Published in final edited form as:

Women Health. 2017 January ; 57(1): 69–87. doi:10.1080/03630242.2016.1153018.

Immigration transition and sleep-related symptoms experienced during menopausal transition

Eun-Ok Im, PhD, MPH^a, Young Ko, PhD^b, Eunice Chee^c, and Wonshik Chee, PhD^a

^aSchool of Nursing, University of Pennsylvania, Philadelphia, Pennsylvania, USA

^bCollege of Nursing, Gachon University, Incheon, South Korea

^cSchool of Engineering and Applied Science, University of Pennsylvania, Philadelphia, Pennsylvania, USA

Abstract

The transition due to immigration from one country to another country (referred to as immigration transition henceforth) is inherently stressful, placing an additional dimension of stress to midlife women in the menopausal transition. However, few studies have examined the association of immigration to sleep-related symptoms experienced by midlife women in the menopausal transition. The purpose of this study was to explore the associations of immigration to sleep-related symptoms among four major racial/ethnic groups of 1,054 midlife women in the U.S. This was a secondary analysis of data from two national surveys that were collected from 2005 to 2013. The instruments included questions on background characteristics, health and menopausal status, immigration transition and the Sleep Index for Midlife Women. The data were analyzed using t-tests, chi-square tests, correlation analyses, and hierarchical multiple regression analyses. Immigrants reported fewer total numbers of and lower total severity scores of sleep-related symptoms than non-immigrants ($p < .01$). Yet, when background characteristics and health and menopausal status were controlled, self-reported racial/ethnic identity was the only significant factor associated with sleep-related symptoms ($R^2=0.02$, $p<0.01$). Health care providers need to consider self-reported racial/ethnic identity as a factor significantly related to sleep-related symptoms during the menopausal transition.

Keywords

Sleep; Immigration; Acculturation; Women; Race; Ethnicity

The prevalence of sleep-related symptoms in midlife women ranges from 38 to 42% (Minarik 2009). Among various clusters of symptoms that could be experienced during the menopausal transition, sleep-related symptoms are one of the most frequently reported symptoms; up to 42% of premenopausal women and 60% of postmenopausal women experience sleep difficulties (U.S. National Library of Medicine 2013). Also, sleep-related symptoms, including difficulty falling asleep and difficulty staying asleep, reportedly

increase as the menopausal transition proceeds (Dennerstein et al. 2007; Kravitz and Joffe 2011).

Sleep-related symptoms have been associated with multiple factors, including chronic stress, psychological symptoms (anxiety, depression), low self-perceived health, vasomotor symptoms associated with menopause (hot flashes, night sweats), underlying sleep disorders (apnea, restless leg syndrome), musculoskeletal pain, and medication side-effects (Ameratunga, Goldin, and Hickey 2012; Joffe et al. 2012; Joffe, Massler, and Sharkey 2010; Minarik 2009). Menopausal stages reflecting midlife women's progression through the menopausal transition are one of the major factors related to sleep-related symptoms (Greenblum et al. 2013; Xu et al. 2011; Kravitz et al 2008). They have been reported as a determinant of sleep quality and associated with different sleep experiences (Greenblum et al. 2013; Xu et al. 2011). Hormonal changes during the menopausal transition have been postulated as the reason for the increased risk of sleep deprivation in midlife women (Grandner et al. 2013; Xu et al. 2011).

Because the transition related to immigration from one country to another country (henceforth called immigration transition) is inherently stressful (Trimble 2003), it may also be associated with sleep-related symptoms of midlife women. Despite a recently increasing number of studies reporting cultural influences on menopausal symptoms (Kravitz et al. 2008; Kravitz and Joffe, 2011; Melby, Lock, & Kaufert, 2005; Sievert, 2006, 2014; Sievert & Obermeyer, 2012), very few studies have examined the associations of immigration transition to sleep-related symptoms experienced by midlife women in the menopausal transition (Hale et al. 2014). Furthermore, the findings of the few studies tend to be different from those of the studies in general populations (Grandner et al. 2013; Kravitz et al. 2008; Kravitz and Joffe, 2011; Sok 2008). For instance, in the Study of Women's Health Across the Nation (SWAN), Hale et al. (2014) found that a lower percent of first-generation immigrant midlife women experienced sleep-related symptoms compared to the percent of U.S.-born midlife women who experienced sleep-related symptoms. Yet, other studies in general adult populations have supported that immigrant midlife women were more likely to experience sleep-related symptoms compared to non-immigrant midlife women (Grandner et al. 2013; Sok 2008).

The purpose of this study was to explore the association of immigration to sleep-related symptoms experienced during the menopausal transition among four major racial/ethnic groups of midlife women in the U.S. This secondary data analysis is unique because the original studies are among the few studies that have nationally recruited the participants in each racial/ethnic group across the U.S. We defined the menopausal transition as the period that begins with variation in menstrual cycle length and ends with the final menstrual period. Menopausal stages were determined based on the criteria by the SWAN (see the Methods section). First, differences in sleep-related symptoms between immigrant midlife women and non-immigrant midlife women were determined as a whole and in each racial/ethnic group (Aim #1). Then, after controlling for background characteristics and health and menopausal status, the relationships of all variables related to immigration transition to the women's sleep-related symptoms were determined as a whole and in each racial/ethnic group (Aim #2).

The Theoretical Bases: Acculturation Theories

The theories that could explain the relations of immigration transition to health could be roughly categorized into: (a) the selective nature of immigration (the positive effect of immigration on health); (b) the negative effect of immigration on health; and (c) acculturation as a health-related outcome of immigration (Im and Yang 2006). The first type of theory has an assumption that immigrants are naturally selected healthy people, and they are more likely to be resilient, willing and capable to deal with possible health hazards caused by immigration (Organista, Organista, and Kurasaki 2003). This type of theory supports that immigrants are less likely to experience sleep-related symptoms during the menopausal transition, which has also been supported by recent studies in midlife women during the menopausal transition (Hale et al. 2014; Pien et al. 2008). The second type of theory assumes that immigration itself is stressful and dangerous and causes an exposure to health risks (Trimble 2003). Thus, this type of theory supports that immigrants are more likely to experience sleep-related symptoms during the menopausal transition. This theory has rarely been tested in the studies among midlife women in the menopausal transition, but has been well-supported in studies of the general adult populations (Sok 2008; Taloyan et al. 2006). Aim #1 is based on these two theories explaining the relationship between sleep-related symptoms and immigration status.

Current acculturation theories—the third type of theory on the relation of immigration to health—includes three main models: (a) single-continuum models, (b) two-culture matrix models, and (c) multidimensional models (Keefe 1987). The single-continuum models (Keefe 1987) assume that the acculturation process is a continuum from the unacculturated to the biculturalized and subsequently to the acculturated (Wallen, Feldman, and Anliker 2002). The two-culture matrix model assumes that immigrants accept the new culture while simultaneously retaining their own culture (Berry et al. 1989). The multidimensional acculturation model has an assumption that the acculturation process is associated with individual cultural traits (Keefe 1987). Therefore, some are more likely to obtain new traits from the host culture than others, and immigrants' selection of their acculturation strategies is inconsistent in different areas of daily life (Berry et al. 1989). In this study, we adopted the multi-dimensional model because this model considers multiple and complex contextual factors related to immigration transition, unlike the other models. Thus, based on this model, we tested the associations of multiple variables related to immigration transition (including self-reported racial/ethnic identity, the length of stay in the U.S., and the level of acculturation) to sleep-related symptoms while considering other multiple contextual factors that might influence the associations (Aim #2).

Methods

These secondary analyses were conducted on the data from two national Internet survey studies among four major racial/ethnic groups of midlife women in the U.S. (Non-Hispanic (NH) White, Hispanic, NH African American, and NH Asian) that aimed to explore racial/ethnic differences in midlife women's health issues/concerns. More detailed information on the original studies is available elsewhere (Authors 2010; Authors 2012). These studies were approved by the Institutional Review Boards of the institutions where the authors were

affiliated. The data were collected from 2005 to 2013. Electronic informed consent was obtained from all participants. The eligibility criteria for the studies included those who could read and write English and were midlife women aged 40 to 60 years who reported their racial/ethnic identity as NH White, Hispanic, NH African American, or NH Asian. A total of 1,245 women participated in the original studies, about 95~96% of the visitors at the project websites.

Sample and Settings

All of the participants were self-identified volunteers who visited the project websites after reviewing the study announcements posted in Internet communities/groups for midlife women and Internet communities/groups for ethnic minorities. The study announcements were made by contacting Web-masters and/or Web-owners of the Internet communities/groups that were identified through Internet searches using Google, Yahoo, MSN, and Bing. When the women visited the project website and indicated their interest in participating in the study, they were screened against the inclusion criteria and quota requirement (equal numbers of women in each racial/ethnic group and in each socioeconomic class (low, middle, and high)) using the computer server-side programming. Because of the inherent nature of a secondary data analysis, the sample size was pre-determined by the size of the original studies. The sample size estimation for this analysis was based on the methodology requiring the largest sample size—hierarchical multiple regression analyses in this study. Thus, the sample size required for the hierarchical multiple regression analyses would be adequate to address both of the stated aims. The number of participants required to perform hierarchical multiple regression analyses was calculated using the G*Power 3.0 program. To detect a statistically significant relationship in a regression model with 11 independent variables, we assumed a small effect size of 0.02 with a two-sided alpha level of 0.05 and 80% power. We used a conventional small effect size because little is clearly known about the associations of immigration with midlife women's sleep-related symptoms and about other factors related to midlife women's sleep-related symptoms. According to the calculation, a total of 850 participants were needed to conduct the hierarchical multiple regression analyses. Therefore, the pre-determined sample size was sufficient.

Instruments

The instruments in the original studies included questions on background characteristics, health and menopausal status, and immigration transition, and the Sleep Index for Midlife Women (SIMW).

Background characteristics and health and menopausal status—To measure the participants' background characteristics and health and menopausal status, eight questions on background characteristics (age, education, employment status, family income level, marital status, number of children, access to health care, and social support) and nine questions on health status (weight, height, and seven items asking last menstrual cycle, menstrual regularity, and menstrual flow) were used in the original studies. These questions have been used in previous studies (Authors 2007; 2008; 2009; 2010; 2012).

BMI was calculated by self-reports of height and weight, and divided into four categories: underweight (BMI<18.4), normal (18.5 to 24.9 kg/m²), overweight (25 to 29.9 kg/m²), and obese (≥ 30 kg/m²) (World Health Organization, 2000). For logistic analyses, BMI was dichotomized into “underweight or normal” and “overweight” because the number of women who were underweight was quite small. Women's menopausal status was based on the questions and criteria adapted from the SWAN (Avis et al. 2001). Thus, when a woman indicated having menses in the last three months with no increase in irregularity, she was regarded as pre-menopausal. When a woman indicated having menses in the past 12 months, but having experienced increasing irregularity in cycle length, she was regarded as peri-menopausal. Finally, when a woman indicated having no menses in the last 12 months (not related to medication, pregnancy, or severe weight loss), she was regarded as post-menopausal.

Immigration transition—In this study, immigration transition was defined as a transition due to migration from one country to a different country, and immigrants were those who were born outside the U.S. and moved to the U.S. (first and 1.5 immigrant generations, respectively), while non-immigrants were those who were born in the U.S. Here, 1.5 generation refers to those who immigrated to a new country before or during their early teens (usually before the age of 12 years)(Oudenhoven 2006). Immigration transition is a complex concept that is not just cultural, but also stems from experiences leading up to, during, or after migration (Alvidrez, Azocar, and Miranda 1996). Because of this, in most studies on immigrants' health, immigration transition has been operationalized into several proxy variables including country of residence, immigrant generation, length of stay in the U.S., and level of acculturation (Flaskerud 2007; Berkman and Ko 2009). In this study, due to the limited number of variables available in the dataset, immigration transition was operationalized into four major variables, including self-reported racial/ethnic identity, immigration status, the length of stay in the U.S., and the level of acculturation. The length of stay in the U.S. was measured in years in the original studies. When participants were born in the U.S., their level of acculturation was replaced with five points (exclusively American), and the length of stay in the U.S. was replaced with their age. The level of acculturation was calculated as the sum of five Likert-scale items (1=exclusively own racial/ethnic group; 5=exclusively American) that asked the women about their preferences for foods, music, customs, language and close friends. These questions came from the Suinn-Lew Asian Self-Identity Acculturation Scale (Suinn, Ahuna, and Khoo 1992). The reliability and validity of these modified questions were established in multi-ethnic groups of midlife women (Im and Chee 2005). Cronbach's alpha for these questions was 0.92 in this analysis.

The Sleep Index for Midlife Women (SIMW)—The Sleep Index for Midlife Women (SIMW) was adapted from the Midlife Women's Symptom Index (MSI) (Im, 2006). The MSI measures physical, psychological, and psychosomatic symptoms that midlife women could experience during their menopausal transition. Among 71 items of the MSI, only 24 items that measure sleep-related symptoms were included in the SIMW. These were chosen based on an integrated literature review on general sleep-related symptoms, such as sleep disorders, chronic pain, mood disorders, and vasomotor symptoms (Fuller et al. 1997; Koseoglu et al. 2006; Krystal et al. 1998). These symptoms could be categorized into

physical, psychosomatic, and psychological symptoms as in the MSI. Each item has two sub-scales: (a) a prevalence sub-scale (1=yes; 0=no) and (b) a severity sub-scale (0=not at all, 1=a little bit, 2=moderately, 3=quite a bit, 4=extremely). For this analysis, the total numbers of sleep-related symptoms (0~24) and the total severity scores of sleep-related symptoms (0~120) were calculated by summing each separate sub-scale of individual items. Higher scores mean more prevalent and severe symptoms. Cronbach's alpha for the SIMW was 0.89 in this study.

Data Analysis

The data from the two studies had the same variables, but the labels of the variables were revised so as to have the same labels for variables and values. A total of 191 women with more than 10% missing data were excluded from these analyses. The means of the variables were used to replace the missing data for those with less than 10% missing data. The data were first analyzed using descriptive statistics including frequencies, percentages, means, standard deviations, and ranges. To address Aim #1, the data were analyzed using t-tests and chi-square tests. To address Aim #2, correlation analyses and hierarchical multiple regression analyses were performed to identify the factors associated with the total numbers and total severity scores of sleep-related symptoms.

For the hierarchical multiple regression analyses, we included background characteristics, health and menopausal status, and immigration transition variables into the multiple regression models because they have been related to the prevalence and severity of sleep-related symptom in the literature (Ameratunga et al. 2012; Joffe et al. 2012; Minarik 2009). However, age was not entered into the equations because the length of stay in the U.S. for those who were born in the U.S. was replaced with age. Then, multicollinearity was determined using the tolerance values and the variance inflation factor (VIF) values. VIF-values greater than 10 and tolerance-values smaller than 0.10 may indicate multicollinearity; no indication of multicollinearity was observed. No potential interactions were identified, and the residuals of variables were normally distributed. For the hierarchical multiple regression analyses, we used all independent variables with VIF-values under 10. The distributions of total numbers and total severity scores of sleep-related symptoms satisfied the criteria for normal distribution. The skewness and kurtosis of the distributions were between -1.0 and +1.0. The differences between adjusted R^2 and R^2 (less than 10%) were used to assess the fit of the model.

A hierarchical model requires thoughtful input by the researcher in determining the order of entry of variables based on a theoretical framework/model or a research focus and yields successive tests of the validity of the hypotheses through determining the order. The primary focus of hierarchical multiple regression analyses in this study was to test the associations of immigration transition to sleep-related symptoms, separately from the associations of background characteristics and health and menopausal status to sleep-related symptoms. Thus, we observed the associations with immigrant transition variables after controlling other multiple variables that could be associated with sleep-related symptoms. Hierarchical multiple regression analyses (with the total numbers and total severity scores of sleep-related symptoms as dependent variables) were run as follows. In the first step, immigration status

was entered. Then, the length of stay in the U.S. and the level of acculturation were entered in the second step. Then, self-reported racial/ethnic identity was entered in the third step. Finally, background characteristics and health and menopausal status, including education, employment status, family income, marital status, number of children, access to health care, social support, body mass index (BMI), and menopausal status were entered into the equations. The increase in R^2 (R^2) was computed to determine the relative contributions of each set of variables in the equations. Standard coefficients (β) were computed to compare the relative importance of each variable in the equations.

Results

Background Characteristics and Health and Menopausal Status of the Participants

The mean age of participants was 48.97 years ($SD = 5.69$) (Table 1). About 87% of the participants were graduates of high school, college, or graduate school. More than two-thirds were married or partnered (67.74%), and 81.78% had more than one child. About 43% of the participants reported that their family income was low. About 87% reported that they had access to health care. Three-quarters (76%) of participants were born in the U.S. The mean level of acculturation was 4.58 ($SD = 0.83$) on a 5-point Likert scale (1~5), and the mean length of stay in the U.S. was 42.71 years ($SD = 14.14$). About 37% had normal body mass index (BMI, 18.5-24.9 Kg/m²), and 33.11% were peri-menopausal. No significant differences were observed in background characteristics, including age, family income, and social support, between immigrants and non-immigrants.

Differences in Sleep-related Symptoms by Immigration Status

The total numbers ($t = 3.27, p < .01$) and total severity scores ($t = 4.06, p < .01$) of sleep-related symptoms significantly differed by immigration status (Table 2); immigrants tended to report fewer total numbers and lower severity scores than non-immigrants. Immigrants tended to report significantly fewer physical ($p < .01$), psychosomatic ($p < .01$) and psychological symptoms ($p < .05$) than non-immigrants. Immigrants also tended to report significantly lower severity scores for physical ($p < .01$), psychosomatic ($p < .01$) and psychological symptoms ($p < .01$) than non-immigrants.

Compared to non-immigrants, immigrants also tended to report significantly lower frequencies of the individual symptoms, such as “night sweats”, “exhaustion or fatigue”, “difficulty in falling or staying asleep”, “night time urination”, “feeling clumsy”, and “worrying about body” ($p < .01$). Immigrants also tended to report significantly lower severity scores than non-immigrants for “painfully swollen joint”, “night sweats”, “exhaustion or fatigue”, “difficulty in falling or staying asleep”, “night time urination”, “feeling clumsy”, “crying,” “feeling grouchy”, “keyed up, jittery, or restless”, “worrying about body” and “difficulty with concentration” ($p < .01$) (Table 3).

When we determined differences in the total numbers and total severity scores of sleep-related symptoms by immigration status in each racial/ethnic group, we observed no significant differences. However, when we examined the associations of immigration status to the frequencies of individual symptoms in each racial/ethnic group, significant differences

in the prevalence of some individual symptoms (“back pain”, “feeling clumsy”, “feeling unhappy”, “feeling depressed”, “worrying gets you down”, and “feeling anxious, tense or nervous”) were found only in NH Asian women ($p < .01$) in whom immigrants tended to report higher frequencies of these symptoms than non-immigrants. Also, only in NH Asian women, immigrants tended to report significantly higher severity scores of some individual symptoms than non-immigrants (“back pain”, “feeling depressed”, “worrying gets you down”, and “being forgetful”)($p < .01$).

Factors Associated With Sleep-related Symptoms

In hierarchical multiple regression analyses, immigration status, the length of stay in the U.S. and the level of acculturation accounted for 1.01% of the total variances in total numbers of sleep-related symptoms and 1.41% of the total variances in total severity scores of sleep-related symptoms (Table 4). Self-reported racial/ethnic identity was significantly related to sleep-related symptoms and accounted for 2.48% of the total variances in total numbers ($F_{ch}=8.98$, $p < .01$) and 2.36% of the total variances of total severity scores of sleep-related symptoms ($F_{ch}=8.55$, $p < .01$). When self-reported racial/ethnic identity was controlled, immigration status, the length of stay in the U.S., and the level of acculturation were not significantly related to the total numbers and total severity scores of sleep-related symptoms. Among the four major proxy variables pertaining to immigration transition, self-reported racial/ethnic identity was the only factor that was significantly associated with sleep-related symptoms when background characteristics and health and menopausal status were controlled. Among the background characteristics and health status variables, the following variables were significantly positively associated with sleep-related symptoms: being unemployed ($\beta = 0.09$); having low ($\beta = 0.21$) or middle ($\beta = 0.12$) family income; no, low, or medium social support ($\beta = 0.12$, 0.09 , and 0.08 , respectively); being overweight ($\beta = 0.03$) or obese ($\beta = 0.10$); and peri- ($\beta = 0.23$) or postmenopausal ($\beta = 0.09$). Among these variables, only having no access to health care ($\beta = -0.07$) was significantly negatively associated with sleep-related symptoms.

When hierarchical multiple regression analyses were conducted in each racial/ethnic group, the factors related to sleep-related symptoms were different in each racial/ethnic group. In Hispanic women, those who were immigrants, stayed longer in the U.S., and were more acculturated tended to report larger total numbers and higher total severity scores of sleep-related symptoms ($R^2=0.04$ for the total numbers and 0.04 for the total severity scores). However, the immigration variables were not significantly related to the total numbers or the total severity scores of sleep-related symptoms in NH White, NH African American, and NH Asian women. Rather, in NH White women, low educational level ($\beta = 0.14$), low ($\beta = 0.37$) and middle ($\beta = 0.16$) family income, and being peri-menopausal ($\beta = 0.25$) and post-menopausal ($\beta = 0.16$) were significantly associated with the total numbers of sleep-related symptoms ($p < .05$). Also, in NH White women, low educational level ($\beta = 0.12$), low ($\beta = 0.35$) and middle ($\beta = 0.17$) family income, no social support ($\beta = 0.14$), and being peri-menopausal ($\beta = 0.24$) and post-menopausal ($\beta = 0.16$) were significantly associated with the total severity scores of sleep-related symptoms ($p < .05$). In NH African American women, low family income ($\beta = 0.19$) and being peri-menopausal ($\beta = 0.19$) were significantly associated with the total numbers of sleep-related symptoms ($p < .05$). Also, in NH African

Americans, low family income ($\beta = 0.25$) and being peri-menopausal ($\beta = 0.18$) were significantly associated with the total severity scores of sleep-related symptoms ($p < .05$). In NH Asian women, low ($\beta = 0.21$) and middle ($\beta = 0.19$) family income, no support ($\beta = 0.21$), being obese ($\beta = 0.19$), and being peri-menopausal ($\beta = 0.30$, $p < .01$) were significantly associated with the total numbers of sleep-related symptoms. Also, in NH Asian women, low ($\beta = 0.20$) and middle ($\beta = 0.19$) family income, no social support ($\beta = 0.20$), being obese ($\beta = 0.23$), being peri-menopausal ($\beta = 0.35$) and post-menopausal ($\beta = 0.16$) were significantly associated with the total severity scores of sleep-related symptoms ($p < .05$).

Discussion

Although only self-reported racial/ethnic identity was significantly associated with sleep-related symptoms when background characteristics and health and menopausal status were controlled, the findings of this study partially support the theories on the selective nature of immigration and positive relation of immigration to health. According to the theories on the selective nature of immigration and the positive effects of immigration on health, immigrants are healthier and more resilient, willing and able to respond to possible health hazards compared with non-immigrants because immigrants are a naturally selected group of healthy individuals from their countries of origin and are highly motivated/driven (Organista et al. 2003). Subsequently, despite stressful immigration process, they are healthier than non-immigrants. The findings of this study are certainly in the same direction of the association between immigration transition and sleep-related symptoms that could be expected from these theories. Also, the findings agree with those in the SWAN (Hale et al. 2014); about 25% of first-generation immigrant women versus 37% of US-born women reported sleep complaints.

The findings of this study also support that self-reported racial/ethnic identity (rather than immigration status, the level of acculturation, or the length of stay in the U.S.) could be the factor significantly related to midlife women's sleep-related symptoms during the menopausal transition. All four variables related to immigration (self-reported racial/ethnic identity, immigration status, the level of acculturation, and the length of stay in the U.S.) were significantly associated with midlife women's sleep-related symptoms in unadjusted analyses. Yet, when other variables were controlled, only the association of self-reported racial/ethnic identity to the sleep-related symptoms remained significant. Also, no significant differences were observed in individual sleep-related symptoms between immigrants and non-immigrants in each racial/ethnic group, except in NH Asian women. Immigration status may not be sensitive enough to reflect the various aspects of their life. It may simply measure if a woman was an immigrant. Rather, self-reported racial/ethnic identity that is often linked to women's inner feelings toward themselves and their discriminative experience could be a better measure of immigration transition. However, this finding needs to be carefully interpreted because the findings in the literature have been inconsistent about the association of race/ethnicity to sleep-related symptoms experienced during the menopausal transition. For example, Pien et al. (2008) reported no significant association of race to sleep quality in a cohort of 436 women from Philadelphia County who were 35 to 47 years of age and had regular menstrual cycles at enrollment, while others have

reported significant associations of race/ethnicity to sleep-related symptoms in midlife women (Chen et al. 2014; Im et al. 2014).

The findings of this study also indicated mixed results regarding the associations of immigration transition to the sleep-related symptoms of midlife women. Again, while immigration status was a significant factor related to women's sleep-related symptoms in unadjusted analyses, the association became non-significant when other variables were controlled. A plausible reason for the mixed findings would be: some properties of individual items might have been deflated or inflated in the data analysis process because composite scores were calculated and used for the data analyses. For instance, as described above, the Sleep Index for Midlife Women (SIMW) includes 24 items on sleep-related symptoms, each of which includes both the prevalence sub-scale and the severity sub-scale (one 6-point Likert scale). Thus, for the data analyses, two composite scores (the total numbers of and total severity scores of sleep-related symptoms) were calculated based on the women's responses to the 24 items. Therefore, some properties of the responses to individual items could have been deflated or inflated during the data analysis process of calculating and utilizing the composite scores. Indeed, the findings on individual symptoms reported in this paper support this position. In addition, other contextual factors such as family income and employment status that were found to be significantly associated with sleep-related symptoms could confound the influences of immigration transition on the sleep-related symptoms.

The findings of this study also support that multiple factors are related to sleep-related symptoms (Ameratunga et al. 2012; Joffe et al. 2012; Minarik 2009). More importantly, this study supported the significant relation of menopausal status to sleep-related symptoms, even when other factors, including the factors related to immigration, were controlled. Studies have supported that menopausal status is significantly associated with midlife women's sleep-related symptoms; women's sleep experience changes from their pre-menopausal to peri-menopausal and post-menopausal periods due to longer sleep onset latency and lack of sleep efficiency (Greenblum et al. 2013; Xu et al. 2011). Also, studies indicated that the effects of menopausal transition stages on different sleep symptoms (especially waking in the night, sometimes called wake after sleep onset) are important (Greenblum et al. 2013; Xu et al. 2011). Indeed, across racial/ethnic groups, being in peri-menopause and being post-menopausal were significantly associated with sleep-related symptoms in this study.

This study had several limitations. First, the cross-sectional design of the studies was a limitation because it prohibited the ability to assess the temporal relation of variables and thus causality. Second, in this study, the self-selective nature of the samples could limit the generalizability of the findings (e.g., the first and 1.5 immigrant generations who tended to be highly acculturated and stayed in the U.S. longer, those on listservs who thus had access to computers and the Internet, and those who could read and write English would not be representative of all immigrants). Another limitation was that the acculturation scale that was used in the original studies may have been inadequate; many researchers have recommended the use of multi-dimensional models of acculturation (Berry et al. 1989). Despite the multi-dimensional questions that were used in this study, the questions might not

have adequately reflected possible inconsistencies of acculturation process in diverse dimensions of daily life. Moreover, because age was replaced for the length of stay in the U.S. for those who were born in the U.S., it might have confounded the findings of the study, and it was impossible to assess the association of age to the relationship between immigration transition and sleep-related symptoms. In addition, the question on social support that was used in this study did not come from a standardized instrument, which may limit comparisons of the findings of this study to those from studies that have used standard instruments to measure social support. In addition, some English words measuring sleep-related symptoms might not have adequately measured the symptoms in some women (e.g., those with little English skills and knowledge) because the questionnaires were only in English. Finally, some of the significant findings could be a result of the large sample size.

Conclusions

Based on the findings of this study, we conclude with the following suggestions for future research and health care practice with midlife women experiencing sleep-related symptoms. First, further studies on the associations of immigration transition to sleep-related symptoms of midlife women are needed with larger sample sizes of diverse groups of racial/ethnic minority midlife women. Because of the inherent nature of a secondary data analyses, we did not have a control of the participants' characteristics; the participants tended to be a select group of racial/ethnic minority midlife women, being highly acculturated, having access to the internet and reading and speaking English. We could get more generalizable findings on the associations between immigration transition and sleep-related symptoms with more diverse groups of midlife racial/ethnic minority immigrant women (e.g., diverse sub-ethnic groups, diverse socioeconomic groups, and diverse immigration generation groups). Also, a more comprehensive multi-dimensional acculturation scale is needed for future studies; despite the use of multi-dimensional questions to measure acculturation, the questions were limited to only five dimensions. Also, further studies on the adequacy of using composite scores to represent sleep-related symptoms are warranted. Using composite scores may result in deflating or inflating some properties of the individual responses, and this may result in inconsistent findings depending on the items included in the analyses. Finally, we suggest that health care providers consider self-reported racial/ethnic identity as a factor significantly related to sleep-related symptoms when evaluating midlife women's health during their menopausal transition.

Acknowledgments

Funding: This is a secondary analysis of the data from two larger studies that were funded by the National Institutes of Health (NIH/NINR/NIA; R01NR008926 and NIH/NINR/ NHLBI; R01NR010568). The authors have no disclosures to make. The study was approved by the Institute Review Board of the University of Pennsylvania and the University of Texas at Austin.

References

- Ameratunga D, Goldin J, Hickey M. Sleep disturbance in menopause. *Intern Med J.* 2012; 42(7):742–7. [PubMed: 22288870]
- Authors. 2007.
- Authors. 2008.

- Authors. 2009.
- Authors. 2010.
- Authors. 2012.
- Avis NE, Stellato R, Crawford S, Bromberger J, Ganz P, Cain V, Kagawa-Singer M. Is There a Menopausal Syndrome? Menopausal Status and Symptoms across Racial/ethnic Groups. *Social Science & Medicine*. 2001; 52(3):345–56. [PubMed: 11330770]
- Berkman CS, Ko E. Preferences for disclosure of information about serious illness among older Korean American immigrants in New York City. *Journal of Palliative Medicine*. 2009; 12(4):351–357. [PubMed: 19327072]
- Berry JW, Kim U, Power S, Young M, Bujaki M. Acculturation Attitudes in Plural Societies. *Appl Psychology*. 1989; 38(2):185–206.
- Chen X, Wang R, Zee P, Lutsey PL, Javaheri S, Alcántara C, Jackson CL, Williams MA, Redline S. Racial/Ethnic Differences in Sleep Disturbances: The Multi-Ethnic Study of Atherosclerosis (MESA). *Sleep*. 2014; 38(6):877–88.
- Dennerstein L, Leher P, Koochaki PE, Graziottin A, Leiblum S, Alexander JL. A Symptomatic Approach to Understanding Women's Health Experiences: A Cross-Cultural Comparison of Women Aged 20 to 70 Years. *Menopause*. 2007; 14(4):688–96. DOI: 10.1097/gme.0b013e31802dabf0 [PubMed: 17290159]
- Flaskerud JH. Cultural competence column: Acculturation. *Issues in Mental Health Nursing*. 2007; 28:543–546. [PubMed: 17613152]
- Fuller KH, Waters WF, Binks PG, Anderson T. Generalized anxiety and sleep architecture: a polysomnographic investigation. *Sleep*. 1997; 20:370–6. [PubMed: 9381061]
- Grandner MA, Petrov ME, Rattanaumpawan P, Jackson N, Platt A, Patel NP. Sleep symptoms, race/ethnicity, and socioeconomic position. *J Clin Sleep Med*. 2013; 9(9):897–905. 905A–905D. [PubMed: 23997702]
- Greenblum CA, Rowe MA, Neff DF, Greenblum JS. Midlife women: symptoms associated with menopausal transition and early postmenopause and quality of life. *Menopause*. 2013; 20(1):22–27. [PubMed: 22929034]
- Hale L, Troxel WM, Kravitz HM, Hall MH, Matthews KA. Acculturation and Sleep among a Multiethnic Sample of Women: The Study of Women's Health Across the Nation (SWAN). *Sleep*. 2014; 37(2):309–17. DOI: 10.5665/sleep.3404 [PubMed: 24497659]
- Im EO. The Midlife Women's Symptom Index (MSI). *Health Care for Women International*. 2006; 27(3):268–87. DOI: 10.1080/07399330500506600 [PubMed: 16524856]
- Im EO, Chee W. A descriptive Internet survey on menopausal symptoms: five ethnic groups of Asian American university faculty and staff. *J Transcult Nurs*. 2005; 16(2):126–35. [PubMed: 15764635]
- Im EO, Yang K. Theories on immigrant women's health. *Health Care Women Int*. 2006; 27(8):666–81. [PubMed: 16893804]
- Im EO, Teng H, Lee Y, Kang Y, Ham OK, Chee E, Chee W. Physical Activities and Sleep-Related Symptoms in 4 Major Racial/ethnic Groups of Midlife Women. *Family & Community Health*. 2014; 37(4):307–16. DOI: 10.1097/FCH.0000000000000041 [PubMed: 25167071]
- Joffe H, Chang Y, Dhaliwal S, Hess R, Thurston R, Gold E, Matthews KA, Bromberger JT. Lifetime history of depression and anxiety disorders as a predictor of quality of life in midlife women in the absence of current illness episodes. *Arch Gen Psychiatry*. 2012; 69(5):484–492. [PubMed: 22566580]
- Joffe H, Massler A, Sharkey KM. Evaluation and management of sleep disturbance during the menopause transition. *Semin Reprod Med*. 2010; 28:404–21. [PubMed: 20845239]
- Keefe, S., Padilla, AM. *Chicano Ethnicity*. Albuquerque, NM: University of New Mexico Press; 1987.
- Koseoglu B, Gokkaya N, Ergun U, Inan L, Yesiltepe E. Cardiopulmonary and metabolic functions, aerobic capacity, fatigue and quality of life in patients with multiple sclerosis. *Acta Neurol Scand*. 2006; 114(4):261–267. [PubMed: 16942546]
- Kravitz HM, Zhao X, Bromberger JT, Gold EB, Hall MH, Matthews KA, Sowers MR. Sleep disturbance during the menopausal transition in a multi-ethnic community sample of women. *Sleep*. 2008; 31(7):979–90. [PubMed: 18652093]

- Kravitz HM, Joffe H. Sleep during the perimenopause: a SWAN story. *Obstet Gynecol Clin North Am.* 2011; 38(3):567. [PubMed: 21961720]
- Krystal AD, Edinger J, Wohlgemuth W, Marsh GR. Sleep in peri-menopausal and post-menopausal women. *Sleep Med Rev.* 1998; 2(4):243–253. [PubMed: 15310495]
- Melby MK, Lock M, Kaufert P. Culture and Symptom Reporting at Menopause. *Human Reproduction Update.* 2005; 11(5):495–512. DOI: 10.1093/humupd/dmi018 [PubMed: 15919681]
- Minarik PA. Sleep disturbance in midlife women. *J Obstet Gynecol Neonatal Nurs.* 2009; 38(3):333–343.
- Oudenhoven, ED. Doctoral dissertation. Loyola University Chicago; 2006. Caught in the middle: Generation 1.5 Latino students and English language learning at a community college. 2006 Digital Dissertations, AAT 3212980
- Organista, PB., Organista, KC., Kurasaki, K. The relationship between acculturation and ethnic minority health. In: Chun, Kevin M.Organista, Pamela B., Marin, Gerardo, editors. *Acculturation: Advances in theory, measurement, and applied research.* Washington, DC: American Psychological Association; 2003. p. 139-162.
- Pien GW, Sammel MD, Freeman EW, Lin H, DeBlasis TL. Predictors of Sleep Quality in Women in the Menopausal Transition. *Sleep.* 2008; 31(7):991–99. [PubMed: 18652094]
- Sievert LL. Menopause across Cultures: Clinical Considerations. *Menopause.* 2014; 21(4):421–23. DOI: 10.1097/GME.000000000000099 [PubMed: 24149928]
- Sievert LL, Obermeyer CM. Symptom Clusters at Midlife: A Four-Country Comparison of Checklist and Qualitative Responses. *Menopause.* 2012; 19(2):133–44. [PubMed: 22042326]
- Sok SR. Sleep patterns and insomnia management in Korean-American older adult immigrants. *J Clin Nurs.* 2008; 17(1):135–43. [PubMed: 17419793]
- Taloyan M, Johansson LM, Johansson SE, Sundquist J, Kocturk TO. Poor self-reported health and sleeping difficulties among Kurdish immigrant men in Sweden. *Transcult Psychiatry.* 2006; 43(3): 445–61. [PubMed: 17090627]
- Trimble, JE. Introduction: Social change and acculturation. In: Chun, Kevin M.Organista, Pamela B., Marin, Gerardo, editors. *Acculturation: Advances in theory, measurement, and applied research.* Washington, DC: American Psychological Association; 2003. p. 3-13.
- U.S. National Library of Medicine. [cited Nov, 22 2014] Sleep disorders - overview. Jan 22. 2014 Available from <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001803/>
- Wallen GR, Feldman RH, Anliker J. Measuring acculturation among Central American women with the use of a brief language scale. *J Immigr Health.* 2002; 4(2):95–102. [PubMed: 16228765]
- World Health Organization. Obesity: preventing and managing the global epidemic: report of a WHO consultation. Geneva: World Health Organization; 2000.
- Xu M, Belanger L, Ivers H, Guay B, Zhang J, Morin CM. Comparison of subjective and objective sleep quality in menopausal and non-menopausal women with insomnia. *Sleep Med.* 2011; 12(1): 65–9. [PubMed: 21147026]

Table 1
Background characteristics of the participants (N=1,054)

Characteristics	n (%) or Mean $\pm$ SD
Age (years)	48.97 $\pm$ 5.69
Education	
high school	141(13.38)
> high school	913(86.62)
Employment	
Yes	790(74.95)
No	264(25.05)
*Difficulty paying for basics	
Very hard (low family income)	185(17.55)
Somewhat hard (middle family income)	406(38.52)
Not hard (high family income)	463(43.93)
Marital Status	
Married/partnered	714(67.74)
Non-married/separated	340(32.26)
Number of children	
None	192(18.22)
1-2	542(51.42)
More than 3	320(30.36)
Access to health care	
Yes	913(86.62)
No	141(13.38)
**Social Support	
None of the time (no support)	171(16.22)
A little of the time (low support)	270(25.62)
Some of the time (medium support)	274(26.00)
Most of the time (high support)	339(32.16)
Race/ethnicity	
***NH White	316(29.98)
Hispanic	255(24.19)
NH African	250(23.72)
NH Asian	233(22.11)
Country of birth	
Outside the U.S.	243(23.06)
U.S.	811(76.94)
Length of stay in the U.S. (years)	42.71 $\pm$ 14.14
Level of acculturation (1-5)	4.58 $\pm$ 0.83
BMI(kg/m ²)	28.49 $\pm$ 7.37
Underweight(<18.4)	27(2.6)
Normal(18.5 to <25)	396(37.6)

Characteristics	n (%) or Mean±SD
Overweight (25 to <30)	265(25.14)
Obese (≥ 30)	366(34.72)
Menopausal status	
Pre-menopause	418(39.66)
Peri-menopause	349(33.11)
Post-menopause	287(27.23)

* Difficulty paying for the basics such as food, housing, clothing, and health care with family income.

** The availability of support from family members and friends/

*** NH=Non-Hispanic

Table 2
Differences in sleep-related symptoms between immigrants and non-immigrants (N=1,054).

Category	Total numbers of symptoms			Total severity scores of symptoms		
	Non-immigrants Mean±SD (n = 811)	Immigrants Mean±SD (n = 243)	t	Non-immigrants Mean ±SD (n = 811)	Immigrants Mean±SD (n = 243)	p value
Physical symptoms	1.25±1.23	0.88±1.04	4.70	4.09±4.48	2.60±3.55	5.41 <.01
Psychosomatic symptoms	1.43±1.24	1.11±1.19	3.55	4.92±4.70	3.54±4.10	4.44 <.01
Psychological symptoms	5.19±4.40	4.46±4.11	2.38	16.34±16.23	13.14±14.34	2.96 <.01
Total	7.87±6.06	6.44±5.55	3.27	25.36±22.86	19.28±19.68	4.06 <.01

Table 3

Differences in individual sleep-related symptoms between immigrants and non-immigrants (N=1,054).

Items	Non-immigrants <i>n</i> (%) (<i>n</i> = 811)	Immigrants <i>n</i> (%) (<i>n</i> = 243)	χ^2	<i>p</i> value	Non-immigrants Mean $\pm$ SD (<i>n</i> = 811)	Immigrants Mean $\pm$ SD (<i>n</i> = 243)	<i>t</i>	<i>p</i> value
Poor appetite	71(9.12)	16(6.58)	1.55	.21	0.29 $\pm$ 0.95	0.19 $\pm$ 0.74	1.75	.08
Painfully swollen joint	127(15.66)	27(11.11)	3.10	.08	0.54 $\pm$ 1.30	0.31 $\pm$ 0.97	2.98	<.01*
Back pain	165(20.35)	49(20.16)	0.00	.95	0.68 $\pm$ 1.42	0.62 $\pm$ 1.30	0.65	.52
Night sweat	251(30.95)	36(14.81)	24.66	<.01	1.01 $\pm$ 1.62	0.46 $\pm$ 1.16	5.91	<.01*
Severe headache	182(22.44)	44(18.11)	2.09	.15	0.77 $\pm$ 1.50	0.58 $\pm$ 1.32	1.89	.06
Dizziness	133(16.40)	35(14.40)	0.56	.46	0.51 $\pm$ 1.22	0.38 $\pm$ 0.98	1.68	.09
Exhaustion or fatigue	391(48.21)	91(37.45)	8.73	<.01	1.64 $\pm$ 1.82	1.22 $\pm$ 1.70	3.27	<.01*
Difficulty in falling or staying asleep	454(55.98)	100(41.15)	16.49	<.01	2.00 $\pm$ 1.92	1.35 $\pm$ 1.74	4.96	<.01*
Night time urination	397(48.95)	85(34.98)	14.71	<.01	1.57 $\pm$ 1.77	1.02 $\pm$ 1.52	4.75	<.01*
Feeling clumsy	248(30.58)	34(13.99)	26.25	<.01	0.89 $\pm$ 1.45	0.41 $\pm$ 1.09	5.53	<.01*
Feeling unhappy	282(34.77)	76(31.28)	1.02	.31	1.11 $\pm$ 1.63	0.95 $\pm$ 1.51	1.44	.15
Crying	195(24.04)	44(18.11)	3.76	.05	0.73 $\pm$ 1.39	0.50 $\pm$ 1.15	2.62	.01*
Feeling depressed	270(33.29)	76(31.28)	0.35	.57	1.08 $\pm$ 1.64	0.94 $\pm$ 1.49	1.26	.21
Worrying gets you down	284(35.02)	82(33.74)	0.13	.72	1.14 $\pm$ 1.66	0.98 $\pm$ 1.48	1.39	.17
Upset or irritated	329(40.57)	95(39.09)	0.17	.68	1.25 $\pm$ 1.63	1.10 $\pm$ 1.50	1.37	.17
Feeling grouchy	295(36.37)	68(27.98)	5.83	.02	1.08 $\pm$ 1.53	0.81 $\pm$ 1.38	2.51	.01*
Feeling anxious, tense or nervous	312(38.47)	86(35.39)	0.76	.39	1.18 $\pm$ 1.62	1.05 $\pm$ 1.52	1.18	.24
Keyed up, jittery or restless	166(20.47)	40(16.46)	1.91	.17	0.64 $\pm$ 1.35	0.46 $\pm$ 1.08	2.22	.03*
Feeling panic	121(14.92)	36(14.81)	0.00	.97	0.50 $\pm$ 1.25	0.41 $\pm$ 1.04	1.07	.29
Worrying about body	465(57.34)	105(43.21)	15.03	<.01	1.89 $\pm$ 1.79	1.36 $\pm$ 1.71	4.09	<.01*
Decreased sexual interest	363(44.76)	104(42.80)	0.29	.60	1.52 $\pm$ 1.85	1.30 $\pm$ 1.67	1.75	.08
Loss of interests	197(24.29)	53(21.81)	0.64	.43	0.77 $\pm$ 1.44	0.62 $\pm$ 1.27	1.58	.12
Difficulty with concentration	251(30.95)	59(24.28)	4.01	.05	0.97 $\pm$ 1.53	0.71 $\pm$ 1.36	2.52	.01*
Being forgetful	427(52.65)	125(51.44)	0.11	.74	1.61 $\pm$ 1.68	1.54 $\pm$ 1.66	0.54	.59

* Statistically significant ($p < .05$).

Table 4

Factors related to the total numbers and total severity scores of sleep related symptoms in multiple hierarchical regression analyses ($N = 1,054$).

	Total numbers of sleep-related symptoms				Total severity scores of sleep-related symptoms			
	Step1 β	Step2 ^a β	Step3 ^b β	Step4 ^c β	Step1 β	Step2 ^a β	Step3 ^b β	Step4 ^c β
Non-immigrant	-0.10**	-0.04	0.03	0.02	-0.12**	-0.03	0.02	0.01
Length of stay in the U.S.		0.03	-0.01	0.01		0.05	0.01	0.03
Level of acculturation		0.04	0.04	0.00		0.05	0.04	0.00
<i>Race/ethnicity (ref. ***NH white)</i>								
Hispanic			-0.06	-0.03			-0.05	-0.02
***NH Asian			-0.22**	-0.13**			-0.20**	-0.11**
***NH African American			-0.11**	-0.09*			-0.12**	-0.09**
Less than high school education				0.05				0.03
Unemployed				0.09**				0.11**
<i>Family income (ref. high income)</i>								
Low family income				0.21**				0.23**
Middle family income				0.12**				0.13**
Non-married/separated				0.01				0.00
No access to health care				-0.07*				-0.07*
<i>Number of children (ref. no children)</i>								
Having 1 or 2 children				0.01				0.01
Having more than 3 children				0.07				0.07
<i>Social support (ref. high social support)</i>								
No social support				0.12**				0.12**
Low social support				0.09**				0.09**
Medium social support (ref. high social support)				0.09**				0.07*
<i>Body mass index (ref. <25 kg/m²)</i>								
25-29.9 Kg/m ²				0.03				0.02
>30 kg/m ²				0.10**				0.12**
<i>Menopausal status (ref. premenopausal)</i>								

	Total numbers of sleep-related symptoms					Total severity scores of sleep-related symptoms				
	Step1 β	Step2 ^a β	Step3 ^b β	Step4 ^c β	Step1 β	Step2 ^a β	Step3 ^b β	Step4 ^c β	Step1 β	Step4 ^c β
Peri-menopausal				0.23 ^{**}				0.23 ^{**}		0.23 ^{**}
Post menopausal				0.09 [*]				0.10 ^{**}		0.10 ^{**}
R ² (%)	1.01	1.05	3.53	19.10	1.32	1.41	3.76	20.24		
R ² (%)	1.01	0.05	2.48	13.24	1.32	0.09	2.36	16.48		
F <i>ch</i>	10.68 ^{**}	0.25	8.98 ^{**}	13.24 ^{**}	14.04 ^{**}	0.47	8.55 ^{**}	14.22 ^{**}		

^{*}
 $p < 0.05$,

^{**}
 $p < 0.01$

^{***}
NH=Non-Hispanic; ref.= referent

^aControlled for the length of stay in the U.S. and the level of acculturation.

^bControlled for the length of stay in the U.S., the level of acculturation, and self-reported race/ethnicity.

^cControlled for the length of stay in the U.S., the level of acculturation, self-reported race/ethnicity, and backgrounds characteristics and health and menopausal status (education, employment, marital status, family income, access to health care, number of children, social support, BMI, and menopause status).