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ORIGINAL PAPER

Depressive Symptom Severity and Immigration-Related Characteristics in Asian American Immigrants

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Abstract
The study examined immigration factors associated with depressive symptom severity among Asian American immigrants. Participants were 458 Chinese, Korean and Vietnamese adults. Depressive symptom severity was measured by PHQ-9. Overall, the likelihood of being moderately to severely depressed was significantly increased among immigrants living in the US for < 10 years and Korean Americans compared to Chinese Americans. However, mild level of depressive symptoms was not associated with any immigration-related factors. The positive impact of shorter duration of living in the US and a younger age at immigration (≤ 17) on depressive symptoms was evident among women but not among men. For men, marital status and education level were significant predictors of being moderately to severely depressed. Differentiating immigrant factors and identifying depressive symptom severity can help drive community and clinical interventions to detect and treat depression early among Asian American immigrants.

Keywords Asian Americans · Immigrants · Depression · Symptom severity

Introduction

Depression is reported as the leading cause of disability worldwide and the fourth largest contributor to the global burden of disease [1]. The prevalence of lifetime and 12-month DSM-V major depressive disorder (MDD) in general United States (US) population is estimated to be 20.6% (14.7% for male and 26.1 for female) and 10.4% (7.2% for male and 13.4%) separately based on the National Epidemiologic Survey on Alcohol and Related Conditions III (NESARC-III) conducted in 2012–2013 [2]. The prevalence of any lifetime DSM-IV affective disorder in Asian Americans was 9.1% according to the National Latino and Asian American Study (NLAAS) conducted in 2002–2003 which is the first national epidemiological survey of Asian Americans in the US [3]. More recent NESARC III data, however, reported an increased rate of 12.2% lifetime MDD among Asian Americans [2].

Recent studies using the large-scale national epidemiological surveys have demonstrated that the prevalence of depressive symptoms varies in different subgroups based on immigration-related characteristics. Specifically, among the sample of NLAAS, Asian Americans who were born in the United States (US) were two times more likely to have depressive disorders than their foreign-born counterparts [3]. In addition to nativity, analyses of the NLAAS and NESARC studies found that depressive disorder was lower among Asian Americans who immigrated to the US at age 18 or older or at age 14 or older compared to their US-born counterparts [3, 4]. When compared with those who immigrated before 18 years old, the later arrivals were reported lower risk of depressive disorder [5]. Asian American men who lived in the US up to 5 years and Asian American women who lived in the US for 6–20 years also reported lower rate of depressive disorders, compared to their US-born counterparts [3]. With regard to English ability, compared to Asian Americans whose English proficiency is fair or poor, those who have good or excellent English ability are less likely to have a depressive disorder [3, 6].

These immigration related factors represent unique immigration experiences and acculturation indication.

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Earlier arrival and longer length of residence in the US may lead to increased socialization and exposure to US lifestyle and culture, which can play out in both protective and detrimental ways. English proficiency is also a main indicator of acculturation that may allow immigrants to be socially integrated into the mainstream society and obtain socio-economic status in the US. The NLAAS and NESARC studies revealed important findings about the disparities between native- and foreign-born Asian Americans and the impact of immigration-related factors on depressive disorders [3, 7]. In addition, they revealed that gender is an important moderator in the relationship between nativity or immigration-related factors and depressive disorder. For example, nativity effect on mental disorder was prominent for Asian women than men and the higher risk of mental disorder among early arrivers (i.e., before age 18) mainly applied to women but not men, whereas the protective effect of higher level of English proficiency was only significant for men but not for women [3, 7].

However, it has not been fully examined how immigration related factors influence the likelihood of depressive disorder within the foreign-born immigrant population, as most analyses in these studies have focused on the comparisons between immigrants and US-born Asian Americans, using the US-born as a reference group. Given that two-thirds of the Asian population is foreign-born, and immigration has been a major driving force for the Asian American population to grow fast, with a 72% increase in population between 2000 and 2015, it is particularly important to understand mental health pattern and associated immigration-related factors in Asian Americans [8–10].

The national epidemiological studies have focused primarily on diagnosis of psychiatric disorders as defined by DSM-IV. This methodology enabled the study findings to be compared with other studies using the same measures. However, it is possible to underestimate the rates of depressive disorders particularly among Asian American immigrants who tend to underreport sadness or depressed mood as their primary complaint [11]. It also has been well documented that Asian Americans delay seeking professional help until the conditions become severe and chronic [12, 13]. This suggests the importance of detecting depression early before the symptoms develop to meet the full diagnosis criteria. For the early detection of depression, it is essential to distinguish between mild and moderate/severe, as well as between diagnosable and non-diagnosable depression and to identify associated factors both mild and moderate/severe depression. However, studies have not differentiated mild from moderate/severe or diagnosable depression and the factors associated with different level of depression severity are not well known. To our best knowledge, no study examined the relationship between immigration-related characteristics and different level of severity of depressive symptoms.

Therefore, the purpose of the present study was to examine whether sociodemographic and immigration related factors including age at immigration, years living in the US, and English proficiency were associated with different level of depressive symptoms (i.e., minimal, mild, and moderate/severe) among Asian American immigrants. Gender has been reported to be an important moderator of the effect of immigration-related factors on depressive symptoms and the association will be investigated separately in men and women.

Methods

Recruitment and Participants

The Center for Asian Health has been collaborating with various Asian community-based organizations (CBOs) including churches, temples, and local ethnic organizations for more than 10 years. Recruitment and data collection were conducted in collaboration with the CBOs, and the organization leaders arranged meetings or events to introduce the study to their organization member. Research staff participated in the social, cultural, or religious events of the CBOs, provided information about the study, and recruited participants.

The participants came from Chinese (n = 159), Korean (n = 179), and Vietnamese (n = 142) American communities within Philadelphia and Montgomery Counties in Pennsylvania. In Philadelphia, Vietnamese, Chinese and Koreans represent the 2nd, 3rd, and 6th largest foreign born residents respectively [14]. Within Philadelphia county, the total population of Asian Americans is 7.1% with a median household income of $50,673, with approximately 38,000 Chinese Americans, 7000 Korean Americans and 16,000 Vietnamese Americans [14]. In Montgomery county, Asian Americans represent 7.1% of the population with approximately 12,000 Chinese Americans, 13,000 Korean Americans and 4000 Vietnamese Americans [14]. Approximately 65% of Chinese, 35% of Korean, and 50% of Vietnamese sample of our study lived in urban areas of Philadelphia, with the rest residing in suburban areas.

Measures

All questionnaires were translated into Korean, Mandarin and Vietnamese languages and were administered at each community-based organization sites with assistance from collaborating community leaders.

Sociodemographic information included gender, age, marital status, and education level. Reported age was divided into

three categories, 18–39, 40–64 and 65 + years old. For *immigration-related variables*, we collected country of origin, age at time of immigration, years living in the US, and English proficiency. Age at time of immigration and years in the US were measured as a continuous variable and then split into categories. Age of arrival to US was categorized into 0–17 and 18 or older. Years in the US was categorized into 0–9 years, 10–19 years, and 20 years or longer. English Proficiency was assessed with the question "How well do you speak English?" and responses were separated into 2 categories: not at all/not well, and well/very well. The subcategories of demographic and immigration-related variables have been made based on the previous studies and immigration-related literature.

Depressive symptoms were assessed by the Patient Health Questionnaire (PHQ-9). The PHQ-9 was a nine-item self-report depression scale developed to screen for depressive symptoms in the primary care setting [15]. The nine items were derived from the DSM-IV diagnostic criteria to address somatic symptoms as well as affective and cognitive aspects of depression and reflects the severity of depressive symptoms over the past 2 weeks. The items of the PHQ-9 are rated on a 4-point response scale from 0 (not at all) to 3 (nearly every day), with a total score ranging from 0 to 27. Cutoff values of 5, 10, 15 and 20 have been widely used. For this study, the total score of 1–4 were defined as minimal depression, 5–9 as mild, and 10 or higher scores were defined as moderate/severe depression. For the three sub-ethnic groups who participated in the study, we used the previously validated Chinese, Korean and Vietnamese version of PHQ-9 [16–18].

Data Analysis

We examined the frequency of demographic variables, immigration-related characteristics, and mental health problems using descriptive statistics. Then, a series of Chi-square tests were used to compare the demographic and immigration-related variables among Asian immigrants with minimal, mild, and moderate/severe depressive symptoms. Multinomial logistic regression was used to examine the association between the different level of depression severity (mild vs. minimal, moderate/severe vs. minimal, and moderate/severe vs. mild) and demographic and immigration related variables in overall Asian American immigrants and each gender group. The odds ratio, confidence interval, and p-values were computed. We used SPSS version 25.0 to conduct the analysis.

Results

Participant Characteristics

As displayed in Table 1, the majority of participants were aged 40 or older (86%) and married (73.0%). Slightly more than half were female (58.6%) and had attained a high school education or less (51.2%). The distribution of ethnic groups was similar for Chinese (33.5%), Korean (35.8%) and Vietnamese (30.3%). With regards to immigrant factors, the majority of participants did not speak English at all or not well (81.2%), had moved to the US when they were 18 years or older (90.0%), and had been living in the US for 10 years or longer (83.1%). With regard to depressive symptom severity, 29.8% reported mild depressive symptoms and 7.7% reported clinically diagnosable moderate/severe depressive symptoms. There were statistically significant differences for education level ($p < 0.001$), ethnicity ($p < 0.001$), age moved to the US ($p < 0.05$) and years since moving to the US ($p < 0.01$) among the three groups with minimal, mild and moderate/severe depressive symptoms. Figure 1 represents the frequency of depressive symptoms by ethnic group.

Multinomial Regression on Depressive Symptom Severity

Multinomial regression analysis was conducted to determine the sociodemographic and immigration-related factors associated with different levels of depressive symptom severity. Among overall participants (Table 2), ethnicity was the only variable associated with mild (versus minimal) depressive symptoms: those of Chinese ethnicity were 2.37 times as likely ($p < 0.01$) to have mild depressive symptoms, and those who were Vietnamese were 50% less likely ($p < 0.05$) to have mild depressive symptoms compared to Koreans. Although not significant, moderate/severe depression (versus minimal) was marginally ($p < 0.1$) associated with age of immigration to the US: those who had moved to the US before 17 years old or younger had 5.32 times odds of having moderate/severe depressive symptoms compared to those who moved to the US after 18 years old. When compared to mild level, moderate/severe depression was associated with years lived in the US and marital status in addition to ethnicity; those who had moved to the US less than 9 years ago were 5.13 times as likely to have moderate/severe depressive symptoms compared to those who moved to the US 20 years ago or more; those who were married were 70% less likely ($p < 0.05$) to have moderate/severe depressive symptoms compared to those who divorced and those of Chinese ethnicity were 87% less likely ($p < 0.05$) to belong in the moderate/severe (versus mild) depressive symptom category compared to those of Korean ethnicity.

Among men (Table 3), those with a high school education or less were 22.56 times more likely ($p < 0.05$) to have moderate/severe depressive symptoms (versus minimal) compared to those with a graduate degree. Furthermore, those who were married were 96% times less likely ($p < 0.05$) to have moderate/severe depressive symptoms (versus mild symptoms) compared to those divorced. Chinese men were

Table 1 Characteristics of study participants

Variables	Overall (n = 458)	Minimal (n = 278)	Mild (n = 143)	Moderate/severe (n = 37)	p value
Age					0.063
Age 18–39	64 (14.0%)	37 (57.8%)	18 (28.1%)	9 (14.1%)	
Age 40–64	210 (45.9%)	123 (58.6%)	76 (36.2%)	11 (5.2%)	
65 or older	184 (40.2%)	118 (64.1%)	49 (26.6%)	17 (9.2%)	
Gender					0.148
Male	189 (41.4%)	115 (60.8%)	64 (33.9%)	10 (5.3%)	
Female	268 (58.6%)	162 (60.4%)	79 (29.5%)	27 (10.1%)	
Marital status					0.087
Single	71 (15.8%)	47 (66.2%)	17 (23.9%)	7 (9.9%)	
Married	327 (73.0%)	193 (59.0%)	112 (34.3%)	22 (6.7%)	
Divorced	50 (11.2%)	33 (66.0%)	10 (20.0%)	7 (14.0%)	
Education					0.000
High school	222 (51.2%)	99 (44.6%)	100 (45.0%)	23 (10.4%)	
College	147 (33.9%)	109 (74.1%)	30 (20.4%)	8 (5.4%)	
Graduate	65 (15.0%)	47 (72.3%)	13 (20.0%)	5 (7.7%)	
Ethnicity					0.000
Chinese	155 (33.8%)	65 (41.9%)	84 (54.2%)	6 (3.9%)	
Vietnamese	139 (30.3%)	109 (78.4%)	19 (13.7%)	11 (7.9%)	
Korean	164 (35.8%)	104 (63.4%)	40 (24.4%)	20 (12.2%)	
English proficiency					0.990
Not at all/not well	363 (81.2%)	219 (60.3%)	114 (31.4%)	30 (8.3%)	
Well/very well	84 (18.8%)	50 (59.5%)	27 (32.1%)	7 (8.3%)	
Age to the US					0.047
0–17 years	45 (10.0%)	25 (55.6%_	12 (26.7%)	8 (17.8%)	
18 or older	406 (90.0%)	251 (61.8%)	126 (31.0%)	29 (7.1%)	
Years since US					
0–9 years	76 (16.9%)	49 (64.5%)	19 (25.0%)	8 (10.5%)	0.004
10–19 years	117 (26.0%)	62 (53.0%)	51 (43.6%)	4 (3.4%)	
20 or longer	257 (57.1%)	165 (64.2%)	67 (26.1%)	25 (9.7%)	

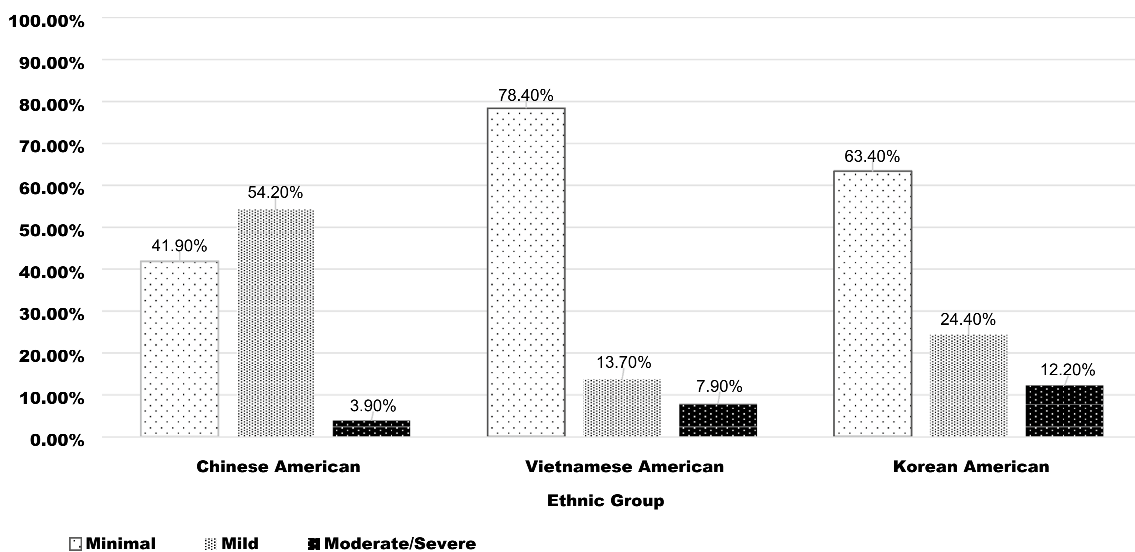

Fig. 1 Depressive symptom prevalence among participants by ethnicity (n = 458)

Table 2 Multinomial regression depressive symptoms in overall participants

Variables	Mild (vs. minimal)	Moderate/severe (vs. minimal)	Moderate/severe (vs. Mild)
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Age			
Age 18–39	1.33 (0.41–4.30)	1.15 (0.23–5.84)	0.87 (0.14–5.53)
Age 40–64	1.18 (0.67–2.05)	0.77 (0.30–1.97)	0.66 (0.24–1.79)
65 or older	1	1	1
Gender			
Male	1.13 (0.70–1.82)	0.62 (0.27–1.42)	0.55 (0.23–1.32)
Female	1	1	1
Marital status			
Single	1.20 (0.31–3.28)	0.40 (0.09–1.81)	0.40 (0.71–2.24)
Married	1.77 (0.75–4.18)	0.53 (0.19–1.46)	0.30 (0.89–0.99)*
Divorced	1	1	1
Education			
High school	1.82 (0.82–4.06)	2.56 (0.80–8.22)	1.41 (0.39–5.13)
College	0.72 (0.33–1.59)	0.63 (0.18–2.15)	0.87 (0.22–3.44)
Graduate	1	1	1
Ethnicity			
Chinese	2.37 (1.27–4.44)**	0.31 (0.10–1.03)†	0.13 (0.04–0.45)**
Vietnamese	0.51 (0.26–0.99)*	0.59 (0.25–1.39)	1.16 (0.43–3.12)
Korean	1	1	1
English proficiency			
Not at all/not well	1.15 (0.54–2.42)	2.51 (0.58–10.96)	2.18 (0.47–10.19)
Well/very well	1	1	1
Age to US			
0–17 years	1.19 (0.38–3.72)	5.32 (0.99–28.5)†	4.46 (0.70–28.47)
18 or older	1	1	1
Years since moving to US			
0–9 years	0.57 (0.26–1.25)	2.91 (0.67–12.6)	5.13 (1.09–24.15)*
10–19 years	0.74 (0.39–1.38)	2.25 (0.57–8.96)	3.05 (0.73–12.67)
20 or longer	1	1	1

AOR adjusted odds ratio, *CI* confidence interval

†p < 0.1; *p < 0.05, **p < 0.01

90% times less likely ($p < 0.05$) to have moderate/severe depression (versus mild depression) compared to the reference group, Koreans.

Among women (Table 4), those of Chinese ethnicity were 2.56 times more likely ($p < 0.05$) to have mild (versus minimal) depressive symptoms, and those who were Vietnamese were 69% times less likely ($p < 0.05$) to have mild (versus minimal) depressive symptoms compared to the reference group, Koreans. Those who had moved to the US before 17 years old had an 8.01 times higher odds ($p < 0.05$) of having moderate/severe (versus minimal) depressive symptoms compared to those who moved to the US after 18 years old. Chinese women were 86% times less likely ($p < 0.05$) to have moderate/severe (versus mild) depression compared to the reference group, Koreans. Lastly, women who had moved to the US less than 9 years ago were 6.85 times more likely to have moderate/severe (versus mild) depressive symptoms compared to those who moved to the US 20 years ago or more.

Discussion

The purpose of this study was to determine the sociodemographic and immigration related factors associated with different levels of depressive symptom severity in Asian American immigrants. In our study, substantial number of Asian immigrants (29.8%) reported mild level of depressive symptoms despite the low rate (7.7%) of clinically diagnosable moderate to severe depressive symptoms. The results indicate that almost one thirds of Asian immigrants suffer from noticeable depressive symptoms that

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Table 3 Multinomial regression on depressive symptoms in men

Variables	Mild (vs. minimal) AOR (95% CI)	Moderate/severe (vs. minimal AOR (95% CI)	Moderate/severe (vs. Mild) AOR (95% CI)
Age			
Age 18–39	5.81 (0.45–75.10)	29.34 (0.12–7253.5)	5.05 (0.02–1316.00)
Age 40–64	1.08 (0.46–2.51)	0.84 (0.13–5.55)	0.78 (0.12–5.25)
65 or older	1	1	1
Marital status			
Single	0.34 (0.03–3.46)	8.47E-12 (8.47E-12–8.47E-12)	2.48E-11 (2.48E-11–2.48E-11)
Married	0.80 (0.23–2.70)	0.04 (0.003–0.45)*	0.05 (0.04–0.61)*
Divorced	1	1	1
Education			
High school	2.76 (0.78–9.79)	22.56 (1.07–476.1)*	8.18 (0.36–188.30)
College	0.78 (0.23–5.27)	0.35 (0.01–8.94)	0.44 (0.02–12.87)
Graduate	1	1	1
Ethnicity			
Chinese	2.27 (0.88–5.85)†	0.22 (0.03–2.03)	0.10 (0.01–0.91)*
Vietnamese	1.00 (0.36–2.77)	0.88 (0.14–5.49)	0.88 (0.13–5.90)
Korean	1	1	1
English proficiency			
Not at all/not well	0.77 (0.28–2.10)	1.16 (0.09–15.81)	1.50 (0.11–20.63)
Well/very well	1	1	1
Age to US			
0–17 years	0.48 (0.07–3.13)	1.00 (0.01–167.10)	2.08 (0.01–378.86)
18 or older	1	1	1
Years since moving to US			
0–9 years	0.39 (0.10–1.56)	1.42 (0.05–40.53)	3.63 (0.12–110.21)
10–19 years	0.10 (0.38–2.63)	2.28 (0.17–30.73)	2.30 (0.17–31.00)
20 or longer	1	1	1

AOR adjusted odds ratio, *CI* confidence interval

†$p < 0.1$; *$p < 0.05$

are not diagnosable but likely to interfere with their daily life functioning. Given that the mild level of depressive symptoms can progress to more severe levels without early detection and treatment, future community based and clinical interventions to screen, diagnose and treat depression based on symptom severity will be beneficial to this population. Our study found that depressive symptoms were significantly associated with immigration-related factors. Specifically, the likelihood of being moderately to severely depressed (versus minimally or mildly depressed) was significantly increased among women who moved to the US at a younger age (< 18) and among those who lived in the US less than 10 years. The impact of immigration related factors on depressive symptoms was moderated by gender and evident only among women, but not among men. Among men, socioeconomic factors such as marital status and education level were the significant predictors of being moderately to severely depressed (versus minimally or mildly depressed). For both men and women, being of Chinese ethnicity lowered the risk of being moderately to severely depressed. Notably, immigration-related factors, except for ethnicity, were not significantly associated with mild depressive symptoms, indicating that they play a greater role in developing more severe form of depressive symptoms. In our overall sample, living in the US less than 10 years was associated with a higher odds of having moderate to severe forms of depression compared to longer (> 20) residency in the US. Existing literature on the risk of depression based on the length of living in the US has shown to be inconsistent. Similar to our study, Singh and Colleagues studied Asian American immigrants and found that recently moving to the US was associated with a higher risk of major depressive episode, and that living in the US for longer had protective effects towards individuals experiencing legal acculturative stressors in their life [5]. However, other epidemiological and community-based studies on Asian American immigrants have found that the number of years living in the US either increased the risk

Table 4 Multinomial regression on depressive symptoms in women

Variables	Mild (vs. minimal) AOR (95% CI)	Moderate/severe (vs. minimal AOR (95% CI)	Moderate/severe (vs. mild) AOR (95% CI)
Age			
Age 18–39	0.86 (0.19–3.84)	0.94 (1.60–5.62)	1.09 (0.13–9.12)
Age 40–64	1.22 (0.56–2.66)	0.80 (0.25–2.51)	0.65 (0.19–2.30)
65 or older	1	1	1
Marital status			
Single	1.06 (0.24–4.75)	1.16 (0.22–6.07)	1.09 (0.14–8.36)
Married	2.10 (0.70–6.27)	0.81 (0.22–2.95)	0.39 (0.08–1.82)
Divorced	1	1	1
Education			
High school	1.28 (0.41–3.95)	1.98 (0.47–8.29)	1.55 (0.30–8.04)
College	0.62 (0.21–1.80)	0.70 (0.17–2.90)	1.13 (0.22–5.86)
Graduate	1	1	1
Ethnicity			
Chinese	2.56 (1.05–6.26)*	0.35 (0.08–1.65)	0.14 (0.03–0.69)*
Vietnamese	0.31 (0.12–0.82)*	0.47 (0.16–1.37)	1.50 (0.40–5.67)
Korean	1	1	1
English proficiency			
Not at all/not well	1.92 (0.56–6.62)	3.42 (0.47–24.81)	1.79 (0.20–15.71)
Well/very well	1	1	1
Age to US			
0–17 years	1.90 (0.38–9.46)	8.01 (1.05–61.35)*	4.21 (0.40–43.86)
18 or older	1	1	1
Years since moving to US			
0–9 years	0.59 (0.21–1.66)	4.00 (0.70–23.00)	6.85 (1.05–44.81)*
10–19 years	0.58 (0.24–1.39)	2.60 (0.48–14.08)	4.48 (0.76–26.43)
20 or longer	1	1	1

AOR adjusted odds ratio, *CI* confidence interval

*$p < 0.05$

or did not have an effect on depressive risk [3, 19, 20]. Takeuchi and colleagues found that men who had been living in the US for less than 5 years and immigrant women who had been living in the US between 6 and 20 years had a lowered risk of depressive disorder compared to those born in the US [3]. Conflicting data regarding the impact of number of years since moving to the US can be due to potential mediating variables that were not investigated in these studies. For instance, there is research indicating that recent immigrants are at a lower risk of depression compared to US born counterparts due to having an overall better physical and mental health status, known as the immigrant paradox [7, 21, 22]. However, the possibility that new immigrants experience acculturative and cultural related stressors that can contribute to developing depression has been displayed [7, 22]. For example, acculturative stress, social isolation, culture shock and having low English proficiency can create challenges that immigrants encounter as a result of moving to the US [6, 7, 22]. Thus, the influence of psychosocial stressors as mediators associated with how many years one has been living in the US and risk of depression are important to investigate in future research.

Our study also found that immigration to the US during childhood or adolescence (< 17 years old) was associated with increased risk of moderate to severe depression significantly among women and marginally ($p < 0.1$) significant among overall participants. This is consistent with recent research on Asian Americans demonstrating that individuals who moved to the US at an early age exhibit similar rates of depression as those US born, and thus, face a higher risk of depression [7, 23]. These findings indicate that immigration characteristics can influence the developmental context of individuals that can impact the risk of depression in their lifetime [23]. More specifically, research has demonstrated that migration during childhood or adolescence was associated with stress due to bicultural challenges, with individuals having to navigate between their heritage and host cultures [24, 25]. Familial pressure and intergenerational conflict related to upholding heritage cultural values at home and

socializing into American mainstream culture can compromise identity development during young adulthood [26, 27]. These bicultural challenges may place strain on identity development and family/peer relationship during a young age and can manifest into depression later in life, having adverse effects during adulthood [28].

The moderating effect of gender in the relationship between immigration-related factors and depressive symptoms is in line with the findings from national datasets. Consistent with our study, analyses from NLAAS reported that the higher risk of psychiatric diagnosis among the individuals who were born in the US or arrived in the US at a younger age applied strongly and stably to women but not to men [23]. NLAAS also demonstrated the protective effect of higher level of English proficiency for men but not for women [23]. However, we did not see the similar impact of English proficiency on depressive symptoms in our study that included a significant proportion of participants with low English proficiency despite having lived in the US for a long period of time. A potential reason for this lack of association may be due to a strong attachment that participants may have to their ethnic community or ethnic enclave, which is protective against depression. Communities with high proportion of one's own ethnic group are characterized as having a social environment that provides strong social cohesion, social support from youth and members and greater access to resources that are supportive for navigating American culture [29].

Sociodemographic factors such as being married and having a higher education level were associated with lower odds of more severe depressive symptoms among men but not among women. The greater impact of immigration-related factors on depressive symptoms among women may indicate that women may be more sensitive to certain family and psychosocial stressors resulting from the immigration experience during a specific developmental stage, which can influence depression occurrence [21]. The greater impact of education level among men on depressive symptoms may involve the fact that educational status directly affects economic and social mobility. Individuals with low educational attainment often have restricted job opportunities and advancement, which can negatively influence mental health [30, 31]. In Asian American communities, men may experience higher stress when they have difficulties providing financial support for their family. Being married in general lowered the risk of depression among Asian Americans by potentially serving a form of social support, and thus having a protective effect of developing depressive symptoms [19, 32, 33].

Regarding ethnic differences in depressive symptom severity, we found that Chinese American men and women had a higher risk of having mild depressive symptoms but a lower risk of having moderate/severe depressive symptoms compared to Korean Americans. The latter part of our findings, the lower risk of severe level of depressive symptoms among Chinese compared to Korean is consistent with previous studies reporting that Korean Americans had generally higher rates of depression compared to Chinese and Japanese Americans [34]. However, the high rates of mild depressive symptoms in Chinese Americans, despite the low rates of moderate/severe depressive symptoms, have not been demonstrated in the previous studies because they mainly assessed moderate/severe or diagnosable depression. It is noteworthy that focusing only on severe forms of depression can give incomplete information that a certain ethnic group has lower rates of depression when they actually suffer from mild depressive symptoms, indicating the importance of assessing different level of symptoms severity. 5

Epidemiological studies conducted in the native countries found similarly high rates of depression among Koreans than Chinese. For example, when measured by the World Health Organization Composite International Diagnostic Interview (CIDI), the prevalence of depression among Koreans (living in South Korea) and Chinese (living in China) were 6.7% and 1.1% respectively [35, 36]. Although gradual increase in the prevalence of depression has been documented in both Korea and China, mental health problems have been a national issue in Korea during the past decades with the 2nd highest suicide mortality rate (25.8 per 100,000 population) out of the country members within the Organization for Economic Co-operation and Development [37]. Further, Korean American immigrants appear to experience greater mental health burden compared to Koreans living in Korea in that 6.7% of the general population in Korea reported moderate to severe level of depressive symptoms (PHQ-9 score of 10 or higher) in the nationwide survey [38], whereas 12.2% of our Korean sample reported moderate to severe depressive symptom. This implies that, in addition to the mental health burden of country of origin, immigration related factors including acculturative stress may contributes to high level of depressive symptoms among Korean Americans [39].

Sociodemographic and immigration-related characteristics of the three Asian ethnic communities also might have contributed to the ethnic difference in depressive symptoms. For example, post-hoc analysis of ethnic differences in sociodemographic characteristics revealed that only 16% of Chinese sample in our study received college or higher education, while 66% of Vietnamese and 64% of Korean sample received college or higher education. This low level of education reported in Chinese community might have contributed to the high rates of mild depressive symptoms in Chinese group. However, the low level of education did not appear to affect strongly enough to increase the rates of severe depressive symptoms in our study. Instead, the protective effect of living in urban areas might have contributed to lower rates of moderate/severe depressive symptoms in

the Chinese community given that 65% of Chinese sample of our study came from urban areas (e.g., Chinatown) compared to 35% of Korean sample. Living in ethnic enclave such as Chinatown can be beneficial in receiving social support and maintaining ethnic identity, which can lead to low level of acculturative stress for Asian immigrants who have a collectivist cultural background.

In addition to sociodemographic factors, reasons for immigration, experience during migration, and history of adjustment after migration may also affect the ethnic differences in depressive symptoms. In general, it has been known that Vietnamese have a history of moving due to political hardships and as refugees, whereas Chinese and Koreans mainly moved for economic reasons and willingly [40]. Given the evidence showing that forced migration and refugee status can come with unique experiences that are associated with depressive symptoms, Vietnamese may report more depressive symptoms [41, 42]. In our study, Vietnamese were more likely to be moderately/severely depressed than Chinese but less likely than Koreans. In general, they were in the middle with regard to socioeconomic status including years lived in the US (21.7 years vs. 19.6 years in Chinese and 25.1 years in Korean), gender composition (60.3% vs. 50.9% in Chinese and 64.8% in Korean), and urban residence (50% vs 65% in Chinese and 35% in Korean), while they reported highest level of education (65% received college or higher education. Since we have limited data on the nature and history of immigration of subgroups of Asian Americans in Philadelphia area, it is warranted to do more study on this topic.

Limitations

This study had few limitations. First, our participants were recruited from community settings, which has been shown to have lower rates of moderate to severe depression compared to clinical settings [19]. Thus, one needs to be cautious with directly comparing or generalizing the findings of this study to clinical populations. In addition, the low rates of moderate to severe depression and small cell counts for some variables led to wide range of confidence interval despite the statistically significant association between the variables and depressive symptoms. Thus, future study with bigger community sample is warranted for more statistically robust findings. Second, depressive symptoms were measured using a self-report survey, which can evoke social desirability and reporting biases. This might have contributed to underreporting of symptoms, resulting in substantially higher mild depressive symptoms than moderate to severe symptoms among Chinese Americans. Future studies will need to incorporate different methods to address these biases, using more structured psychological assessment tools [43]. Third, we included only three out of five largest Asian ethnic groups in the US; Chinese, Korean and Vietnamese Americans. However, given the unique cultural and immigration history of other Asian ethnic groups, caution is needed when generalizing the findings of the present study to other Asian ethnic groups such as Filipino and Indians, who also have a high presence in the US. Furthermore, we only measured immigration-related and sociodemographic factors in this study. Psychosocial factors including ethnic identity or acculturative stress that relate to immigration can be investigated in the future. Future studies also can investigate longitudinal impacts of immigration on the development of depressive symptoms.

Conclusions

Despite these limitations, our study contributes to expanding the knowledge base regarding the impact of immigration on depressive symptoms among foreign born Asian Americans by shedding light on how the immigration-related factors may lead to developing different severity levels of depressive symptoms in Asian American immigrants, a unique population with mental health need. In particular, the assessment of multiple depressive symptom outcomes, including mild versus minimal, moderate/severe versus minimal, and mild versus moderate/severe depressive symptoms are informative. Differentiating mild versus moderate/severe depression and identifying specific factors associated with different depressive symptom severity should enable researchers and clinicians to obtain a better understanding about depression development, progression and treatment.

Particularly, increased awareness by practitioners of depression symptom severity and identifying individuals who experience not only moderate to severe symptoms but mild symptoms as well can help prevent the occurrence of more severe development of the disorder. In addition, being cognizant of the immigrant related factors that contribute to depression progression from mild to moderate/severe symptoms are useful in providing individualized treatment. Given that Asian Americans experience low levels of service use and more informal service use, community and clinical interventions to detect and treat depression early among Asian American immigrants continue to be priority [13, 44, 45]. Developing culturally sensitive programs and increasing cultural competence among mental health care professionals are needed to improve recognizing and treating depression among Asian immigrants.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

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