Check List (Lubin, 1981).	Fair
Yuan 2021, China, cross-sectional	Age range = 16-42, median (IQR) age = 22 (3) years	46.82%, 0.58% unknown	519	N/A	Financial situation; Mature age status	PHQ-9	Good
Lin 2022, US, cross-sectional	Mean age = 21.39 (SD=2.479)	48.10%	1881	N/A	Mental health literacy (awareness, recognition);	PHQ-9	Good

Author, year, country where study was conducted, study design	**Age range or mean age (years)**	**Gender (percent female unless otherwise specified)**	**Total sample size**	**Participants' country of origin, specific ethnicities (where applicable)[1]**	**Exposure(s)**	**Depression assessment tool**	**Study Quality[2]**
					Financial situation; Social connectedness		
Li 2021, China, cross-sectional	Mean age = 20.65 years (SD= 2.40)	47.60%	349	N/A	Quality of social support systems	Self-rating Depression Scale (Zung, 1965) 20-item	Good
*Lee 2016, Korea, Cross-sectional	Mean age = 26.15 (4.22)	100%	98	Korean (n = 100%)	Acculturative stress; Social capital; Self-efficacy	PHQ-9	Fair
***Lai 2020, UK and US, cross-sectional	Age ranges 18-25 (86.3%), >25 (13.7%)	63.70%	124	Chinese. Hong Kong/China (80.6%), Others (19.4%).	Perceived discrimination; Family; Quality of social support systems	PHQ-4	Good
Kim 2021, South Korea, cross-sectional	Age range 25-30 (63.9%)	58.20%	488	N/A	Living with dependents; Housing stability and accommodation	PHQ-9	Fair
Alam 2021, China, cross-sectional	Age ranges18-25 = 129 (32.1%); 26-30 =162 (40.3%); 31-35 = 85 (21.1%); 36-40 = 26 (6.5%)	15.40%	402	The world's geographical regions are divided into four regions (Asia, Africa, Europe, or America). The geographical regions of China have been divided into seven regions (eastern, northern, southwest, northeast, central, southern, or northwest region).	Isolation (loneliness); Housing stability and accommodation	DASS-21	Fair
Akhtar 2020, Germany, cross-sectional	Mean age = 25.77 (SD = 3.79)	53.10%	557	Students from Latin America mostly belonged to Brazil, Mexico, Colombia, Chile, Argentina and Costa Rica. European students were mainly from France, Italy, Romania, Spain, Bulgaria, Poland and Ukraine. The sample was comprehensively diverse with representation from Asia, Africa, Latin America and Europe. Asian countries included China, Pakistan, Indonesia, India, Iran and Thailand. Cameroon, Kenya, Ethiopia, Ghana and Egypt represented African countries.	Financial situation; Living with dependents; Family	Major Depression Inventory[7]	Good
Zhang 2011, US, cross-sectional	Mean age = 26.19 (SD=3.75)	43.50%	508	508 Chinese international students (i.e., citizens of People's Republic of China). China.	Adjustment difficulties; Social connectedness; Quality of social support systems	CES-D	Good

Author, year, country where study was conducted, study design	Age range or mean age (years)	Gender (percent female unless otherwise specified)	Total sample size	Participants' country of origin, specific ethnicities (where applicable)[1]	Exposure(s)	Depression assessment tool	Study Quality[2]
Ying 2005, US, Cohort study	Mean age = 25.42 (SD = 2.52) at Time 1	43.30%	172[8]	Taiwanese. Taiwan.	Isolation (loneliness); Homesickness	CES-D	Fair
Yang 1995, US, cross-sectional	Age range = 18-40 years, mean age = 23.49 (SD = 4.48)	27.72%	101	Countries of origin: India (29), People's Republic of China (21), Indonesia (10), Vietnam (9), South Korea (6), Taiwan (4), Malaysia (3), Philippines (3), Pakistan (3), Hong Kong (2), Thailand (2), Iran (2), Japan (1), Singapore (1), Bangladesh (1), Sri Lanka (1), Israel (1), Lebanon (1), and Turkey (1).	Isolation (loneliness); Quality of social support systems	Zung's Self-Rating Depression Scale	Good
Yang 1994, US, cross-sectional	Age range = 18-40, mean age = 23.49 (SD = 4.48)	27.72%	101	Countries of origin: India (29), People's Republic of China (21), Indonesia (10), Vietnam (9), South Korea (6), Taiwan (4), Malaysia (3), Philippines (3), Pakistan (3), Hong Kong (2), Thailand (2), Iran (2), Japan (1), Singapore (1), Bangladesh (1), Sri Lanka (1), Israel (1), Lebanon (1), and Turkey (1).	Isolation (loneliness)	Zung's Self-Rating Depression Scale	Good
Xiong 2022, US, cross-sectional	Mean age = 25.05 (SD = 5.50)	57.89%	188	20.37% students indicated they were from the China (PRC), 13.58% students from Mexico, and 11.11% students from India. The rest of the sample (53.29%) were from (Nepal = 5, Bangladesh = 8, Egypt = 4, South Korea = 4, etc.). We coded students from PRC, South Korea, and Vietnam as East Asians and students from India, Nepal, and Pakistan as South Asians.	Perceived discrimination; mature age status	DASS-21	Good
*Xiong 2019, US, cross-sectional	Unknown	Female: 51.2% (Asian) 51.3% (American) 55.4% (Other). Trans 0.4% (Asian) 0.4% (American) 0.3% (Other)	114,816		Family	Depressive disorder symptoms. Nine items measured depressive disorder symptoms.	Fair

Author, year, country where study was conducted, study design	**Age range or mean age (years)**	**Gender (percent female unless otherwise specified)**	**Total sample size**	**Participants' country of origin, specific ethnicities (where applicable)[1]**	**Exposure(s)**	**Depression assessment tool**	**Study Quality[2]**
Wei 2015, US, cross-sectional	Age range = 18-36, mean age = 22.8 (SD = 3.46)	50%, 2% unknown	201	Chinese. 91% of them were from China, 8% were from Taiwan, and 1 did not report a home country.	Language (barriers, proficiency); Perceived discrimination	DASS-21	Good
Wei 2007, US, cross-sectional	Mean age = 27.97 (SD = 4.65)	51%	189	Chinese. The predominant countries of origin were China (n = 135; 71.4%) and Taiwan (n = 43; 22.8%; 11 participants did not report their country of origin).	Acculturative stress	CES-D	Good
Wang 2017, US, cross-sectional	Mean age = 25.02 (SD = 4.1)	57.02%, 0.83% unknown	121	Taiwanese. Taiwan.	Language (barriers, proficiency); Social connectedness; Quality of life (life satisfaction, academic satisfaction)	DASS-21	Good
Tsacoumangos 2018, US, cross-sectional	Age range = 18-28	66.67%	24	There was one participant from each of the following countries: Thailand, Indonesia, Singapore, Chile, Egypt, Mexico, India, Rwanda, and one of unknown origin. Five participants reported they were from China, five from South Korea, three from Taiwan, and two from Japan.	Acculturative Stress; Quality of social support systems	BSI	Poor[9]
Tausova 2019, Netherlands, cross-sectional	Age range = 17-37, mean age = 24.51 (SD = 3.57)	50.78%	315	International students from 62 countries attending University in the Netherlands, predominantly from Europe (62%)	Acculturative Stress; Language (barriers, proficiency); Mature age status; Quality of life (life satisfaction, academic satisfaction)	DASS-21; BSI	Good
Sun 2021, US, cohort study	Age range = 17-29, mean age = 20.65 (SD = 2.37)	59%, 0.5% unknown	210	Chinese. China.	Language (barriers, proficiency); Perceived discrimination; Social connectedness; Connection to campus and student culture	BDI	Good
Sumer 2008, US, cross-sectional	Age range = 18-49 years, mean age = 26.15 (SD = 4.78)	Unknown	440	68% of the participants were Asian, followed by 16% White/non-Latino/a, 4%, Latino/a, 3% Middle Eastern, 2% Black, 7% who identified themselves as other. A breakdown of Asian students by region was as follows: India, 38%; China, 28%; Korea,	Language (barriers, proficiency); Quality of social support systems; Mature age status	Goldberg Depression Scale (Goldberg, 1993; Holm,	Good

Author, year, country where study was conducted, study design	Age range or mean age (years)	Gender (percent female unless otherwise specified)	Total sample size	Participants' country of origin, specific ethnicities (where applicable)[1]	Exposure(s)	Depression assessment tool	Study Quality[2]
				13%; Taiwan, 8%; Japan, 3%; Singapore, 3%; Thailand, 2%; 1% each from Malaysia, Nepal, Pakistan, and Sri Lanka; and less than 1% each from Indonesia, Philippines, and students who did not indicate their country of origin.		Holm, & Bech, 2001)[10]	
Suh 2019, (South) Korea, cross-sectional	Age ranges 20-24 (n= 59; 48.3%), 25-30 (n = 33; 27.5%), >30 (n = 18; 15.0%), 19 (n = 11; 9.1%)	52.54%	118	The geographical regions from which participants' home countries were located included South–East and East Asia region (n= 77; 63.3%), followed by Middle East and West Asian region (n= 40; 33.9%)	Language (barriers, proficiency); Perceived discrimination	CES-D	Fair
Smiljanic 2013, US, cross-sectional	Age range = 22-45, mean age = 28.88	50.55%	91	42 identified themselves as Asian, 35 as White, 6 as Latino, and 8 as other, such as Middle Eastern.	Acculturative Stress	CES-D	Good
*Shenoy 2003, US, case Control	Unknown	Unable to determine	145[11]	Pilot study: 10 American, 10 Chinese, 10 Indian. Main study: 45 American, 35 Chinese, 35 Indian.	Adjustment difficulties	GHQ-28	Fair
Shafaei 2018, Malaysia, cross-sectional	Age ranges = 25-35 (64%), 36-45 (25%), <25 (5%), >46 (6%)	35% female	974	Asia (45%), Middle East (36%) and Africa (19%).	Adjustment difficulties; Quality of life (life satisfaction, academic satisfaction)	DASS-21 Depression 6-item scale	Fair
***Sammour 1993, US, cross-sectional	Unknown	Unable to determine	62	36 Arab graduate students (25%), 31 African graduate students (25%) and 45 East Asian graduate students (5%).	Social connectedness	BDI	Fair
Sam 1991, Norway, cross-sectional	Average age (mode) 26-[12]30	38.06%, 0.65% unknown.	310	Of these 310 students, 34 were Scandinavians; 50 Europeans; 47 Black Africans; 21 Arabic speaking citizens; 92 Asians; 36 North Americans; five Latin Americans and one Australian. Twenty-four respondents did not indicate their country of origin.	Isolation (loneliness); Quality of social support systems; Quality of life (life satisfaction, academic satisfaction)	Symptom Checklist[13]	Poor[14]
Rice 2012, US, cross-sectional	Age range = 20-43, mean age = 23.37 (SD = 2.51)	China = 45.74%, India = 19.88%	295	China (N = 129) and India (N = 166)	Acculturative Stress	CES-D	Good

Author, year, country where study was conducted, study design	**Age range or mean age (years)**	**Gender (percent female unless otherwise specified)**	**Total sample size**	**Participants' country of origin, specific ethnicities (where applicable)[1]**	**Exposure(s)**	**Depression assessment tool**	**Study Quality[2]**
Reid 2022, US (Florida), cross-sectional	Age ranges = 18-24 n = 138 (63.0%); 25-30 n = 46 (21.0%); 31-35 n = 22 (10.1%); >35 years n = 13 (5.9%)	61.60%	219		Quality of social support systems	DASS-21	Good
Rahman 2004, US, cross-sectional	Age range = 18-31, mean age = 21.4	16.08%	199	India, Pakistan, Bangladesh.	Language (barriers, proficiency); Perceived discrimination; Self-efficacy	CES-D	Good
Qi 2018, US, Cohort study	Mean age = 24.3 (SD = 3.30)	58.44%	177[15]	37 respondents were from Taiwan and 106 from Mainland China.	Acculturative stress; mature age status	BSI	Fair
Mirzadeh 2000, US, Cohort study	Age range = 17-41, mean age = 24.43	52%	102	On the race/ethnicity dimension, most of the participants identified themselves as Asian (n =68; 67%), followed by White (n = 26; 26%), and Black (n = 3; 3%). The sample included students of 34 nationalities with students from China forming the largest group (n = 21; 20.6%), followed by students from Thailand (n = 11; 10.8%). When students were assigned to geographical regions according to their country/culture of origin the Far East was the largest group (n = 54; 52%), followed by the Middle East (n = 16; 15%) and Western Europe (n = 12; 12%). For the purposes of hypothesis D, the regions were then collapsed into European (n = 17; 17%) and non-European (n = 85; 83%).	Quality of social support systems	SCL-90-R	Good
Meghani 2016, US, cohort study	Age range = 21.2-35.3, mean age = 24.1 at Time 1	34%	114	Asian Indian. India.	Adjustment difficulties; Social connectedness	Boston X 4 CES-D (Kohout, Berkman, Evans & Cornoni-	Good

Author, year, country where study was conducted, study design	Age range or mean age (years)	Gender (percent female unless otherwise specified)	Total sample size	Participants' country of origin, specific ethnicities (where applicable)[1]	Exposure(s)	Depression assessment tool	Study Quality[2]
						Huntley, 1993)[16]	
Mason 2018, US, cross-sectional	Age ranges = 18-25 66 (62.26%); 26-35 36 (33.96%); 36-55 3 (2.83%); >55 1 (0.94%)	67.92%	106	India 44 (41.51%); China 20 (18.87%); North Korea 9 (8.49%); Indonesia 5 (4.72%); Taiwan 4 (3.77%); Vietnam 4 (3.77%); Nepal 4 (3.77%); Thailand 3 (2.83%); Japan 3 (2.83%); Pakistan 2 (1.89%); Philippines 2 (1.89%); Singapore 1 (0.94%); Malaysia 1 (0.94%); Myanmar 1 (0.94%); South Korea 3 (2.83%).	Perceived discrimination	CES-D	Good
*Mallinckrodt 1992, US, cohort study	<25 7%, 25-30 50%, >30 43%	International: 25%, .37% unknown. Comparison group females: 45%	272	106 international (39%), 166 domestic US grad students. 72% Asian, 21% White, 4% Black, 2% Hispanic.	Financial situation; Living with dependents; Quality of social support systems; Connection to campus and student culture	Bell Global Psychopathology Scale (Schwab, Bell, Warheit, & Schwab, 1979). Depression subscale (10 items).	Fair
Maleku 2021, US, cross-sectional	Mean age = 27.8 (SD=5.53)	61.20%	103	The students identified themselves as Asian (58.3%), Hispanic or Latino (22.3%), White (9.7%) or another ethnicity (9.7%). China (16.5%), South Korea (15.5%), India (10.3%), Brazil (7.2%) and Nepal (5.2%) as the top five countries represented.	Isolation (loneliness); Perceived discrimination	PHQ-9	Good
Ma 2021, US, cohort study	Age range = 21-39, mean age = 25.15 (SD = 3.31), 21-25 39 (70.9%), 26-30 13 (23.6%), >30 3 (5.5%)	Chinese = 43.8%, Indian= 39.1%	55[16]	Chinese and Indian. China and India.	Acculturative Stress; Financial situation; Quality of social support systems	CES-D	Good
Lu 2022, China, Cross-sectional	Mean age = 22.76 (SD = 3.60)	46.82%	519		Quality of social support systems; Mature age status	PHQ-9	Good
*Liu 1985, US, Cross-sectional	Mean age = 29	13.87%	137	Graduate students: Arab, Chinese, Indian, Japanese, Korean, Latin American.	Family; Mature age status	Zung (1974) Self-Rating	Poor[17]

Author, year, country where study was conducted, study design	**Age range or mean age (years)**	**Gender (percent female unless otherwise specified)**	**Total sample size**	**Participants' country of origin, specific ethnicities (where applicable)[1]**	**Exposure(s)**	**Depression assessment tool**	**Study Quality[2]**
						Depression Scale	
Liu 2016, China, Cross-sectional	Mean age = 2.75 (SD = 4.11)	40.70%	567	94 countries. African (40.40%) and Asian countries (43.84%), and less than 20% were from Europe, North or South America and Oceania.	Acculturative Stress; Homesickness	CES-D	Fair
Liu 2022, US, Cross-sectional	Age range = 18-35, mean age = 25.47 (SD = 3.95)	48.20%	167	Chinese. 165 (98.8%) were mainland Chinese, 1 (0.6%) was from Hong Kong or Macau, and 1 (0.6%) did not respond to this item.	Acculturative Stress	DASS-21	Fair
Lee 2004, US, Cross-sectional	Age range = 19-41, mean age = 30.	30%	74	Korean. Korea.	Quality of social support systems; Mature age status	BSI modified[18]	Fair
Lau 2007, US, Cross-sectional	Age range = 19-48, mean age = 29.35 (SD = 4.83)	44%	184	88% were from Mainland China, 9% from Taiwan, and 2% from Hong Kong.	Acculturative Stress; Homesickness; Family; Quality of social support systems; Quality of life (life satisfaction, academic satisfaction)	BSI	Good
Koppenborg 2022, Netherlands, Cross-sectional	Age range = 18-43, mean age = 22.86 (SD=3.33)	81.10%	190	Participants were from 53 different nationalities, with German (30.5%), Greek (6.3%) and Chinese (5.3%) being the most frequent.	Mental health literacy (awareness, recognition)	PHQ-9	Fair
**Kim 2016, US, Cross-sectional	Mean age = 24.64 (SD =3.84).	44.40%	322	Students originated from 24 countries. The largest group of international students came from India (37.6%), followed by China (23.6%), South Korea (15.5%), and other (23.3%). Other countries included Afghanistan, Bangladesh, Brazil, Egypt, France, Jordan, Kazakhstan, Kenya, Laos, Mexico, Nepal, Nigeria, Palestine, Russia, Saudi Arabia, Singapore, Thailand, Vietnam, Uganda, and UK.	Acculturative Stress; Financial situation; Perceived discrimination; Family; Social capital	PHQ-9	Good
Kim 2013, US, Cross-sectional	Age range = 18-56, mean age = 26.5 (SD = 5.56)	57.10%	224	The ethnicity of the participants was 96 Korean (42.9%), 82 Chinese (36.6%), 12 Taiwanese (5.4%), 10 Asian Indian (4.5%), 5 Thai (2.2%), 4 Japanese (1.8%), 2 Indonesian (0.9%), 2 Singaporean (0.9%), 2 Vietnamese (0.9%), 1 Malaysian (0.4%), and 8 other Asian (3.6%).	Acculturative Stress; Quality of social support systems	CES-D	Good

Author, year, country where study was conducted, study design	Age range or mean age (years)	Gender (percent female unless otherwise specified)	Total sample size	Participants' country of origin, specific ethnicities (where applicable)[1]	Exposure(s)	Depression assessment tool	Study Quality[2]
Kegel 2015, US, Cross-sectional	Age range = 18-49, mean age = 24.55 (SD =4.83)	59%, 1% unknown	386	Asian racial/ethnic background according to the U.S. Census definition, which includes persons from Far Eastern Asia, Southeastern Asia, and the Indian subcontinent (Hoeffel, Rastogi, Kim, & Shahid, 2012). A breadth of home countries was represented, including China (32%), India (23%), Korea (8%), Taiwan (5%), Japan(4%), Vietnam (4%), and Thailand (3%) (12% from 10 additional countries; 8% missing).	Acculturative Stress; Homesickness; Social connectedness	Depression, Anxiety, and Somatization subscales[19]	Good
Jung 2007, US, Cross-sectional	Median age range = 22-25	34%, 1.38% unknown	218	35% from China, 22% from Korea, 2% from Japan, 23%from one of other Asian countries, 7% from one of mid-eastern countries, 6% from one of Latin American countries, 3% from one of European countries, 2% from one of African countries.	Acculturative Stress; Perceived discrimination	CES-D	Fair
Jin 2018, US, Cross-sectional	Age range = 18-42, mean age = 26.0 (SD= 4.5)	48.40%	217	The majority of them (78.3%) reported that they were from Asian countries, including China(n = 53, 24.4%), India (n = 40, 18.4%), Taiwan (n = 37, 17.1%), and South Korea(n = 15, 6.9%), but the sample also included participants from many non-Asian countries such as Saudi Arabia (n = 9, 4.1%), Mexico (n = 7, 3%), and Iran (n = 6, 2.8%).	Quality of life (life satisfaction, academic satisfaction)	DASS-21	Good
Huang 2018, Australia, Cross-sectional	Age range = 17-47, mean age = 25.5 (SD=5.0)	49.2%, 0.52% unknown	384	Most were from China or Hong Kong (n = 156, 40.6%), India (n = 65, 16.9%) or Sri Lanka (n = 20,5.2%), followed by Malaysia n = 21, 5.5%), Indonesia, (n = 18, 4.7%), Iran (n = 17, 4.4%), and Vietnam (n = 15, 3.9%). Several other Asian nationalities were also represented with a count less than 10, including from the Philippines, Pakistan, South Korea, Bangladesh, Iraq, Japan, Thailand, Bhutan, Brunei, and Cambodia	Acculturative Stress	CES-D	Good
*/**Hsu 1983, US, Case Control	Age range = 19-40, mean age = 27.56	38.93% unknown	131	Taiwan and Hong-Kong.	Isolation (loneliness)	Beck Depression Inventory	Good

Author, year, country where study was conducted, study design	**Age range or mean age (years)**	**Gender (percent female unless otherwise specified)**	**Total sample size**	**Participants' country of origin, specific ethnicities (where applicable)[1]**	**Exposure(s)**	**Depression assessment tool**	**Study Quality[2]**
*Hamamura 2014, Canada, Case Control	Age range = 18-46, mean age =21.6 (SD=3.5)	71.90%	178	52 East Asian international students and 126 domestic students participated	Acculturative Stress	CES-D	Poor[20]
Hahn 2010, US, Cross-sectional	Age ranges = 15-20 102 (20.0%), 20-25 223 (43.6%), 26-30 137 (26.8%), 31-35 36 (7.0%)	50.30%	511	Europe 91 (17.8%), Africa 22 (4.3%), Middle East 23 (4.5%), Asia 290 (56.8%), Oceania 13 (2.5%), North America 35 (6.8%), Central/Latin America 9 (1.8%), South America 28 (5.5%).	Financial situation; Language (barriers, proficiency); Perceived discrimination	PHQ-9	Good
Gebregergis 2020, China, Cross-sectional	Mean age = 27.32 (SD = 5.90)	44%	506	Participants of the study originated from more than 110 countries in which majority of the participants were from Asia (45%), and Africa (41%), and the remaining 14% were from the rest of the continents (Europe, Oceania, Latin America, and North America).	Acculturative Stress	CES-D	Good
*Fonseca 1996, US, Cross-sectional	Age range = 22-46, mean age = 32.71 (SD = 6.57)	48%	228[21]	Most participants were from Asia: Korea, Republic of China (Taiwan), People's Republic of China, India, Bangladesh, Indonesia, Philippines, Pakistan, and Sri Lanka. Less than a fifth of the sample was from Latin America and the Caribbean, and very few were from Africa, Middle East, and Europe.	Financial situation; Language (barriers, proficiency); Quality of social support systems	6 -item scale of depressive mood[22]	Good
Dong 2022, US, Cross-sectional	Mean age = 29.4 (SD = 5.11)	50.80%	177	Asian. China (including mainland China, Hong Kong, and Taiwan) 105 (59.3%), South Korea 36 (20.3%), India 24 (13.6%), Japan 2 (1.1%), Malaysia 2 (1.1%), Singapore 2 (1.1%), Thailand 1 (0.6%), Vietnam 1 (0.6%), Others 2 (1.1%).	Isolation (loneliness); Perceived discrimination	PHQ-9	Fair
Constantine 2004, US, Cross-sectional	Age range = 17-51, mean age = 23.63 (SD = 4.73)	59.40%	320	81 (25.3%) of the participants were from African countries (e.g., Nigeria, Ghana, Kenya, South Africa, Zimbabwe, and Ethiopia), 136 (42.5%) were from Asian countries (e.g., China, India, Japan, Korea, Taiwan, Pakistan, Vietnam, and the Philippines), and 103 (32.2%) were from Latin American countries (e.g., Mexico, Brazil, Colombia, Peru, Venezuela, Ecuador, Chile, Dominican Republic, and Guatemala).	Acculturative Stress; Language (barriers, proficiency); Self-efficacy	CES-D	Fair

Author, year, country where study was conducted, study design	Age range or mean age (years)	Gender (percent female unless otherwise specified)	Total sample size	Participants' country of origin, specific ethnicities (where applicable)[1]	Exposure(s)	Depression assessment tool	Study Quality[2]
Cheung 2013, Hong Kong, Cross-sectional	Mean age = 21.9 (SD = 2.9)	62.60%	215	Chinese. Mainland China.	Social connectedness	CES-D	Fair
Bissram 2016, US, Cross-sectional	Age range = 18-43, mean age = 25.07 (SD = 5.11).	54.24%, .42% unknown	236	~52% of the population originated from East Asia (China, Korea, Japan, Hong Kong, Taiwan, ~20% from South Asia (India, Bangladesh, Nepal, Pakistan), ~10% from South America.	Acculturative Stress; Living with dependents; Language (barriers, proficiency); Quality of social support systems; Quality of life (life satisfaction, academic satisfaction)	CES-D	Good
Billedo 2019, Amsterdam, Netherlands, Cohort study	Age range = 16-49, mean age = 25.21 (SD = 4.50) at Time 1	59.40%	414[23]	76 different countries (43.4% from Europe, 27.6% from Asia, and the rest from South America, Africa, North America, and Australia).	Quality of social support systems	CES-D	Fair
An 2022, Japan, Cross-sectional	Age range = 18-29, mean age =23.34 (SD=2.48)	53.35%	523	Chinese. Mainland China.	Acculturative Stress	Self-Rating Depression Scale[24]	Fair
Amado 2020, US, Cross-sectional	Age range = 18-35, mean age = 22.27 (SD = 3.8)	65.50%	171	39 different countries, with the most participants from China (46%) and India (14%) (other countries <10% each).	Acculturative Stress; Mature age status	CES-D	Good
Al-Krenawi 2021, US, Cross-sectional	Age range = 17-58, mean age = 28.6 (SD=8.3)	100%	84	Saudi. Saudi Arabia.	Acculturative Stress; Language (barriers, proficiency); Mature age status	BDI-II (Beck et al. 1996)[25]	Good
Chen 1992, US, Cross-sectional	Age range = 20-50+	43.0%	342	Anglo-American, Asian-American, Foreign Students.	Quality of support systems; social connectedness	Health and Daily Living Form (HDL) (Moos, Cronkite, Billings, & Finney, 1983).	Fair
Ben-Ari 2002, Israel, Cross-sectional	Group 1 mean age = 21.6 (SD = 2.3); Group 2 mean age = 24.9 (SD = 3.9);	83.8%	278	Israeli Arabs, Israeli Jews, Russian immigrants.	Quality of social support systems	Beck Depression Inventory	Poor[26]

Author, year, country where study was conducted, study design	**Age range or mean age (years)**	**Gender (percent female unless otherwise specified)**	**Total sample size**	**Participants' country of origin, specific ethnicities (where applicable)[1]**	**Exposure(s)**	**Depression assessment tool**	**Study Quality[2]**
	Group 3 mean age = 23.1 (SD = 3.0)					(Beck & Steer, 1987)	
Seo 2012, US, Cross-sectional	Age range = 18-43, mean age = 24.76 (SD = 4.71)	61.6%	255	171 (61.7%) participants identified their country of origin as China, 64 (25.1%) as Korea, 11 (4.3%) as Japan, 4 (1.6%) as Taiwan and 5 (2%) as Other.	Isolation	Hopkins Symptom Check List (HSCL-25; Hesbacher, Rickels, & Morris, 1980)	Good
Xiong 2023, US, Cross-sectional	Not reported	52.5%, 0.35% Transgender	10,731	Asian, American, Other.	Isolation; Family	American College Health Association-National College Health Assessment (ACHA-NCHA), depressive disorder symptoms	Fair
Ma 2022, US, Cross-sectional	Not reported	53.3%, 4.4% unknown	433	Chinese	Perceived discrimination; Language;	Mental health problems adapted from Gong et al., 2010 and Lovibond & Lovibond, 1995	Fair
Hirai 2013, US, Longitudinal	Mean age = 22.6 (SD = 3.6) at T1	52%	211[27]	Most identified as Asian (87%) followed by White (8%), Hispanic/Latino(a) (3%), and Black/African (2%). Roughly half reported growing up in China (47%), followed by India (18%), Korea (7%), and all other countries (28%; each less than 3%).	Acculturative stress; Language; Social Connectedness; Perceived Discrimination	21-item Depression Anxiety Stress Scale (DASS-21;	Good

Author, year, country where study was conducted, study design	Age range or mean age (years)	Gender (percent female unless otherwise specified)	Total sample size	Participants' country of origin, specific ethnicities (where applicable)[1]	Exposure(s)	Depression assessment tool	Study Quality[2]
						Lovibond & Lovibond, 1995)	

Footnotes can be found in Supplementary Table 3.
*=Domestic student comparison group
**= Other international student comparison groups in the same country of study
***=COVID-19 international students in the UK and USA who returned to their home country or region (returnees) and those who stayed in their institution country

Table 3
Results of meta-analyses including the meta-analytic model employed per exposure: estimates, standard errors, prediction intervals in Pearson's r, and heterogeneity estimates

Exposure	Number of Studies reporting exposure	Number of effect sizes	Multilevel model	Estimated r (Confidence Intervals lower bound, upper bound)	Prediction Intervals, r (lower bound, upper bound)	I-squared % (total heterogeneity/total variability)
Acculturative Stress	18	20	No	0.44*** (0.39, 0.49)	(0.22, 0.62)	88.94
Language	13	15	No[1]	-0.18*** (-0.23, -0.11)	(-0.37, -0.04)	54.89
Social Connectedness	5	10	Yes	-0.26*** (-0.36, -0.15)	(-0.49, -0.01)	Within (7.33) Between (77.84)
Social Support	20	25	Yes	-0.29** (-0.35, -0.22)	(-0.53, -0.01)	Within (0) Between (87.24)
Life Satisfaction	5	5	No	-0.20 (-0.53, 0.18)	(-0.92, 0.62)	98.76

[1] A multilevel was not used as there were only 2 papers with 2 effect sizes. This analysis involved a simple random mixed effects model by removing the bigger effect size (absolute value).