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Clusters of Midlife Women Identified by Cognitive Symptoms

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Abstract

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Contributors

Eun-Ok Im designed the analysis, structured the paper, conducted the study and analysis, and drafted the manuscript.

Yun Hu conducted the data analyses and review and wrote the results section.

Ching-Yu Cheng contributed to the data analyses and review and helped write the results section.

Young Ko helped design the analysis and contributed to the data analyses and review.

Eunice Chee contributed to the literature reviews and to the drafting of the introduction and discussion sections, and edited the initial manuscript.

Wonshik Chee was Co-Investigator of the parent studies, helped design the analysis, reviewed the paper, and provided the feedback on the content of the paper.

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

The two parent studies were approved by the Institutional Review Boards of the Univ. of Texas at Austin (IRB Protocol #s:

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Informed consent was obtained from all participants.

Provenance and peer review

This article has undergone peer review.

Research data (data sharing and collaboration)

There are no linked research data sets for this paper. The authors do not have permission to share data.

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Objectives—The study aimed to identify clusters of midlife women by their cognitive symptoms and to examine racial/ethnic differences in the clusters.

Study Design—This secondary analysis was conducted on the data from 1,054 midlife women of multi-ethnic groups in two Internet studies (conducted from 2005 to 2013).

Main Outcome Measures—Only the data from the questions on background characteristics, perceived health, and menopausal status and the Cognitive Symptom Index for Midlife Women were used for this secondary analysis. The data were analyzed using factor analyses, hierarchical cluster analyses, chi-square tests, multinomial logistic analyses, and analyses of covariance.

Results—Four clusters were extracted: the low total symptom group (Cluster 1; 49.9%), the low-moderate total symptom group with high tertiary symptoms (Cluster 2; 17.3%), the high-moderate total symptom group with low tertiary symptoms (Cluster 3; 21.2%); and the high total symptom group (Cluster 4; 11.7%). There were significant differences in the level of education, employment status, family income, marital status, social support, the country of birth, race/ethnicity, body mass index, perceived general health, diagnosed disease(s), access to health care, and menopausal status among the clusters ($p < .01$). There were significant racial/ethnic differences in the total numbers and total severity scores of tertiary symptoms in Cluster 1. Also, there were significant racial/ethnic differences in individual symptoms in each cluster.

Conclusions—Racial/ethnic differences in midlife women's cognitive symptoms and multiple factors that might differently influence their cognitive symptoms need to be considered in health care for midlife women in menopausal transition.

Keywords

Cognition; Symptom; Cluster analysis; Middle Aged; Women; Race/Ethnicity

1. Introduction

As women became aged, they begin to have memory problems, and memory problems are prevalent in midlife [1,2]. In a study by Mitchell and Woods [2], 60% of the participants reported memory changes during the past few years, and they indicated problems in remembering words and numbers, interruptions in everyday behavior (related to loss of memory), concerns on concentration, and needs for memory aids. In a longitudinal study by the Study of Women's Health Across the Nation (SWAN) team, peri-menopause was found to be significantly associated with self-reported forgetfulness [1]; 31% of pre-menopausal, 44% of early or late peri-menopausal and 42% of naturally menopausal women indicated their symptoms of forgetfulness.

Despite the high prevalence rate of cognitive symptoms experienced by midlife women in their menopausal transition, racial/ethnic differences in the cognitive symptoms have rarely been determined, especially among multi-ethnic groups of midlife women [3]. Although racial/ethnic differences in hormone levels during the menopausal transition could be vague, significant racial/ethnic differences in sex hormone-binding globulin (SHBG) and free androgen index (FAI) among a multi-ethnic group of pre-menopausal and peri-menopausal

women have been reported [4]. In other words, these hormonal variances could influence racial/ethnic variances in the cognitive symptoms [5].

A cluster analysis could be useful in identifying sub-groups with similar characteristics, which allows researchers to identify the association of specific factors to being included in the category [6]. Subsequently, a cluster analysis could help identify the association of race/ethnicity to cognitive symptoms experienced by midlife women during their menopausal transition, and give future directions for effective interventions on cognitive symptoms in midlife racial/ethnic minority women [6]. Furthermore, a cluster analysis predicts behaviors/characteristics of the sub-groups on the basis of the participants' membership to the sub-groups (with specific common characteristics). Thus, a cluster analysis helps identify risk groups and approaches to efficiently decrease the risks by intervening the common characteristics of the sub-groups [6].

No study in the literature identified through PUBMED, however, has examined clustering of cognitive symptoms, especially among multi-ethnic groups of midlife women. Rather, a few cluster analyses have been conducted on general menopausal symptoms, including physical and psychological symptom profiles [7,8,9] or menopausal symptoms experienced by breast cancer survivors [10,11]. Cluster analyses could be conducted by people or by symptoms. Cluster analyses by people help identify risk groups while cluster analyses by symptoms could help identify the associations of various co-existing symptoms (e.g., how sleep disturbances influence memory problems) [6]. Yet, most of the few cluster analyses have been done only by symptoms. For instance, the cluster analysis by Terauchi et al. [9] reported three components that defined the variance of physical and psychological symptom profiles in Japanese midlife women (depression, somatic, and vasomotor/sleep). The cluster analysis conducted by Cray, Woods, and Mitchell [7] found a mood component, a vasomotor component, and a pain component in menopausal symptoms. The cluster analysis by Mishra & Kuh [8] found four clusters of menopausal symptoms including psychological, somatic, vasomotor, and sexual discomfort symptoms. Thus, this study is one of the first cluster analyses to examine the associations of race/ethnicity to cognitive symptoms experienced during menopausal transition by conducting a cluster analysis by people. This analysis is expected to help identify risk groups of midlife women by their cognitive symptoms and provide directions for future interventions for this specific population.

The purpose for this study was to identify the clusters of midlife women by cognitive symptoms (Aim #1) and to examine racial/ethnic differences in the clusters (Aim #2). In this analysis, "symptom" means "subjective experiences indicating changes in bio-psycho-social function, sensation, and cognition of a person" [12]. Accordingly, in this study, "cognitive symptom" broadly means subjective experience of changes in cognitive functions of a midlife woman and its accompanying bio-psycho-social symptoms (e.g. fatigue, sleep difficulties, mood changes, hot flashes). Subsequently, due to this definition of cognitive symptoms as subjective experience, there is an inherent limitation in this analysis. The recent literature is clear that subjective measurement of cognitive symptoms (e.g., self-reported symptoms) is often weakly associated with objective cognitive functions [13] despite its prognostic value (e.g., prediction of dementia within several years) [14]. Also, the literature indicates that subjective measurement of cognitive symptoms is associated with

various factors differently from objective cognitive functions [13, 14]. Thus, the findings of this study could be different from those that use objective measurement of cognitive functions.

2 Methods

This was a secondary analysis of the data from two larger Internet-based studies in four major racial/ethnic groups of midlife women in the U.S. (Non-Hispanic [NH] Whites, Hispanic, NH African Americans, and NH Asians) [15,16]. The two larger studies were approved by the institutional review boards of the University of Texas at Austin and the University of Pennsylvania.

2.1. Samples and Settings

The data from a total of 1,054 midlife women (316 NH Whites 255 Hispanics, 250 NH African Americans, and 233 NH Asians) were used for this secondary analysis. Only midlife women who were aged 40 to 60 years, who were able to read and write English, and who self-identified their ethnic identity as NH White, Hispanic, NH African American or NH Asian were included. The response rate based on the total number of visitors at the project website was approximately 95%. The sample size was predetermined because we used the data from existing studies, yet the sample size was adequate for the study. Formann [17] suggested that the least number of cases for a cluster analysis is no less than 2^k cases (k =the total number of variables), but preferably over 5×2^k .

2.2. Instruments

Among the various instruments used in the original studies, only the data from the following instruments were included in this analysis.

Background characteristics, health status, and menopausal status—Several items about age, education, employment, family income, marital status, number of children, social support, and country of birth and self-reported ethnic identity were used to measure background characteristics of the participants. Socioeconomic status was determined based on the question on family income level (the ability to pay for basic necessities such as food, clothing, and shelter). Social support was measured using a four-point ordinal scale (none of the time, a little of the time, some of the time, and most of the time) on the amount of support received from family members, relatives, or friends.

Health status was measured by items on body weight and height and by a 5-point Likert scale on perceived general health (1 = *very unhealthy* to 5 = *very healthy*). Also, two questions on diagnosed disease(s) and access to health care were used. To determine menopausal status, seven questions on the last menstrual cycle, menstrual regularity, and menstrual flow were used. When a participant menstruated in the last 3 months with no change in regularity, she was considered as pre-menopausal. When a participant had menstruation in the previous 3 months with increasing irregularity in cycle length over the past year, she was considered as early peri-menopausal. When a participant had menstruation in the previous 12 months but not in the former 3 months, she was considered

as late peri-menopausal. Finally, when a participant did not have menstruation in the last one year, she was regarded as post-menopausal.

The Cognitive Symptom Index for Midlife Women (CMW)—The Cognitive Symptom Index for Midlife Women (CMW) was adopted from the Midlife Women's Symptom Index (MSI) [18]. While the MSI includes 71 items on physical, psychological, and psychosomatic symptoms that midlife women could experience in their menopausal transition, the CMW includes a total of 20 items on cognitive symptoms in three domains (primary, secondary, and tertiary symptoms). Primary symptoms are those directly reflecting changes in cognitive functions (e.g. forgetfulness, concentration problems, etc.). Secondary symptoms are those that are strongly associated with changes in cognitive functions (e.g. depression, anxiousness, etc.). Tertiary symptoms are those that may influence cognitive functions (e.g., hot flush, night sweats). All items were selected based on a systematic literature review/analysis on research related to cognitive symptoms experienced during menopausal transition, and they covered a broad range of symptoms that could directly or indirectly indicate alterations in cognitive functions of midlife women during menopausal transition.

Individual items included two sub-scales: (a) the prevalence subscale (yes/no) and (b) the severity subscale (0~5= no symptom to extreme symptom). The total number of all cognitive symptoms was calculated as the total number of total symptoms (0~20). The total number of cognitive symptoms in individual domains was summed to the total number of primary (0~8), secondary (0~9), and tertiary symptoms (0~3). The total severity scores were generated by adding the severity scores of all the items (0~100). Then, the total severity scores of cognitive symptoms in individual domains were generated by adding the severity scores of individual items in each domain (the total severity scores of primary [0~40], secondary [0~45], and tertiary symptoms [0~15]). Higher scores mean more frequent and severe symptoms. The Cronbach's alpha of the CMW was .89 (the prevalence part) and .92 (the severity part) in this study.

2.3. Data Collection Procedures

In the original studies, the project websites were developed to confirm to the Health Insurance Portability and Accountability Act (HIPAA) and the SysAdmin, Audit, Network, Security (SANS)/Federal Bureau of Investigation (FBI) recommendations. When a participant came to the project websites first, she was asked to go through the *informed consent sheets* and give her consent to participate in the studies. Then, she was screened against the inclusion criteria and the quota requirement, and asked to go through the Internet survey site if she met the criteria and requirement.

2.4. Data Analysis

The data from the original studies were de-identified, and analyzed using SPSS (version 24.0) and Mplus (7.0) software. The data with less than 10% missing fields were included for this study. First of all, all 20 items in the CMW were analyzed using an exploratory factor analysis (EFA). Then, a confirmatory factor analysis (CFA) was performed in order to obtain a factor structure that was well-adjusted to the data. Next, to identify the clusters of

midlife women by their cognitive symptoms, hierarchical clustering methods with an agglomerative approach and the average linkage between clusters were adopted. Three domain scores of cognitive symptoms (primary, secondary, and tertiary symptoms) were included in hierarchical clustering analyses. First, Z scores of the sum of individual domain scores were calculated to standardize continuous variables and identify outliers. Agglomerative schedule and Dendrogram helped determine the number of clusters. After deciding the number of clusters, the data were again subjected to K-mean cluster analyses to figure out the final cluster centers. ANOVA (F-ratios and p-values) was used to examine the differences among the clusters. Then, differences in background characteristics, perceived general health, and menopausal status among the finalized clusters were analyzed using Chi-square tests and multinomial logistic regression analyses.

First of all, individual independent variable was examined using a univariate regression model. Then, only independent variables whose p-values were less than .05 in the likelihood ratio chi-square tests were determined and included in a multivariable regression model. Potential multicollinearity [19] was screened using correlations among independent variables, variance inflation factors, and tolerance values for the model (no concern on multicollinearity). The model fit was also determined using the likelihood ratio chi-square (50.15, p-value < .01). Finally, racial/ethnic differences in cognitive symptoms in each cluster were examined using the analysis of covariance (ANCOVA) while adjusting the independent variables that were significantly different among the four racial/ethnic groups in univariate analyses. An alpha level of .05 was used to determine statistical significances.

3 Results

3.1. Characteristics of the Participants

Table 1 summarizes background characteristics and health and menopausal status of the participants. The participants' mean age was 48.97 years (SD=5.69). Approximately 88% of them were college graduates or had graduate degrees. About 44% of them reported that it was not hard to pay basics (e.g., foods, housing, etc.) with their family income. About 68% were married or partnered, 51% had 1 or 2 children, 32% reported that they had supports from family members or friends in most of the time, and 77% were born in United States. About 30% were NH Whites, 24% were Hispanics, 24% were NH African Americans, and 22% were NH Asians. About 40% had a normal BMI. About 74% reported that their perceived health is good. Over 55% did not have any diagnosed diseases. Over 53% were early or late peri-menopausal.

3.2. Factor Analyses of the CMW

The KMO was 0.95, and 56.52% of the variances were explained by three factors extracted through EFA with a principal component analysis. Chi-Square tests of model fit (1096.41, p=0.00) and Fit indexes (CFI=0.91, TLI=0.90, and RMSEA=0.00) showed the good fitness of the model in CFA (Table 2).

3.3. Clusters of Midlife Women by Cognitive Symptoms

A four-cluster solution was adopted for this study, which were determined based on the findings from Dendrogram and K-mean (Table 3). Over 49.9% of the participants were categorized into Cluster 1 (the low total symptom group); 17.3% were categorized into Cluster 2 (the low-moderate total symptom group with high tertiary symptoms); 21.2% were categorized into Cluster 3 (the high-moderate total symptom group with low tertiary symptoms); and 11.7% were categorized into Cluster 4 (the high total symptoms). There existed significant differences in the total numbers and total severity scores of cognitive symptoms (total and three domain scores) among the four clusters ($p<.01$) (Table 3).

3.3. Differences in Background Characteristics among Clusters

There existed no significant differences among the four clusters in age and the number of children. However, there were significant differences in the level of education, employment status, family income, marital status, social support, the country of birth, race/ethnicity, BMI, perceived general health, diagnosed disease(s), access to health care, and menopausal status among the clusters ($p<.01$) (Table 1).

Table 4 summarizes the results of the multinomial logistic regression analyses that show the predictors of Clusters 2, 3 and 4 (compared with Cluster 1). Asian ethnicity (OR=0.21), being born in the U.S. (OR=14.70), having access to health care (OR=2.29), and pre- and peri- menopausal status (OR=0.02 and 0.19 respectively) were significantly associated with Cluster 2. Being born in the U.S. (OR=17.49), low family income (very hard or somewhat hard to pay basics with family income, OR=2.51 and 1.66, respectively), having access to health care (OR=2.15), and pre- and peri- menopausal status (OR=0.01 and 0.23, respectively) were significantly associated with Cluster 3. The lack of social support (social support available at none of the time; OR=5.19), being born in the U.S. (OR=50.84), low family income (very hard or somewhat hard to pay basics with family income, OR=3.36 and 2.15, respectively), poor perceived general health (as unhealthy or don't know; OR=2.77 and 4.49, respectively), and peri-menopausal status (OR=0.18) were significantly associated with Cluster 4.

3.4. Racial/Ethnic Differences in Cognitive Symptoms by Cluster

Table 5 includes the findings on racial/ethnic differences in total numbers, total severity scores, and three domain scores among the clusters (ANCOVA tests). Only in Cluster 1 (low total symptom group), there existed significant racial/ethnic differences in the total numbers and total severity scores of tertiary symptoms. Only in Cluster 1, Hispanic and Asian women had significantly lower total numbers of tertiary symptoms than White and African American women ($p<.01$). Also, only in Cluster 1, Hispanic women had significantly lower total severity scores of tertiary symptoms than African women ($p<.01$).

When the associations of race/ethnicity to individual symptoms in each cluster were examined using Spearman tests, there existed significant associations of race/ethnicity to “night sweet ($r_s=0.10$, $p<0.05$)” “hot flash ($r_s=0.15$, $p<0.01$),” and “upset or irritated ($r_s=-0.09$, $p<0.05$)” in Cluster 1. In Cluster 2, there were significant associations of race/ethnicity to “feeling clumsy ($r_s=0.15$, $p<0.05$)” and “feeling grouchy ($r_s=0.18$, $p<0.05$).” In

Cluster 3, there were significant associations of race/ethnicity to “feeling clumsy ($r_s=0.24$, $p<0.01$)” and “depressed ($r_s=0.13$, $p<0.05$).” In Cluster 4, there were significant associations of race/ethnicity to “night sweat ($r_s=0.22$, $p<0.05$).”

4. Discussion

As discussed in the introduction, the findings reported in this paper are relatively new to the literature on cognitive symptoms experienced during menopausal transition. Cluster analyses have rarely been conducted on cognitive symptoms experienced during menopausal transition. The significant associations of race/ethnicity to cognitive symptoms that were found in this study agree with the literature on menopausal symptoms in general. Whites have been reported to have larger total numbers and higher total severity scores of symptoms experienced during their menopausal transition while Asians have been reported to have lower numbers and severity scores of symptoms than other racial/ethnic groups [5, 20–22]. Thus, the findings on cognitive symptoms of Asians are consistent with those of the existing studies on menopausal symptoms in general. However, the findings on cognitive symptoms of Whites are different from those of the current literature on menopausal symptoms. In this study, Whites tended to have total numbers and severity scores of cognitive symptoms that were similar to or lower than those of African Americans. Also, the findings on Hispanics’ cognitive symptoms are new to the literature; they reported lower total numbers and severity scores of cognitive symptoms compared with Whites and African Americans in this study. Although further studies on racial/ethnic differences in cognitive symptoms experienced during menopausal transition are needed, these findings support that Asian and Hispanic midlife women may not be the risk groups to target in terms of cognitive symptoms experienced during menopausal transition.

The finding that only the predictors of Cluster 2 (against Cluster 1) included race/ethnicity needs to be highlighted as well. The racial/ethnic association might become prominent only when midlife women experience secondary and tertiary symptoms because these symptoms could be heavily influenced by cultural attitudes related to the symptoms. Indeed, researchers have emphasized that multiple factors such as women’s psychological influences, cultural and social characteristics, cultural and social contexts, the microenvironment of the household, and the aging process need to be considered in the interpretation of the symptoms [23–28]. Yet, the findings reported in this paper also indicated that, even in other clusters (Clusters 2 to 4), there existed significant associations of race/ethnicity to many individual symptoms. Therefore, race/ethnic differences may be linked to specific types of symptoms rather than total numbers or total severity scores of cognitive symptoms experienced during the menopausal transition.

The findings on significant differences in employment status, family income, level of social support, country of birth, race/ethnicity, BMI, perceived general health, diagnosed disease, access to health care, and menopausal status among the clusters are consistent with those in the literature. Yet, the findings on significant factors associated with different clusters tend to be new to the literature. Indeed, cognitive symptoms are reportedly associated with multiple factors, and socioeconomic status (represented as family income and social support) is one of the most frequently reported significant factors associated with cognitive symptoms

[29–31]. Also, self-reported health and menopausal status are other significant factors that have been reported to influence cognitive symptoms [32]. Indeed, the findings reported in this paper support that midlife women who are from low socioeconomic status and who are post-menopausal would be the risk groups to target in terms of cognitive symptoms experienced during menopausal transition.

Interestingly, the country of birth was a prominent significant predictor associated with cognitive symptoms in each of all the clusters. Those who were born in the U.S. were more likely to report cognitive symptoms compared to those who were born outside the U.S. in each cluster. This finding could be interpreted using the theories on the selective nature of migration and the positive effect of immigration on health. According to the theories, immigrants are a naturally selected group of healthy individuals who are highly motivated/driven [33]. In other words, the theories support that immigrants would be less likely to have cognitive symptoms compared with non-immigrants because they are selected healthy people.

The findings reported in this paper need to be carefully interpreted due to several limitations of the study. First of all, a broad definition of cognitive symptoms was adopted for this study to cover a wide range of cognitive symptoms that could be differently experienced by different racial/ethnic groups. Second, the parent studies used Internet surveys as data collection methods, so the participants could be a selected group of midlife women (highly educated and with high income). Third, the data were collected based on self-reports (subjective measurement of cognitive symptoms). Thus, as discussed above, there was an inherent limitation in the study due to not using objective measurements of cognitive functions. Fourth, the parent studies were cross-sectional studies, which made it impossible to interpret possible temporal and/or causal relations. Finally, clinical meanings of the findings reported in this paper are unclear with the given data.

5. Conclusions

This study confirmed the significant association of race/ethnicity to cognitive symptoms experienced during menopausal transition through a cluster analysis. The findings suggest the following implications for future research and practice. First of all, this study would be one of the first cluster analyses on cognitive symptoms of midlife women, but has several study limitations as discussed above. Therefore, the findings need to be confirmed through further studies with diverse groups of midlife women across countries. Also, the findings on racial/ethnic differences in the cognitive symptoms could provide a basis for health care providers to identify risk groups to promote better cognitive outcomes. Finally, the findings on significant factors influencing cognitive symptoms in different clusters could provide directions for future development of preventive and/or treatment interventions for cognitive symptoms of midlife women during menopausal transition.

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Table 1

Background characteristics of the participants by cluster.

Variables	Cluster 1 n(%)	Cluster2 n(%)	Cluster4 n(%)	Cluster3 n(%)	Total N (%)	p-value
Age (Mean±SD)	48.84 ±5.84	49.92±5.42	48.70±5.90	48.61±4.91	48.97±5.69	0.09
Education						<0.01
high school	53 (37.6)	23 (16.3)	39 (27.7)	26 (18.4)	141 (13.38)	
>high school	471 (51.8)	159 (17.4)	184 (20.2)	97 (10.6)	913 (86.62)	
Employment						<0.01
Yes	413 (52.3)	135 (17.1)	167 (21.1)	75 (9.5)	790 (75.0)	
No	113 (42.8)	47 (17.8)	56 (21.2)	48 (18.2)	264 (25.0)	
Family Income						<0.01
Very hard	62 (33.5)	28 (15.1)	48 (25.9)	47 (25.4)	185 (17.6)	
Somewhat hard	176 (43.3)	75 (18.5)	101 (24.9)	54 (13.3)	406 (38.5)	
Not hard	288 (62.2)	79 (17.1)	74 (16.0)	22 (4.8)	463 (43.9)	
Marital status						0.13
Married/partnered	371 (52)	119 (16.7)	150 (21.0)	74 (10.4)	714 (67.7)	
Non-married/separated	155 (45.6)	63 (18.5)	73 (21.5)	49 (14.4)	340 (32.3)	
Number of children						0.18
None	114 (59.4)	31 (16.1)	30 (15.6)	17 (8.9)	192 (18.2)	
1–2	275 (50.7)	85 (15.7)	118 (21.8)	64 (11.8)	542 (51.4)	
More than 3	137 (42.8)	66 (20.6)	75 (23.4)	42 (13.1)	320 (30.36)	
Social support						<0.01
None of time	75 (43.9)	29 (17.0)	36 (21.1)	31 (18.1)	171 (16.2)	
A little of the time	120 (44.4)	37 (13.7)	71 (26.3)	42 (15.6)	270 (25.6)	
Some of the time	128 (46.7)	58 (21.2)	53 (19.3)	35 (12.8)	274 (26.0)	
Most of the time	203 (59.9)	58 (17.1)	63 (18.6)	15 (4.4)	339 (32.2)	
Country of birth						<0.01
US	376 (46.4)	159 (19.6)	171 (21.1)	105 (12.9)	811 (76.9)	
Outside of US	150 (61.7)	23 (9.5)	52 (21.4)	18 (7.4)	243 (23.1)	
Race/ethnicity						<0.01
Hispanic	106 (41.6)	48 (18.8)	71 (27.8)	30 (11.8)	255 (24.2)	

Variables	Cluster 1 n(%)	Cluster2 n(%)	Cluster4 n(%)	Cluster3 n(%)	Total N (%)	p-value
Asian	161 (69.1)	12 (5.2)	46 (19.7)	14 (6.0)	233 (22.1)	
African American	124 (19.6)	60 (24)	38 (15.2)	28 (11.2)	250 (23.7)	
White	135 (42.7)	62 (19.6)	68 (21.5)	51 (16.1)	316 (30.0)	
Body Mass Index (kg/m ²)						<0.01
Normal (<25)	243 (57.4)	59 (13.9)	85 (20.1)	36 (8.5)	423 (40.1)	
Overweight (25 to <30)	131 (49.4)	51 (19.2)	56 (21.1)	27 (10.2)	265 (25.1)	
Obese (≥ 30)	152 (41.5)	72 (19.7)	82 (22.4)	60 (16.4)	366 (34.7)	
Perceived general health						<0.01
Unhealthy	63 (31.2)	37 (18.3)	51 (25.2)	51 (25.2)	202 (19.2)	
Don't know	25 (32.5)	14 (18.2)	18 (23.4)	20 (26)	77 (7.3)	
Healthy	438 (56.5)	131 (16.9)	154 (19.9)	52 (6.7)	775 (73.5)	
Diagnosed disease(s)						<0.01
Yes	184 (39.0)	97 (20.6)	116 (24.6)	75 (15.9)	472 (44.8)	
No	342 (58.8)	85 (14.6)	107 (18.4)	48 (8.2)	582 (55.2)	
Access to health care						<0.01
Yes	439 (48.1)	170 (18.6)	202 (22.1)	102 (11.2)	913 (96.6)	
No	87 (61.7)	12 (8.5)	21 (14.9)	21 (14.9)	141 (13.4)	
Menopausal Status						<0.01
Pre-	269 (90.9)	21 (7.1)	6 (2.0)	0 (0)	296 (28.1)	
Early/late peri	100 (29.4)	100 (29.4)	123 (36.2)	17 (5.0)	340 (32.3)	
Post	157 (37.6)	61 (14.6)	94 (22.5)	106 (25.4)	418 (39.7)	
Total	526	182	223	123	1054	

Cluster 1=the low total symptom group; Cluster 2=the low-moderate total symptom group with high tertiary symptoms; Cluster 3=the high-moderate total symptom group with low tertiary symptoms; and Cluster 4= the high total symptom group.

Table 2

The results of factor analyses: CMW

	Component		
	1	2	3
Depression	.834		
Feeling unhappy	.807		
Feeling getting down	.790		
Often crying	.755		
Feeling anxious	.693		
Irritated	.685		
Feelings easily hurt	.680		
Feeling grouchy	.630		
Mood swings	.555		
Feeling tense		.657	
Feeling easily excitable		.639	
Forgettable		.579	
Feeling keyed up		.498	
Concentration problems		.469	
Mental exhaustion		.466	
Worrying		.410	
Feeling clumsy		.408	
Night sweats			.853
Hot flush			.834
Sleep difficulties			.445

Table 3

Cognitive symptoms by cluster in the four cluster solution.

Variables	Cluster 1 m±SD	Cluster 2 m±SD	Cluster 3 m±SD	Cluster 4 m±SD	Total m±SD	F (p)
Total number of symptoms (0–20)	2.76±2.28	8.82±3.58	10.77±2.94	16.72±1.98	7.13±5.53	1169.4 (0.00) a<b<c<d
Primary symptoms (0–8)	1.23±1.18	3.28±1.71	3.92±1.46	6.16±1.35	2.73±2.17	538.55 (0.00) a<b<c<d
Secondary symptoms (0–9)	0.92±1.37	2.97±2.51	5.84±2.12	8.14±1.10	3.16±3.19	785.00 (0.00) a<b<c<d
Tertiary symptoms (0–3)	0.62±0.73	2.57±0.52	1.00±0.71	2.41±0.70	1.24±1.07	496.21 (0.00) a<c<d,b
Total severity score (0–100)	6.93±5.66	26.75±10.44	31.82±9.66	64.07±11.91	22.28±20.38	1703.31 (0.00) a<b<c<d
Subtheme 1 severity (0–40)	3.16±3.15	9.89±5.51	11.81±4.69	23.32±6.59	8.50±7.90	750.64 (0.00) a<b<c<d
Subtheme 2 severity (0–45)	2.13±3.28	7.73±6.64	17.09±7.44	31.11±7.16	9.65±11.18	1081.98 (0.00) a<b<c<d
Subtheme 3 severity (0–15)	1.64±1.94	9.12±2.53	2.92±2.00	9.63±3.39	4.13±4.05	763.07 (0.00) a<c<b,d

a=Cluster 1, b=Cluster 2, c=Cluster 3, and d=Cluster 4

Cluster 1=the low total symptom group; Cluster 2=the low-moderate total symptom group with high tertiary symptoms; Cluster 3=the high-moderate total symptom group with low tertiary symptoms; and Cluster 4= the high total symptom group.

Table 4

Differences in background characteristics of the participants among the clusters.

Variables	Cluster 2 Vs. Cluster 1 Adjusted OR(95%CI)	Cluster 3 Vs. Cluster 1 Adjusted OR(95%CI)	Cluster 4 Vs. Cluster1 Adjusted OR(95%CI)
Social support			
None of the time			5.19 (2.14–12.59) ^b
A little of the time			2.11 (0.94–4.76)
Some of the time			2.20 (0.97–5.02)
Most of the time			1.00
Birth Place			
The U.S.	14.70 (5.26–41.06) ^b	17.49 (6.55–46.70) ^b	50.84 (16.16–159.92) ^b
Outside the U.S.	1.00	1.00	1.00
Family income			
Very hard to pay		2.51 (1.36–4.62) ^b	3.36 (1.44–7.81) ^b
Somewhat hard		1.66 (1.07–2.58) ^a	2.15 (1.09–4.22) ^a
Not hard		1.00	1.00
Race/ethnicity			
Hispanic	1.00 (0.57–1.77)		
Asian	0.21 (0.09–0.51) ^b		
African American	1.19 (0.70–2.12)		
White	1.00		
Access to health care			
Yes	2.29 (1.10–4.77) ^a	2.15 (1.16–4.02) ^a	
No	1.00	1.00	
Perceived health			
Unhealthy			2.77 (1.34–5.72) ^b
Don't know			4.49 (1.85–10.90) ^b
Healthy			1.00
Menopausal status			
Pre-	0.02 (0.01–0.04) ^b	0.01 (0.00–0.01) ^b	
Peri-	0.19 (0.18–0.45) ^b	0.23 (0.10–0.55) ^b	0.18 (0.01–0.05) ^b
Post-	1.00	1.00	1.00

Presented as adjusted odds ratio (95% CI).

Eleven independent variables, including education, employment, family income, social support, country of birth, ethnicity, BMI, perceived health, diagnosed diseases, access to health, and menopausal status were considered.

Cluster 1=the low total symptom group; Cluster 2=the low-moderate total symptom group with high tertiary symptoms; Cluster 3=the high-moderate total symptom group with low tertiary symptoms; and Cluster 4= the high total symptom group.

^a p<0.05

^b p<0.01

Table 5
Racial/ethnic differences in the numbers and severity scores of cognitive symptoms in each cluster.

Clusters	Symptoms	Hispanic M±SD	N-H Asian M±SD	N-H African American M±SD	White M±SD	Total M±SD	F*(P)
Numbers of Symptoms							
Cluster 1	Primary (0–8)	1.28±1.14	1.04±1.06	1.23±1.15	1.40±1.36	1.22±1.18	1.02(0.38)
	Secondary (0–9)	1.00±1.49	0.89±1.23	0.80±1.35	0.99±1.44	0.92±1.37	1.08(0.36)
	Tertiary (0–3)	0.49±0.68	0.44±0.64	0.88±0.79	0.70±0.72	0.62±0.73	5.86(<0.01) a, b<c, d
Cluster 2	Total (0–20)	2.77±2.26	2.38±2.07	2.90±2.25	3.08±2.49	2.76±2.28	1.88(0.13)
	Primary (0–8)	3.21±1.66	3.25±1.36	3.17±1.71	3.45±1.83	3.28±1.71	0.15(0.93)
	Secondary (0–9)	2.65±2.12	3.33±2.53	2.90±2.58	3.22±2.72	2.97±2.51	0.52(0.67)
	Tertiary (0–3)	2.54±0.54	2.50±0.52	2.57±0.50	2.61±0.52	2.57±0.52	0.69(0.56)
Cluster 3	Total (0–20)	8.40±3.01	9.08±2.87	8.63±3.69	9.29±3.99	8.82±3.58	0.41(0.74)
	Primary (0–8)	3.86±1.39	3.83±1.65	3.95±1.54	4.04±1.37	3.92±1.46	0.16(0.92)
	Secondary (0–9)	5.69±2.04	6.43±2.05	5.47±2.15	5.82±2.20	5.85±2.12	0.17(0.92)
	Tertiary (0–3)	0.96±0.66	0.83±0.68	1.16±0.75	1.06±0.75	1.00±0.71	1.06(0.37)
Cluster 4	Total (0–20)	10.51±2.79	11.09±3.13	10.58±3.09	10.93±2.90	10.77±2.94	0.25(0.86)
	Primary (0–8)	6.37±1.27	6.14±1.10	5.89±1.73	6.20±1.23	6.16±1.35	0.72(0.54)
	Secondary (0–9)	8.10±1.30	8.00±1.04	8.14±1.04	8.20±1.04	8.14±1.10	0.14(0.94)
	Tertiary (0–3)	2.23±0.77	2.14±0.77	2.46±0.64	2.57±0.64	2.41±0.70	0.48(0.70)
Severity of Symptoms							
Cluster 1	Total (0–20)	16.70±2.07	16.29±2.02	16.50±2.13	16.96±1.84	16.72±1.98	0.55(0.64)
	Primary (0–40)	3.42±3.26	2.63±2.75	3.20±3.13	3.53±3.47	3.16±3.15	0.60(0.61)
	Secondary (0–45)	2.20±3.30	2.12±3.02	1.87±3.29	2.33±3.55	2.13±3.28	0.62(0.60)
	Tertiary (0–15)	1.29±1.80	1.21±1.78	2.35±2.08	1.77±1.92	1.64±1.94	5.35 (<0.01) b<c
Cluster 2	Total (0–100)	6.91±5.65	5.97±5.16	7.42±5.75	7.63±6.03	6.93±5.66	1.11(0.35)
	Primary (0–40)	9.71±5.61	9.42±4.17	9.60±5.56	10.40±5.7	9.89±5.51	0.05(0.99)
	Secondary (0–45)	6.85±5.90	9.17±7.46	7.69±6.90	8.19±6.84	7.74±6.64	0.63(0.60)
	Tertiary (0–15)	8.85±2.50	8.50±2.35	9.07±2.48	9.50±2.65	9.12±2.54	0.72(0.54)

Clusters	Symptoms	Hispanic M±SD	N-H Asian M±SD	N-H African American M±SD	White M±SD	Total M±SD	F*(P)
Cluster 3	Total (0–100)	25.42±9.48	27.08±8.60	26.35±11.38	28.10±10.59	26.75±10.44	0.38(0.77)
	Primary (0–40)	11.76±4.91	11.35±5.05	11.39±3.80	12.40±4.70	11.81±4.69	0.74(0.53)
	Secondary (0–45)	16.76±7.26	18.72±7.26	15.37±6.77	17.29±7.99	17.09±7.44	0.73(0.53)
	Tertiary (0–15)	2.76±1.86	2.41±2.01	3.45±2.19	3.13±1.98	2.92±2.00	0.96(0.41)
Cluster 4	Total (0–100)	31.28±9.86	32.48±10.26	30.21±8.28	32.82±9.80	31.82±9.66	0.97(0.41)
	Primary (0–40)	25.10±6.14	23.29±5.14	21.82±8.32	23.12±6.06	23.32±6.59	0.65(0.59)
	Secondary (0–45)	32.00±7.35	30.21±6.24	29.86±6.79	31.53±7.55	31.11±7.16	0.38(0.77)
	Tertiary (0–15)	8.90±3.50	8.21±3.45	9.57±3.05	10.49±3.35	9.63±3.39	0.40(0.76)
	Total (0–100)	66.00±10.05	61.71±10.00	61.25±13.63	65.14±12.32	64.07±11.91	0.75(0.53)

N-H= non-Hispanic/ a=Asian, b=African American, c=Hispanic, and d=White

Cluster 1=the low total symptom group; Cluster 2=the low-moderate total symptom group with high tertiary symptoms; Cluster 3=the high-moderate total symptom group with low tertiary symptoms; and Cluster 4= the high total symptom group.

Adjusted F scores after controlling for multiple variables (education, employment, family income, social support, country of birth, BMI, perceived health, diagnosed diseases, access to health, and menopausal status) using ANCOVA.

Bonferroni was used for adjustment