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Physical Activity and Depressive Symptoms in Four Ethnic Groups of Midlife Women

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Abstract

The purpose of this study was to determine the associations between physical activity and depression and the multiple contextual factors influencing these associations in four major ethnic-groups of midlife women in the U.S. This was a secondary analysis of the data from 542 midlife women. The instruments included questions on background characteristics and health and menopausal status; the Depression Index for Midlife Women; and the Kaiser Physical Activity Survey. The data were analyzed using chi-square tests, the ANOVA, twoway ANOVA, correlation analyses, and hierarchical multiple regression analyses. The women's depressive symptoms were negatively correlated with active living and sports/exercise physical activities whereas they were positively correlated with occupational physical activities ($p < .01$). Family income was the strongest predictor of their depressive symptoms. Increasing physical activity may improve midlife women's depressive symptoms, but the types of physical activity and multiple contextual factors need to be considered in intervention development.

Keywords

depressive symptoms; physical activity; midlife women; race; ethnicity

Depression is one of the most prevalent symptoms experienced by midlife women during their menopausal transition (Judd, Hickey, & Bryant, 2012). Women in late menopausal transition are reportedly 3 times more likely to experience depressive symptoms compared with premenopausal women (Freeman et al., 2004). With hormonal changes during menopausal transition, midlife women experience multiple personal, social, and cultural changes that are frequently linked to negative attitudes such as worries about getting ill and getting old and to feeling less feminine, loneliness, and meaninglessness, subsequently making them at risk of depression (Judd et al., 2012). However, depression is often unknown and untreated in midlife women, especially in those from ethnic minority groups

(Sin, Jordan, & Park, 2011). Furthermore, ethnic minority midlife women have been reported to hide their symptoms because of their cultural stigma attached to depression (Sin et al., 2011). To decrease the women's depressive symptoms, physical activities have been suggested as effective modalities (Mansikkamäki et al., 2012). Despite an increasing number of studies supporting the benefits of physical activities on depressive symptoms among specific ethnic groups (Torres, Sampselle, Gretebeck, Ronis, & Neighbors, 2010), little is known about racial/ethnic variations in the relationships between physical activity and depressive symptoms and their influencing factors.

Physical Activity and Depressive Symptoms of Midlife Women

Physical activities are reported to decrease depression among midlife women in menopausal transition (Mansikkamäki et al., 2012). Indeed, regular physical activities have been reported to provide mental health benefits to participants (De Moor, Beem, Stubbe, Boomsma, & De Geus, 2006). It is suggested that physical activity could influence depression by: (a) increasing cortical blood flow; (b) releasing endorphins; and (c) increasing epinephrine and nor-epinephrine synthesis (Torres et al., 2010). Also, studies have indicated that physical activity helps discharge hostility, diminish emotional tension, and lessen or moderate the impact of stressful events (Torres et al., 2010). Furthermore, studies have supported that physical activity provides a sense of mastery, subsequently enhancing participants' self esteem, diverting participants from negative feelings, or providing the social support that enhances mood (Torres et al., 2010). However, nothing is clearly known about the exact mechanism through which physical activity influences depression.

Race/ethnicity places an additional dimension to the relationships between physical activity and midlife women's depressive symptoms. Indeed, an increasing number of studies have reported racial/ethnic differences in physical activity (Centers for Disease Control and Prevention [CDC], 2007). White women meet the CDC recommended guidelines for physical activity more likely than ethnic minorities, and ethnic minority women tend to be physically inactive, subsequently in fair or poor health (Vásquez, Shaw, Gensburg, Okorodudu, & Corsino, 2013). However, nothing is clearly known about the racial/ethnic differences in physical activity as well (Ramos et al., 2011). Also, an increasing number of studies report certain racial/ethnic differences in depression experience; depression is often unrecognized and untreated in ethnic minorities despite its high prevalence (Sin et al., 2011). Despite an increasing number of studies on depressive symptoms among specific ethnic groups, the relationships between physical activity and depressive symptoms have rarely been explored among multi-ethnic groups of midlife women (Torres et al., 2010). Furthermore, multiple contextual factors (e.g., age, household income, disease status, menopausal status, level of acculturation, etc.) have rarely been considered in determining the relationships between physical activity and depressive symptoms (Torres, Sampselle, Ronis, Neighbors, & Gretebeck, 2013).

The multiple factors that reportedly influence midlife women's depression include: background characteristics, health/disease status, stress, perceived discrimination, perceived social support, and genetic factors. Those aged 55 to 64 had the highest prevalence of depression across all age groups (Chen, Huang, Chang, & Chung, 2006). Those with lower

income had a higher prevalence rate of depression compared with their counterparts (Pratt & Brody, 2008). Those with poor health had a significantly higher rate of depression than those in good health (Gazmararian, Baker, Parker, & Blazer, 2000). The positive influence of social supports (resources) on depression (inverse relationship) has also been reported (Wolff & Agree, 2004). Those acculturated more had less stress, subsequently less depression (Koneru, de Mamani, Flynn, & Betancourt, 2007). Time frequency of self-reported discrimination had a significant association with depression (Lee, 2005). Those with a family history of depression were more likely to have depression compared with those without a family history. (Husain et al., 2009).

In this analysis, a feminist approach was used to theoretically guide the study as in the original study (Im, Chang, Ko, Chee, Stuijbergen, & Walker, 2012; Chang, Chee, & Im, 2013). Feminists claim that marginalized groups could further lose their power and their concerns could become irrelevant or inaccurate when researchers misuse their studies to support predominant androcentric and ethnocentric views and concerns (Hesse-Biber, 2011). Thus, research participants' own views, perspectives, opinions, and experiences should be prioritized rather than researchers' (Hesse-Biber, 2011). Based on this stance, we respected the women's self-reports on depression and physical activity. Also, we considered gender as a significant factor that could influence other characteristics of the women (e.g., race, ethnicity, and social class), subsequently influencing their physical activity and depression (Hesse-Biber, 2011). In addition, we also viewed race/ethnicity as a significant characteristic that could influence the women's physical activity and depression, and we tried to determine how other contextual factors including socioeconomic status influenced the women's physical activity and depression in different racial/ethnic group.

We also used the University of California, San Francisco (UCSF) symptom management model (Dodd et al., 2001) as the theoretical basis; the model provided the basis for the specific aims and hypotheses. This model has been widely adopted to theoretically guide a number of studies on various symptom experience such as cancer pain, menopausal symptoms, sleep symptom, etc. (Dodd et al., 2001). The model has major domains of "person," "health and illness," and "environments." These domains are assumed to influence "symptom experience," "symptom management strategies," and "outcomes" (three major concepts of the model). These major concepts include several related sub-concepts (e.g., "perception of symptoms," "evaluation of symptoms," and "response to symptoms"). The model's assumptions and propositions have been widely evaluated and supported in research and practice (Dodd et al., 2001). Among the major domains, concepts, and sub-concepts of the model, we determined the influences of physical activity (a characteristic of a person under the major domain of person) on symptom experience (a sub-concept of perception of symptoms under the major concept of symptom experience). Also, we examined multiple contextual factors that influenced the women's depressive symptoms, which included the factors related to the major domains of person (background characteristics), health and illness (health and menopausal status), and environment (acculturation factors).

Purpose

The purpose of this study was to determine the associations between physical activity and depression and the multiple contextual factors influencing these associations in four major ethnic-groups of midlife women in the U.S. The hypotheses that were tested included: (a) there are significant racial/ethnic differences in depressive symptoms (Hypothesis 1); (b) there are significant racial/ethnic differences in depressive symptoms by menopausal status (Hypothesis 2); (c) there are significant associations between physical activity and depression scores (Hypothesis 3); (d) physical activity adds significantly to the prediction of depression scores after controlling for selected characteristics including background characteristics (age, education, marital status, family income, employment, number of children, and level of acculturation), perceived health (BMI, perceived general health, diagnosis of disease, and use of medication), and menopausal status (Hypothesis 4); and (e) the selected factors add significantly to the prediction of depression scores (Hypothesis 5).

Method

This was a secondary analysis of the data from a larger Internet survey study on racial/ethnic differences in midlife women's attitudes toward physical activity. More detailed information on the original study can be found elsewhere (Im et al., 2012; Chang et al., 2013). The IRB approval was obtained from the institution where the researchers were affiliated.

Settings and Participants

In the original study (Im et al., 2012; Chang et al., 2013), the women were sampled through Internet communities and groups in the U.S. using a quota sampling by race/ethnicity and socioeconomic status (SES). The participants included a total of 542 women from four major racial/ethnic groups (157 Non-Hispanic [N-H] Whites, 127 Hispanics, 135 N-H African Americans, and 123 N-H Asians). The inclusion criteria were: midlife women aged 40 to 60 years who could be involved in any form of physical activity, who could read and write English, who had regular access to the Internet, and whose racial/ethnic identity was NH White, Hispanic, N-H African American, or N-H Asian. The sample size in this analysis was determined based on the methodology requiring the most strength (i.e., largest sample size), hierarchical multiple regression analyses. Power analyses were conducted using the G*power 3.1 program with an alpha level of .05 and a power of .80 for hierarchical multiple regression analyses. Seventy seven participants per racial/ethnic group ($N = 308$) were needed for hierarchical multiple regression analyses with 18 controlled independent variables with an effect size of .33 (Cohen's f^2) from a previous study (Im, Lee, Chee, Brown, & Dormire, 2010).

Instruments

The instruments included: (a) questions on background characteristics, (b) questions on perceived health and menopausal status, (c) the Kaiser Physical Activity Survey (KPAS), and (d) the Depression Index for Midlife Women (DIMW).

Questions on background characteristics—Questions on age, education, marital status, employment, family income, and the number of children were used to measure background characteristics of the participants. To measure the women's self-reported race/ethnic identity, the questions on race and ethnicity by the National Institutes of Health (NIH) were used. One item on the country of birth was included, and the level of acculturation was measured using questions about the length of stay in the U.S. (in years) and five questions on preferences for foods, music, customs, language, and close friends. These questions were originally adopted from the Suinn-Lew Asian Self-Identity Acculturation Scale (SL-ASIA; (Suinn, Ahuna, & Khoom, 1992) and altered to measure the level of acculturation in various racial/ethnic groups. These were used in previous studies by the research team (Im & Chee, 2005; Im, Shin, & Chee, 2008). The means of the five items were used as the level of acculturation (1 = *exclusively own ethnic group* to 5 = *exclusively American*). Cronbach's alpha of these questions was .84, and the content validity was confirmed by several expert reviews (Im & Chee, 2005; Im et al., 2008). In this analysis, Cronbach's alpha for these questions was .96.

Perceived health and menopausal status—To measure perceived health, five questions were used: (a) 2 items on body weight and height, (b) 1 item on perceived general health (1 = *very unhealthy* to 5 = *very healthy*), and (c) 2 items on diagnosed diseases and medicine. To measure self-reported menopausal status, seven items on last menstrual cycle, menstrual regularity, and menstrual flow were used. Based on these items, the women were divided into pre-, early peri-, late peri-, and postmenopausal. In this analysis, the definitions of menopausal transition and menopausal status followed those by the STRAW revision (Harlow et al., 2012).

Physical activity—To measure physical activity, the KPAS was used (Ainsworth, Sternfeld, Richardson, & Jackson, 2000). The KPAS includes four subscales: (a) household/caregiving index, (b) occupational index, (c) active living index, and (d) sports/exercise index. Each item is on a 5-point Likert scale. In this analysis, we used the modified calculation method by Schmidt et al. (2006). Then, the means of all the items in each index were calculated for each index, and the total physical activity scores were calculated by adding the means of all the indices (range = 4 to 20). A higher total physical activity score means greater physical activity. In the original study of the instrument development (Ainsworth et al., 2000), the 1-month test-retest reliability scores of the KPAS were .79 to .91. In this analysis, Cronbach's alpha for the KPAS was .79. Cronbach's alphas of individual subscales were: .72 for the household/caregiving index, .78 for the occupational index, 0.42 for the active living index, and .85 for the sports/exercise index.

Depression—The DIMW was derived from the Midlife Women's Symptom Index (MSI; Im, 2006). The original MSI is a 71-item scale that measures physical, psychological, and psychosomatic symptoms experienced by midlife women during their menopausal transition. The DIMW is a subscale of the MSI that includes 17 items on the signs and symptoms of depression. More information on this subscale can be found elsewhere (Im, Lee, Chang, Chee, Mao, & Chee, 2014). The DIMW includes two subscales: (a) the prevalence subscale using a dichotomous scale (1 = yes; 0 = no) and (b) the severity

subscale using a 6-point Likert scale (0 = no symptom; 5 = extremely). The total numbers of depressive symptoms were calculated by adding all the responses to the prevalence items (range: 0~17). The total severity scores of depressive symptoms were calculated by adding all the responses to the severity items (range: 0~85). Higher total numbers of depression symptoms mean more prevalent depressive symptoms, and higher total severity scores mean more severe depressive symptoms. In this analysis, Cronbach's alpha of the DIMW was .88 for the total numbers of depressive symptoms and .91 for the total severity scores.

Data Collection Procedures

In the original study, a project website that complied with the Health Insurance Portability and Accountability Act (HIPAA) and the SysAdmin, Audit, Network, Security (SANS)/Federal Bureau of Investigation (FBI) recommendations was developed. Then, study announcements were made on the Web sites, Web pages, and e-mail lists of Internet communities and groups. When a potential participant visited the project website, she was requested to go over the informed consent sheet and to click the button of "I agree to participate" when she agreed to participate in the study. Then, she was checked against the inclusion criteria (age, mobility, literacy, Internet access, and ethnic identity) and quota requirements based on race/ethnicity and SES (an equal number of participants in four race/ethnic groups and three SES groups). Only those who met the inclusion criteria and quota requirements were linked to the Internet survey page. The collected data were stored confidential, and accessed only by the research team. The research team assigned a serial ID number to the data, and the data were saved in a locked file cabinet (in CDs).

Data Analysis

The data were saved directly from the Internet survey site to researchers' computers. Then, the data were analyzed using the SPSS. First, descriptive statistics were used to analyze the data (frequencies, percentages, means, standard deviations, and ranges). Then, the data were analyzed using chi-square tests, ANOVA with Duncan's post-hoc tests, two-way ANOVA, correlation analyses, and hierarchical multiple regression analyses to address Hypotheses 1 to 3. Before conducting hierarchical multiple regression analyses, the degree of multicollinearity was checked. VIF values greater than 10 and tolerance values smaller than .10 were considered indicators of multicollinearity. Scatterplots of residuals were examined to evaluate the assumptions of linearity and equality of variance. Multicollinearity was detected between age, the length of stay in the US, and the level of acculturation. Thus, based on the related literature, only the level of acculturation was included in the regression analyses. Then, correlation analyses were done to decide the order of entering the variables into the equations. Participants' background characteristics (age, education, marital status, family income, employment, number of children, and level of acculturation) were entered in the first step, followed by perceived health (BMI, perceived general health, diagnosis of disease, and use of medication) and menopausal status in the second step. The four physical activity subscale scores were entered in the last step. Also, for each ethnic group, separate hierarchical multiple regression analyses were performed to determine the beta weights of the variables in order to explore relative contributions of each variable to each equation.

Results

Background Characteristics, Perceived Health, and Menopausal Status (Table 1 & 2)

The average age was 49.04 years ($SD = 6.05$), the average level of acculturation was 4.49 ($SD = 0.93$), the mean BMI was 28.41 Kg/m^2 ($SD = 7.09$), and the average level of perceived general health was 3.71 ($SD = 1.01$). The average total physical activity score was 10.21 ($SD = 2.20$) while the mean of each subscale scores ranged from 2.52 to 2.78 ($SD = 0.66 - 1.23$). Sixty-eight percent were married/partnered, 77.1% were employed, 16.4% reported their family income as very low, and 45.9% were post menopausal.

Differences in Depressive Symptoms across the Racial/Ethnic Groups (Hypothesis 1)

Among all participants, the mean total number of depressive symptoms was 4.91 ($SD = 4.43$), and the total numbers of depressive symptoms were significantly different according to racial/ethnic group ($p < .05$). N-H Whites and Hispanics had significantly higher total numbers of depressive symptoms compared to N-H African Americans and N-H Asians ($p < .05$). There were statistically significant racial/ethnic differences in the frequencies of “exhaustion,” “difficulty in falling asleep,” “feeling clumsy,” “feeling unhappy,” “often crying,” “worrying,” and “problem in concentration” ($p < .05$). N-H Whites were more likely to report depressive symptoms in most individual items whereas Asians were less likely to report depressive symptoms in all individual items ($p < .05$).

Among all participants, the mean total severity score of depressive symptoms was 15.32 ($SD = 15.90$), and the total severity scores of depressive symptoms were significantly different by racial/ethnic group ($p < .05$). N-H Whites and Hispanics had significantly higher total severity scores compared to N-H African Americans and N-H Asians ($p < .05$). The severity scores of “exhaustion,” “difficulty in falling asleep,” “feeling clumsy,” “feeling unhappy,” “worrying, feeling anxious,” and “problem in concentration” were significantly different by racial/ethnic group ($p < .05$). Compared with other racial/ethnic groups, N-H Whites and Hispanics had significantly higher severity scores in “exhaustion,” “feeling clumsy,” and “problem in concentration” while Asians had significantly lower severity scores in “difficulty in falling asleep,” “feeling clumsy,” and “feeling anxious” ($p < .05$).

Racial/Ethnic Differences in Depressive Symptoms by Menopausal Status (Hypothesis 2)

Peri-menopausal women had significantly higher total numbers and total severity scores than pre- and post-menopausal women across racial/ethnic groups ($p < .05$). Premenopausal women tended to report lower total numbers and total severity scores than periand post-menopausal women in all racial/ethnic groups except N-H African Americans ($p < .05$). The main effects of race/ethnicity and menopausal status were significant ($p < .05$) while the interactions between race/ethnicity and menopausal status were not significant.

The Relationships between Physical Activity and Depressive Symptoms (Hypotheses 3 and 4)

The total numbers and total severity scores of depressive symptoms were negatively correlated with total physical activity scores ($r = -.18$, $p < .01$ for the total numbers and $r = -.18$, $p < .01$ for the total severity scores), active living scores ($r = -.18$, $p < .01$ for the total

numbers and $r = -.16$, $p < .01$ for the total severity scores), and sports/exercise scores ($r = -.23$, $p < .01$ for the total numbers and $r = -.24$, $p < .01$ for the total severity scores) whereas they were positively correlated with occupational physical activity scores ($r = .20$, $p < .01$ for the total numbers and $r = .19$, $p < .01$ for the total severity scores). Across racial/ethnic groups, the physical activity variables combined accounted for 3 % of the total variances in the total numbers of depressive symptoms ($F=8.42$, $p<.01$) and 2% of those in the total severity scores of depressive symptoms ($F=8.97$, $p<.01$)(see Tables 3 and 4). Also, in each racial/ethnic group, the physical activity variables combined significantly contributed to the total variances in the total numbers and total severity scores of depressive symptoms ($p<.01$) (see Tables 3 and 4). When controlling for other influencing factors, household/caregiving activities were significant predictors of the total numbers of depressive symptoms in N-H African Americans ($\beta=.18$) and of the total numbers and total severity scores in N-H Asians ($\beta=.23$, $.24$ respectively)($p<.05$). Similarly, occupational physical activity scores were significant predictors of the total numbers of depressive symptoms in all participants ($\beta=.14$), N-H Whites ($\beta=.16$), and N-H African Americans ($\beta=.22$) and of the total severity scores in all participants ($\beta=.12$) and N-H African Americans ($\beta=.21$)($p<.05$)(see Tables 3 and 4). Active living activities were significant predictors of the total numbers ($\beta=.35$) and total severity scores ($\beta=.30$) only in N-H Asians ($p<.01$)(see Tables 3 and 4). Sports/exercise activities were not significant predictors of the total numbers and total severity scores of depressive symptoms in any racial/ethnic groups.

Ethnic-Specific Predictors of Depressive Symptoms (Hypothesis 5)

In all participants, family income, perceived general health, and peri-menopausal status were significant predictors of the total numbers of depressive symptoms ($p < .01$)(see Table 3). Among N-H Whites, education ($p<.05$), family income (very low and somewhat low income)($p < .05$), perceived general health ($p<.01$), and the use of medication ($p < .01$) were significant predictors of the total numbers of depressive symptoms. Among Hispanics, only employment was a significant predictor of the total numbers of their depressive symptoms ($p<.01$). Among N-H African Americans, perceived general health ($p < .001$) was a significant predictor of the total numbers of their depressive symptoms ($p < .05$). Among NH Asians, family income (very low income)($p < .05$) and perceived general health ($p < .01$) were significant predictors of the total numbers of their depressive symptoms. Among all the variables considered, family income (very low income) was the strongest predictor of the total numbers of depressive symptoms among all participants ($\beta = -.31$), N-H Whites ($\beta = -.34$), and N-H Asians ($\beta = -.37$). Employment ($\beta = .28$) was the strongest predictor of the total numbers of depressive symptoms among Hispanics, and perceived general health ($\beta = -.34$) was the strongest predictor among N-H African Americans.

Among all participants, family income (very low and somewhat low income), perceived general health, peri-menopausal status, and diagnosis of disease were significant predictors of the total severity scores of depressive symptoms ($p < .05$)(see Table 4). Among N-H Whites, family income (very low income)($p < .01$), perceived general health ($p < .05$), and use of medication ($p < .05$) were significant predictors of the total severity scores of depressive symptoms. Among Hispanics, employment ($p < .01$) and perceived general health ($p < .05$) were significant predictors of the total severity scores of depressive

symptoms. Among N-H African Americans, perceived general health ($p < .001$) was a significant predictor of the total severity scores of depressive symptoms. Among N-H Asians, family income (very low income) ($p < .05$) and perceived general health ($p < .01$) were significant predictors of the total severity scores of depressive symptoms. Family income (very low income) was the strongest predictor of the total severity scores of depressive symptoms among all participants ($\beta = -.30$), N-H Whites ($\beta = -.34$), and N-H Asians ($\beta = -.38$). Among Hispanics, employment ($\beta = .27$) was the strongest predictor of the total severity scores of depressive symptoms, and perceived general health ($\beta = -.38$) was the strongest predictor of the total numbers of depressive symptoms among N-H African Americans.

Discussion

The findings of this analysis supported significant racial/ethnic differences in depressive symptoms experienced by midlife women during their menopausal transition; N-H Whites and Hispanics had significantly higher scores in the total numbers and total severity scores of depressive symptoms compared to N-H African Americans and N-H Asians. Actually, the findings on racial/ethnic differences in depressive symptoms reported in the literature tend to be inconsistent. In the study by Dunlop, Song, Lyons, Manheim, and Chang (2003), N-H African Americans and Hispanics had higher rates of major depression relative to N-H Whites. However, after controlling for confounders, Hispanics and Whites had similar rates, and N-H African Americans had significantly lower rates than Whites. Gore and Aseltine (2003) reported different findings that N-H African Americans and Hispanics were more likely to be depressed compared with N-H Whites and N-H Asians, regardless of socioeconomic factors. The findings of this analysis are similar to those by Dunlop et al. (2003) in terms of the racial/ethnic differences among N-H Whites, Hispanics, and N-H African Americans. The discrepancies in the findings may be due to cultural inappropriateness and inadequacy of the instruments used to measure depressive symptoms in different racial/ethnic groups. Depending on wordings used in the measurement scales, the women's responses to depressive symptoms could be quite different (Kim, Chiriboga, & Jang, 2009).

According to a systematic literature review of cohort studies by Vesco, Haney, Humphrey, Fu, and Nelson (2007), the findings on the association between menopausal transition and depression in the literature are also inconsistent. In five cohort studies that they reviewed, there was no association between menopausal transition and depression. On the opposite, in three cohort studies, peri-menopausal or post-menopausal women were more likely to be depressed compared with pre-menopausal women. The finding of this analysis—the total numbers and severity scores of depressive symptoms were higher in the perimenopausal period than pre- or post-menopausal period—is consistent with the later studies. Also, the finding that pre-menopausal women had lower total numbers and total severity scores than peri- and post-menopausal women across racial/ethnic groups (except N-H African Americans) concurs with the later studies. Menopausal transition brings about biological and psychosocial changes that could be frequently linked to emotional changes, subsequently making midlife women experience depressive symptoms that they did not experience previously (Llaneza, García-Portilla, Llaneza-Suárez, Armott, & Pérez-López, 2012).

However, the associations between depressive symptoms and hormonal changes such as estrogen decrease have not been clearly known so far (Llaneza et al., 2012).

The findings of this analysis also supported significant associations of physical activity to depressive symptoms of midlife women, but the directions of the associations were different depending on the types of physical activity. Although total physical activity scores, active living physical activity scores, and sports/exercise physical activity scores were negatively associated with depressive symptoms, occupational physical activity scores were positively associated with depressive symptoms. These findings have been reported in the literature. According to Chen et al. (2012), occupational physical activities are often performed at a shorter duration and/or with insufficient intensity, which rarely produce benefits to health. As Lin (2003) postulated, women may have more extrinsic motivation to engage in occupational and household/caregiving physical activities (e.g., less control of activities with less autonomy), which could increase depressive symptoms. Indeed, studies on the relationship between locus of control and depression reported that depressed people experienced greater external locus of control (Banks & Goggin, 1983). On the opposite, other types of physical activities with intrinsic motivation (e.g., sports/exercise) could decrease depressive symptoms because intrinsic motivations are reportedly associated with happiness and life satisfaction (Lyubomirsky, 2001). However, there are possibilities that some women could be simply too depressed to be physically active in any types of activity, which have rarely been incorporated and/or reported in the studies though.

The findings on racial/ethnic-specific predictors of depressive symptoms also agree with the literature. In all participants, in N-H Whites, and in N-H Asians, family income was the strongest predictor of depressive symptoms. This finding agrees with the previous findings in the literature: family income was a significant predictor of depressive symptoms, and people with lower income were reported to have a higher prevalence rate of depression compared with their counterparts (Pratt & Brody, 2008). Pratt and Brody (2008) also reported that those aged 40 to 59 years with low family income (below the federal poverty level) had a higher prevalence rate of depression compared with their counterparts.

The findings of this analysis also supported that employment was the strongest predictor of the total numbers of depressive symptoms among Hispanics, and perceived general health was the strongest predictor among N-H African Americans. These findings have been frequently reported in the literature. Melchior et al. (2010) found that employment was directly linked to family income, and family income was also significantly associated with depressive symptoms. Also, Gazmararian et al. (2000) reported that those with poor health had a significantly higher rate of depression than those in good health, which is also supported in this analysis.

As a secondary analysis of the data from an Internet survey data, this study has several limitations. First of all, the participants were more likely to be highly educated, married, and employed although a quota sampling was adopted. Second, the participants might not reflect all the sub-ethnic groups within the major racial/ethnic groups, which limits the generalizability of the findings. Finally, the data were self-reported, and there was no objective validation of the self-reports.

Based on the findings, the following implications for future research are proposed. First of all, researchers need to further explore the specific racial/ethnic differences in depressive symptoms that are experienced by midlife women during their menopausal transition. As discussed above, the literature has been inconsistent on the racial/ethnic differences, so further in-depth studies on the racial/ethnic differences are necessary. Also, the reasons for the racial/ethnic differences and racial/ethnic-specific predictors need to be further explored. Second, the findings support that increasing physical activity would improve midlife women's depressive symptoms, but the types of physical activity need to be carefully considered in future development of midlife women's mental health promotion programs using physical activities as modalities. Researchers also need to consider ethnic-specific predictors of midlife women's depressive symptoms in the future program development. For example, the study findings indicated that occupational physical activity and perceived general health were significant predictors of depressive symptoms in N-H African American women. To make a mental health promotion program culturally competent for N-H African American women, the program needs to incorporate occupational physical activity and perceived general health into the program design in a way (e.g., different components of the program by occupations, etc.).

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Table 1Background characteristics and physical activity of the participants—continuous variables ($N=542$)

		M (SD)
Age (years)		49.04 (6.05)
BMI (Kg/m ²)		28.41(7.09)
PGH		3.71 (1.01)
Length of stay (years)		43.30 (13.24)
Level of acculturation		4.49 (0.93)
Physical activity	Total PA	10.21 (2.20)
	Household/caregiving PA	2.63 (0.66)
	Occupational PA	2.52 (0.71)
	Active living PA	2.64 (0.78)
	Sports/exercise PA	2.78 (1.23)

Note. BMI = body mass index, PGH = perceived general health, and PA = physical activity

Table 2Background characteristics and health status of the participants—categorical variables (*N*=542)

		n (%)
Education	High school	52 (9.6)
	Partial college	132 (24.4)
	College graduation	358 (66.1)
Marital status	Married/partnered	368 (67.9)
	Single/separated	174 (32.1)
Employment	Yes	418 (77.1)
	No	124 (22.9)
Family income	Very low	89 (16.4)
	Somewhat low	216 (39.9)
	Sufficient	237 (43.7)
Number of children	None	107 (19.7)
	1-2	276 (50.9)
	3	159 (29.4)
Ethnicity	Hispanic	127 (23.4)
	N-H Asian	123 (22.7)
	N-H AA	135 (24.9)
	N-H White	157 (29.0)
Country of birth	Outside USA	132 (24.4)
Menopausal status	Pre-menopause	176 (32.5)
	Early peri-menopause	93 (17.2)
	Late peri-menopause	24 (4.4)
	Post-menopause	249 (45.9)
PGH	Very unhealthy	15 (2.8)
	Unhealthy	85 (15.7)
	Don't know	30 (5.5)
	Healthy	323 (59.6)
	Very healthy	89 (16.4)
Diagnosed disease	Yes	259 (47.8)
Use of medication	Yes	311 (57.4)

Note. N-H = Non-Hispanic/ AA=African American

Table 3

Factors influencing the total numbers of depressive symptoms in each ethnic group

	Total (N=542)			N-H White (n=157)			Hispanic (n=127)			N-H AA (n=135)			N-H Asian (n=123)		
	β	β	β	β	β	β	β	β	β	β	β	β	β	β	β
<u>Step 1</u>															
Age	.02	.03	.03	-.02	-.01	-.00	.08	.10	.06	-.08	.00	.01	.11	.07	.13
Education	-.04	-.01	.01	-.17*	-.10	-.07	.01	.03	.02	.04	-.05	-.02	.08	.13	.10
Marital status	.03	-.02	-.20	.01	-.07	-.06	.0	.01	-.02	.12	.11	.12	-.01	.01	.07
Employment	.08	.*	.06	.08	.04	-.02	.28**	.21*	.20*	-.01	.01	-.00	.00	.06	.04
Family Income															
Very low	***	-.31	-.22	-.34**	-.31**	-.26**	-.05	-.04	.01	-.17	-.03	.06	-.37*	-.22	-.13
Somewhat low	.*	-.16	-.12	-.21*	-.24**	-.18*	.05	.11	.14	-.09	-.00	.03	-.15	-.02	.01
Number of children	.01	.00	-.01	-.03	-.04	-.05	.08	.08	.08	.15	.16	.12	-.04	.01	.03
Level of acculturation	.00	-.02	-.01	.04	.08	.08	-.03	-.08	-.10	.04	-.01	.03	-.07	-.04	-.02
<u>Step 2</u>															
BMI		.02	.00		.09	.02		-.01	-.03		-.12	-.12		-.06	-.10
PGH		-.29	-.27	***	-.29	-.28		-.20	-.19		-.34	-.35	***	-.29	***
Menopausal status															
Peri-menopausal		.12**	.11*		.08	.08		.14	.10		.04	.05		.16	.07
Post-menopausal		-.00	-.02		.01	-.01		-.09	-.09		-.13	-.13		.05	-.04
Diagnosed disease		.09	.07		-.03	-.10		.06	.08		.18	.14		.04	.05
Use of medication		.05	.06		.25**	.26		.17	.17		-.17	-.16		.00	-.03
<u>Step 3</u>															
Household/caregiving PA			.03			-.03			-.13			.18*			.23*
Occupational PA			.14**			.16*			.09			.22*			.15
Active living PA			-.09			-.14			.06			-.12			-.35**
Sports/exercise PA			-.03			-.12			-.11			.05			.20
R ² / R ²	.08	.20/.12	.23/.03	.18	.34/.16	.40/.06	.12	.24/.12	.26/.02	.05	.21/.16	.29/.08	.07	.17/.09	.28/.11

	Total (N=542)			N-H White (n=157)			Hispanic (n=127)			N-H AA (n=135)			N-H Asian (n=123)		
	β_1	β_2	β_3	β_1	β_2	β_3	β_1	β_2	β_3	β_1	β_2	β_3	β_1	β_2	β_3
<i>F</i>	5.58***	9.39***	8.42***	4.09***	5.19***	5.04***	2.01***	2.52***	2.07***	0.83***	2.31***	2.60***	1.15***	1.57***	2.26***

Notes: N-H = Non-Hispanic, AA = African American, BMI = body mass index, PGH = perceived general health, and PA = physical activity Education 1 = high school or less, 2 = college or over; Marital status 1 = single/unmarried/separated, 2 = married/partnered; Employment 1 = yes, 0 = no; Number of children 1 = yes, 0 = no; Diagnosed disease 1 = yes, 0 = no; Use of medication 1 = yes, 0 = no

β_1 = β coefficients in Step 1, β_2 = β coefficients in Step 2, β_3 = β coefficients in Step 3

* $p < .05$

** $p < .01$

*** $p < .001$

Table 4

Factors influencing the total severity scores of depressive symptoms in each ethnic group

	Total (N=542)			N-H White (n=157)			Hispanic (n=127)			N-H AA (n=135)			N-H Asian (n=123)		
	β	R^2	β	β	R^2	β	β	R^2	β	β	R^2	β	β	R^2	β
<u>Step 1</u>															
Age	.04	.04	.05	-.01	.00	.00	.12	.12	.07	-.06	.02	.14	.07	.13	
Education	-.05	-.02	.00	-.14	-.07	-.05	-.01	.01	-.00	-.00	-.08	.06	.10	.08	
Marital status	.03	-.02	-.02	.04	-.03	-.03	.01	-.02	-.05	.13	.10	-.02	-.02	.05	
Employment	.07	.08	-.05	.05	.03	-.02	.27**	.19*	.18	-.02	.00	.00	.07	.05	
Family Income															
Very low	-.30***	-.20**	-.15*	-.34**	-.31**	-.27*	-.02	-.02	.05	-.19	-.06	-.38*	-.19	-.10	
Somewhat low	-.13*	-.09	-.06	-.18	-.21*	-.16	.08	.12	.16	-.08	-.02	-.13	.03	.06	
Number of children	.00	-.01	-.02	-.03	-.04	-.05	.07	.06	.07	.14	.13	-.04	-.00	.02	
Level of acculturation	.02	-.01	-.00	.05	.09	.10	.02	-.04	-.06	.06	.02	-.04	.00	.02	
<u>Step 2</u>															
BMI	.01	-.00	-.00	.07	.01	.01	-.02	-.03	-.03	-.08	-.08	-.06	-.09	-.09	
PGH	-.30***	-.28***	-.28***	-.28***	-.27***	-.27***	-.23*	-.22*	-.22*	-.38***	-.39***	-.30***	-.30***	-.30***	
Menopausal status															
Peri-menopausal	.13**	.12*	.12*	.07	.08	.08	.15	.12	.12	.02	.03	.19	.10	.10	
Post-menopausal	.00	-.01	-.01	-.02	-.02	-.02	-.05	-.06	-.06	-.12	-.12	.09	-.00	-.00	
Diagnosed disease	.12*	.11*	.11*	.03	-.03	-.03	.07	.08	.08	.18	.14	.12	.12	.13	
Use of medication	.04	.05	.05	.20*	.20	.20	.18	.18	.18	-.14	-.12	-.02	-.02	-.05	
<u>Step 3</u>															
Household/caregiving PA			.02		-.04	-.04	-.14	-.14			.17		.24*		
Occupational PA			.12**		.12	.12	.13	.13			.21*		.14		
Active living PA			-.05		-.11	-.11	.08	.08			-.08		-.30**		
Sports/exercise PA			-.05		-.12	-.12	-.10	-.10			.02		.16		
R^2/ R^2	.08	.22/.14	.24/.02	.16	.30/.14	.34/.04	.11	.25/.14	.27/.02	.06	.24/.18	.31/.06	.22/.13	.32/.10	
F	5.62***	10.43***	8.97***	3.53**	4.30***	3.97***	1.82	2.66**	2.26**	1.00	2.76***	2.85***	1.38*	2.14*	2.67**

Notes: N-H = Non-Hispanic, AA = African American, BMI = body mass index, PGH = perceived general health, and PA = physical activity.
Education 1 = high school or less, 2 = college or over; Marital status 1=single/unmarried/separated, 2 = married/partnered; Employment 1 = yes, 0 = no; Number of children 1 = yes, 0 = no; Diagnosed disease 1 = yes, 0 = no; Use of medication 1 = yes, 0 = no.
 $\beta 1 = \beta$ coefficients in Step 1, $\beta 2 = \beta$ coefficients in Step 2, $\beta 3 = \beta$ coefficients in Step 3

* $p < .05$
** $p < .01$
*** $p < .001$