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Clusters of Midlife Women by Physical Activity and Their Racial/Ethnic Differences

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Abstract

Objective—The purpose of this study was to identify clusters of midlife women by physical activity and to determine racial/ethnic differences in physical activities in each cluster.

Methods—This was a secondary analysis of the data from 542 women (157 Non-Hispanic [NH] Whites, 127 Hispanics, 135 NH African Americans, and 123 NH Asian) in a larger Internet study on midlife women's attitudes toward physical activity. The instruments included the Barriers to Health Activities Scale, the Physical Activity Assessment Inventory, the Questions on Attitudes toward Physical Activity, Subjective Norm, Perceived Behavioral Control, and Behavioral Intention, and the Kaiser Physical Activity Survey. The data were analyzed using hierarchical cluster analyses, ANOVA, and multinomial logistic analyses.

Results—A three cluster solution was adopted: Cluster 1 (high active living and sports/exercise activity group; 48%), Cluster 2 (high household/caregiving and occupational activity group; 27%), and Cluster 3 (low active living and sports/exercise activity group; 26%). There were significant racial/ethnic differences in occupational activities of Clusters 1 and 3 (all $p < .01$). Compared with Cluster 1, Cluster 2 tended to have lower family income, less access to health care, higher unemployment, higher perceived barriers scores, and lower social influences scores (all $p < .01$). Compared with Cluster 1, Cluster 3 tended to have greater obesity, less access to health care, higher perceived barriers scores, more negative attitudes toward physical activity, and lower self-efficacy scores (all $p < .01$).

Conclusions—Midlife women's unique patterns of physical activity and their associated factors need to be considered in future intervention development.

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Keywords

Physical Activity; Cluster Analysis; Middle Age; Women; Race; Ethnicity

Introduction

Midlife is a critical time for women because of menopausal transition, which is associated with changes in weight, systolic blood pressure, and blood lipid profiles.^{1,2} These changes reportedly increase the risk of cardiovascular disease and diabetes in midlife women.^{1,2} Physical inactivity is one of the important modifiable contributors to cardiovascular diseases and diabetes.¹⁻³ Thus, to decrease the risk of the diseases, the necessity of physical activity promotion has been emphasized for those in midlife, especially for ethnic minority midlife women.⁴ However, little is known about how to effectively promote physical activities in this population.

A cluster analysis is useful in identifying sub-groups with similar characteristics.⁵ Subsequently, a cluster analysis provides a prediction of behaviors/characteristics of the subgroups based on the participants' membership to the groups with specific common characteristics, which helps identify strategies to effectively reduce the risks by intervening the characteristics of the sub-groups.⁵ Furthermore, identifying racial/ethnic differences in the subgroups would provide directions for effective physical activity promotion in racial/ethnic minority midlife women.⁵

Despite potential benefits of cluster analyses, few studies have examined clustering of midlife women by their physical activities. Furthermore, inconsistent associations between cluster patterns of physical activities and sociodemographic indicators have been found.^{6,7} Thus, there is a certain need to clarify the associations between physical activity patterns and their sociodemographic indicators in order to determine the characteristics of sub-groups at risk. Furthermore, to design interventions to promote physical activity in racial/ethnic minority midlife women, it is necessary to understand how the women cluster together by their patterns of physical activities and how race/ethnicity is associated with the clusters.

For this study, a feminist perspective was adopted because it signifies contextual understanding of a phenomenon in racially/ethnically diverse situations.⁸⁻¹⁰ A feminist perspective helps identify the women's physical activity patterns within their contexts of daily lives by considering multiple contextual factors (background characteristics and perceived health and menopausal status) in determining the clusters of the women by physical activity.⁸⁻¹⁰ Also, a feminist perspective allows researchers to consider midlife women's own self-reports as valid and reliable and to prioritize women's own views and experiences.⁸⁻¹⁰ In addition, it allows researchers to consider both race/ethnicity and gender as significant factors influencing women's physical activity experience that interact with other characteristics such as socioeconomic status, geographical areas, and age.^{9,10}

The purpose of this study was to identify clusters of midlife women by physical activity, and to determine racial/ethnic differences in physical activities in each cluster. Thus, a null hypothesis that the entire group of midlife women is homogeneous in their physical activity

was tested first. Then, after identifying the clusters, the relationships of multiple variables to the women's physical activity were tested within the identified clusters while determining racial/ethnic differences in physical activities in each cluster.

Methods

This secondary analysis used the data from a cross-sectional descriptive national Internet survey on midlife women's attitudes toward physical activity.¹² An approval was obtained from the Institutional Review Board (IRB) of the institution where the researchers were affiliated.

Settings and Participants

In the original study, study announcements were made nationally through Internet communities and groups for racial/ethnic minorities. A total of 542 midlife women were recruited (157 Non-Hispanic [NH] Whites, 127 Hispanics, 135 NH African Americans, and 123 NH Asian) through the announcement process. Included were midlife women aged 40 to 60 years who could read and write English; identified themselves as NH White, Hispanic, NH African American, or NH Asian; could participate in all forms of physical activity; and had access to the Internet. In this study, midlife is defined as the time between ages 40 and 60 years old¹¹ to reflect cultural differences in the definition of midlife because 60 years and older are considered as "elderly" or older person in many cultures.¹¹ Indeed, the United Nations agreed that cutoff is 60 years to refer to older populations across the countries.¹¹

Because midlife women's physical activity is reportedly influenced by race/ethnicity and socioeconomic status,^{33–35} a quota sampling method was used to have an equal number of participants in each racial/ethnic group and in each family income group (low, middle, and high). When a woman visited a project website, agreed to participate in the study, and met the inclusion criteria, she was checked against the quota requirement. Only when the quota that she belonged needed more participants, she was included in the study. Formann¹³ indicates that the minimum required number of cases for a cluster analysis is no less than 2^k cases (k =the total number of variables), preferably 5×2^k .⁵ Because we used four variables, 542 participants were adequate to conduct a cluster analysis.

Instruments

Multiple instruments were used in the original study. More detailed information on the instruments used in the original study can be found elsewhere.¹²

Questions on background characteristics, perceived health, and menopausal status—In the original study, multiple questions were used to measure background characteristics including age, education, employment, family income, marital status, number of children, race/ethnicity, and country of birth. Educational level was measured using a Likert-scale item and categorized into: "high school graduate or less," "partial college," and "college graduate or more." Family income level was defined as the ability to pay for basic necessities (e.g., food, clothing, and shelter) and measured using a question on subjective perception of the adequacy of family income for basic needs such as food, housing, clothing,

and healthcare. Then, family income was categorized into: low (very hard to pay for basic needs); middle (somewhat hard to pay for basic needs), and high (not hard to pay for basic needs). Race/ethnicity (self-identified race/ethnicity) was determined using two questions (one item on race and the other item on ethnicity) in line with the National Institutes of Health (NIH) guideline.¹⁴ An open space was also provided so that participants could self-identify their specific race/ethnicity if needed.

Multiple questions were also used to measure perceived health and menopausal status in the original study. The questions inquired perceived general health (on a 5-point Likert scale; 1 = *very unhealthy* to 5 = *very healthy*), self-reported body weight and height, diagnosed disease, and access to health care. BMI was calculated based on self-reported body weight and height, and divided into four categories: underweight (<18.5 kg/m²), normal weight (18.5 to 25 kg/m²), overweight (25 to 29.9 kg/m²), and obese (≥ 30 kg/m²).¹⁵ Menopausal status was determined based on their answers to the questions on last menstrual cycle, regularity of menstruation intervals, and menstrual flow. Then, based on the criteria by the Study of Women's Health Across the Nation (SWAN),¹⁶ the women were divided into four menopausal stages: pre-, early peri-, late peri-, and postmenopausal. Menopausal symptoms were also measured using the Midlife Women's Symptom Index (MSI).¹⁷ The validity of the MSI was supported in previous studies.¹⁷ In this study, Cronbach's alpha coefficient was 0.93.

Perceived barriers of physical activity—The Barriers to Health Activities Scale (BHAS) was altered to measure perceived barriers related to physical activity and reviewed by 8 experts in physical activity¹². The original BHAS¹⁸ aims to measure the barriers related to health-promoting lifestyles of persons with disabilities, including physical activity. Thus, some items needed to be modified to measure the barriers to regular physical activity in healthy midlife women. The modified BHAS consists of 18 items on barriers to regular physical activity, and each 4-point Likert scale item measures the frequency that each problem interferes with their regular physical activity (1 = *never* to 4 = *routinely*). The barrier scores were calculated by averaging all the items in the BHAS. A higher score means more perceived barriers. Its content validity was ensured through an expert review, and Cronbach's alpha was 0.88 in a previous study.¹⁹ In this study, Cronbach's alpha coefficient of the modified BHAS was also 0.88.

Physical activity self-efficacy—The Physical Activity Assessment Inventory (PAAI) was also modified for the original study.¹² The original PAAI²⁰ aims to measure self-efficacy specifically for physical activity in women receiving treatment for cancer. Thus, to use the PAAI in healthy midlife women, some items of the PAAI needed to be altered. The modified PAAI includes 13-items to measure how confident the women feel about their performance of usual physical activity (including all activity at work, home, or leisure in a variety of situations). Each item includes choices ranged from 0 = *cannot do at all* to 100 = *certainly can do*. The self-efficacy scores were calculated by averaging 13 items of the PAAI. Content validity of the modified PAAI was ensured through an expert review, and Cronbach's alpha was 0.95.¹⁹ In this study, Cronbach's alpha of the modified PAAI was 0.95.

Social influence and attitudes toward physical activity—Social influence and attitudes toward physical activity were measured using the Questions on Attitudes toward Physical Activity, Subjective Norm, Perceived Behavioral Control, and Behavioral Intention (QASPB).²¹ The QASPB consists of items in four subscales (attitudes, social influence, perceived behavioral control, and behavioral intention). The original study included only the attitude scale (6 items) and the social influence scale (3 items) on 7-point Likert scales (−3 to +3 for the attitude scale and 1 to 7 for the social influence scale). The attitude scores were calculated by averaging all items in each sub-scale. Content validity was ensured through an expert review, and Cronbach's alpha was 0.87 for the attitude scale and 0.86 for the social influence scale.¹⁹ In this study, Cronbach's alpha was 0.89 for the attitude scale and 0.76 for the social influence scale.

The Kaiser Physical Activity Survey (KPAS)—To measure physical activity, the Kaiser Physical Activity Survey (KPAS) was adopted in the original study.²² The KPAS has four sub-scales including the household/caring index, occupational index, active living index, and sports/exercise index (5-point Likert scales). In this secondary analysis, both total physical activity scores and mean index scores were calculated to reflect the women's physical activity. By summing the four sub-scale averages (minimum 4 to maximum 20) for each participant, we calculated total physical activity scores. Cronbach's alpha of the KPAS was 0.81.

Data Collection Procedures

To conduct the Internet survey in the original study, we developed a project website that conforms to the Health Insurance Portability and Accountability Act (HIPAA) and the SysAdmin, Audit, Network, Security (SANS)/Federal Bureau of Investigation (FBI) recommendations. The project website was inclusive of informed consent and Internet survey questionnaires. When a potential participant visited the project website, she was required to review the *informed consent*, and give her consent to participate by clicking a button of "I agree to participate." Once her consent was given, she was checked against the inclusion criteria and the quota requirement. Only those who met the inclusion criteria and quota requirement were allowed to enter the Internet survey questionnaire page. The collected data were de-identified, managed, and handled confidentially, and only the research team had access to the data. The data were attached only with serial numbers assigned by the research team. Participants' identification information such as IP addresses was separately stored from the data with identity information.

Data Analysis

The Statistical Package for Social Science version 22.0 was used to analyze the data. When missing fields for all items were less than 10%, the data were included in the data analysis; mean substitution was used for the missing data for continuous variables. The missing data for continuous variables were less than 0.37%. There were no missing data for categorical variables. The data were analyzed utilizing descriptive statistics, hierarchical cluster analyses, the analysis of variance (ANOVA) with Scheffe tests, Chi-square tests, multinomial logistic analyses, and the analysis of covariance (ANCOVA).

To determine clusters of midlife women by physical activity scores, hierarchical clustering methods were used with the agglomerative approach and the average linkage between clusters.^{23,24} Four sub-scale scores were used for clustering. Dendrogram were used to determine which clusters could be combined.²⁴ A split-half cross validation was used to verify the stability of clusters in the final solution. Then, to validate the cluster solution, ANOVA was used (with the cluster as an independent variable and physical activities as dependent variables). We calculated the Variance Ratio Criterion (VRC) to choose the number of clusters that maximized the ratio between overall between-cluster variations and overall within-cluster variations. Thus, the number of clusters was decided by comparing the values for ω_k as suggested in the literature.²³ Then, Chi-square tests and ANOVA were conducted to test differences in background characteristics, perceived health, and menopausal status among the clusters. Multinomial logistic regression analyses were also conducted to determine the factors associated with each cluster. Initially, each independent variable was tested on its own in a univariate regression model. Independent variables for which p-values of less than 0.05 from chi-square tests or ANOVA were selected and then included in a multivariable regression model. We screened the correlations among independent variables, variance inflation factors, and tolerance values for this model, and found that multicollinearity was not a concern in this model. ANCOVA using a general linear model (to adjust independent variables that were significantly different among the four racial/ethnic groups in univariate analyses) was employed to determine racial/ethnic differences in physical activities in each cluster. Differences and associations were regarded as statistically significant when p-values were smaller than 0.05.

Results

Background Characteristics of the Participants

Background characteristics of the participants are summarized in Table 1. Among 542 women, 29.0% were NH Whites, 24.9% were NH African Americans, 23.4% were Hispanics, and 22.7% were NH Asians. The average age was 49.01 years (SD=6.05). About 66.1% were highly educated (college graduate or more), and 16.4% were with low family income. About 68% were married or partnered, and 75.6% were born in the United States.

Clusters of Midlife Women by Physical Activity

The number of clusters was decided based on Dendrogram. The three cluster solution was chosen for this study after comparing four sub-scale scores and the percent of participants in each cluster on each solution and after reviewing the meaningfulness of clusters (Table 2). Furthermore, to determine the right number of clusters, we computed ω_k for the three ($\omega_3 = -34.490$) and four ($\omega_4 = 100.071$) cluster solutions using VRC, and determined that the minimum ω_3 was achieved with three clusters ($k=3$).

Significant differences were found in total physical activity scores and four sub-scale scores among the three clusters (all $p < .01$) (see Table 2). Forty-eight percent of the participants were categorized into Cluster 1 (high active living and sports/exercise activity group); about 27% were categorized into Cluster 2 (high household/caregiving and occupational activity

group); and about 26% were categorized into Cluster 3 (low active living and sports/exercise activity group)(Table 2).

Differences in Characteristics among the Clusters and Factors Associated with Each Cluster

No significant differences were found among the clusters in terms of age, marital status, race/ethnicity, country of birth, and diagnosed diseases (Tables 3 and 4). However, there were significant differences in education, employment status, family income, number of children, perceived general health, BMI, access to health care, and menopausal symptoms among the clusters (all $p < .05$).

Perceived barriers scores in Cluster 1 were lower than those in Clusters 2 and 3, while self-efficacy and social influence scores in Cluster 1 were higher than those in Clusters 2 and 3 (all $p < .05$). Attitudes scores in Cluster 1 were more positive than those in Cluster 2, and those in Cluster 2 are more positive than those in Cluster 3 (all $p < .05$).

Table 5 summarizes the results of multinomial logistic regression analyses on the factors associated with Clusters 2 and 3. Compared with Cluster 1 (high active living and sports/exercise activity group), Cluster 2 (high household/caregiving and occupational activity group) was more likely to have low family income, no access to health care, unemployment, high scores of perceived barriers, and low scores of social influences (all $p < .01$). Compared with Cluster 1, Cluster 3 (low active living and sports/exercise activity group) was more likely to have obesity, no access to health care, high scores of perceived barriers, negative attitudes toward physical activity, and low scores of self-efficacy (all $p < .01$).

Racial/ethnic Differences in Physical Activities by Cluster

Table 6 summarizes racial/ethnic differences in total physical activity scores and four sub-scale scores in each cluster. There were no significant racial/ethnic differences in total physical activity scores and four sub-scale scores in Cluster 2. However, in Clusters 1 and 3, there were significant racial/ethnic differences in occupational activity scores.

Discussion

In this secondary analysis, three clusters of midlife women were determined by their patterns of physical activity, and significant racial/ethnic differences in occupational physical activities were found in two clusters (those with high active living and sports/exercise activities and those with low active living and sports/exercise activities). Also, prominent differences among the clusters were found in multiple factors associated with physical activity, including sociodemographic characteristics, health and menopausal status, perceived barriers to physical activity, and attitudes toward physical activity.

The clusters of midlife women by physical activity that were found in this analysis are different from those found in general adult populations by Rovniak et al.²⁵ They found three clusters of adults by physical activity: active leisure, active job, and low activity. However, because of inherent characteristics of midlife women in their life stage (e.g., household tasks, caregiving responsibilities), Cluster 2 that was identified in this analysis had high

household/caregiving activities that were not found in the active job cluster by Rovniak et al.²⁵ Therefore, although total physical activities of Cluster 2 were moderate, the benefits of their physical activities were in question. Chen et al.²⁶ claimed that occupational physical activities were frequently performed at a shorter duration and/or with inadequate intensity, which hardly resulted in benefits to health. Also, Lin et al.²⁷ asserted that women might have more extrinsic motivation (e.g., less control, with less autonomy) to conduct occupational and household/caregiving activities, which were detrimental to their health, especially psychological health. Thus, this group of midlife women with high household/caregiving and occupational activities is a risk group to target in future interventions.

Another unique finding from this analysis was that there were no racial/ethnic differences in physical activities in Cluster 2 (high household/caregiving and occupational activity group), but there were significant racial/ethnic differences in physical activities in Clusters 1 and 3. As the findings indicated, Asian women tended to have less occupational physical activities than other racial/ethnic groups in Cluster 1, and Asian and Hispanic women tended to have less occupational physical activities than other racial/ethnic groups in Cluster 3. A possible reason for the racial/ethnic differences would be: Asian women in Clusters 1 and 3 and Hispanic women in Cluster 3 tended to be married and housewives. Thus, in future interventions aiming at Asian women in Clusters 1 and 3 and Hispanic women in Cluster 3, this tendency needs to be incorporated by including several strategies that help increase their physical activity during their daily life as housewives or by suggesting sample physical activities that they can do with their spouses or family members.

Household/caregiving and occupational physical activities usually depend on women's employment, occupations, and tasks in their daily schedule.²⁷ For example, in most cases, a housewife has less occupational physical activities, but more household/caregiving physical activities than an employed woman. On the contrary, active living and sports/exercise activities tend to be determined by intrinsic motivation (e.g., willingness to do regular exercise), and women's intrinsic motivation is largely influenced by their cultural values and beliefs related to physical activity.^{19,27,28} Thus, racial/ethnic differences in women's physical activity, which partially result from the cultural differences, may become prominent when intrinsic motivation mainly determines physical activity experience as in Clusters 1 and 3.

The findings on differences in background characteristics among the clusters and different factors associated with each cluster also add new information to the literature. Yet, these factors have also been reported in the literature as those significantly associated with midlife women's physical activity regardless of their patterns of physical activities. For example, education, socioeconomic status, number of children, perceived general health, BMI, and menopausal symptoms have been reported to significantly influence midlife women's physical activity.^{4,29,30} Also, self-efficacy, social influences, perceived barriers, and attitudes toward physical activity are the most frequently reported factors associated with physical activity in general.^{4,31,32} However, researchers rarely reported the differences in background characteristics among different clusters of midlife women by physical activity and the different factors associated with different clusters.

Strong associations of socioeconomic factors to Cluster 2 need to be interpreted within the contexts of midlife women's daily lives. Again, socioeconomic status reflected in educational level and family income have been reported to be major determinants of midlife women's physical activity.^{33–35} Household/caregiving and occupational activities are frequently determined by women's socioeconomic status; low income women tend to be more involved in household/caregiving and occupational activities.^{33–35} Thus, it would be natural to find the significant association of socioeconomic factors to Cluster 2.

The finding on significant associations of obesity, perceived barriers, and negative attitudes to Cluster 3 adds new information to the literature. Indeed, all of these factors have been reported to be associated with physical activity of general populations.^{29,30,36} However, their significant association with the low active living activity and sports/exercise group has rarely been reported in midlife women. Thus, this finding can be uniquely used for future development of interventions targeting this specific group of midlife women. For example, there existed a significant association between negative attitudes and physical activity in Cluster 3. Thus, the intervention for this group needs to aim at changing their negative attitudes by debunking myths or misbelief related to physical activity (e.g., no physical activity during menstruation) through providing valid and reliable information.

This analysis has several limitations because of its inherent nature as a secondary analysis. First, the sample size was pre-determined; there was no control of the sample size and subsequent power of the performed analyses. Second, the variables were also predetermined by the original study. Third, there existed potential selection bias because the sample tended to be highly educated, married, and employed although a quota sampling was adopted. Also, the age range of the participants (40 to 60 years) was another limitation that needs to be carefully considered in interpretation of the findings. Fourth, the sample did not include all sub-ethnic groups within 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.

Conclusion

This secondary analysis identified three clusters of midlife women by their patterns of physical activity and reported racial/ethnic differences in occupational physical activities in two clusters of midlife women, 'high active living and sports/exercise activity group' (Cluster 1) and 'low active living and sports/exercise activity group' (Cluster 3). In this analysis, significant differences were found in education, employment status, family income, number of children, perceived general health, BMI, and menopausal symptoms among the clusters.

Based on the findings of this analysis, several implications for future research and practice are proposed. First of all, as the findings indicated, midlife women's patterns of physical activity are quite different from those of other populations in general. Thus, in future research and practice, these differences in women's patterns of physical activity need to be incorporated. Also, since very little is known about the patterns of physical activity among midlife women, especially among multi-ethnic groups of midlife women, further studies

with diverse groups of midlife women are needed to confirm the findings reported in this study.

In future program development, health care providers need to consider multiple factors that might differently influence midlife women's physical activity depending on their patterns of physical activity. For instance, the findings of this study indicated: (a) there existed significant associations of perceived barriers to physical activity in those with low active living activities and sports/exercise activities; and (b) NH Asian women tended to have low occupational activities because many of them were married and housewives. Thus, if a health care provider targets to increase physical activity of NH Asian women in this group, she/he needs to incorporate some components that aim to change their perceived barriers. Considering that child care is a frequently reported barrier in NH Asian women,³⁷ she/he needs to provide some sample strategies to avoid the barrier (e.g., information on resources for child care options).

This study found significant differences in education, employment status, family income, number of children, perceived general health, BMI, and menopausal symptoms among the clusters. Thus, in approaching to different groups of midlife women by their patterns of physical activity, a health care provider needs to plan a different educational/information session by their characteristics. For example, if a health care provider wants to provide an educational/information session for those with high household/caregiving and occupational activities, she/he needs to consider that this group of midlife women tends to have low education, low family income, and no access to health care. Thus, she/he needs to include some sample strategies to increase physical activities without any extra expense and plan educational modules written at a low literacy level.

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Table 1

Background characteristics of the participants (N=542).

Characteristics		n	%
Age (year)	40–44	151	27.9
	45–49	147	27.1
	50–54	127	23.4
	55–60	117	21.6
Education	High school graduate or less	52	9.6
	Partial college	132	24.4
	College graduate or more	358	66.1
Employment	No	124	22.9
	Yes	418	77.1
Family income *	Low	89	16.4
	Middle	216	39.9
	High	237	43.7
Marital status	Married/partnered	368	67.9
	Non-married/separated	174	32.1
Number of children	None	107	19.7
	1–2	276	50.9
	More than 3	159	29.3
Ethnicity	NH White	157	29.0
	NH African American	135	24.9
	Hispanic	127	23.4
	NH Asian	123	22.7
Country of birth	The United State.	410	75.6
	Other countries	132	24.4

Note. NH=Non-Hispanic

* The difficulties in paying basics such as food, clothing and shelter with family income.

Table 2

Physical activity scores by cluster solutions (N=542).

Cluster Solution	n (%)	Cluster 1 ^a M±SD	Cluster 2 ^b M±SD	Cluster 3 ^c M±SD	Cluster 4 ^d M±SD	F	p	Scheffe test
Two clusters								
	n (%)	404(74.5)		138(25.5)				
	<i>Total Physical activity scores (4–20)</i> *	11.05±1.81		7.77±1.22		391.503	<.01	
	Household/caregiving (1–5) *	2.71±0.68		2.42±0.58		19.139	<.01	
	Occupational activity(1–5) *	2.63±0.72		2.20±0.56		39.924	<.01	
	Active living activity (1–5) *	2.88±0.68		1.94±0.60		205.450	<.01	
	Sports/exercise (1–5) *	3.26±1.04		1.38±0.38		434.769	<.01	
Three clusters								
	n (%)	260(48.0)	144(26.6)	138(25.5)				
	<i>Total Physical activity scores (4–20)</i> *	11.21±1.52	10.74±2.21	7.77±1.22		201.734	<.01	a<b<c
	Household/caregiving (1–5) *	2.49±0.60	3.09±0.64	2.42±0.58		55.578	<.01	a,c<b
	Occupational activity(1–5) *	2.23±0.46	3.34±0.55	2.20±0.56		103.241	<.01	a,c<b
	Active living activity (1–5) *	2.90±0.68 ^a	2.84±0.69 ^a	1.94±0.60 ^b		421.675	<.01	c<a,b
	Sports/exercise (1–5) *	3.69±0.73 ^a	2.49±1.06 ^b	1.38±0.38 ^c		201.734	<.01	c<b<a
Four clusters								
	n (%)	260(48.0)	106(25.5)	138(25.5)	38(7.0)			
	<i>Total Physical activity scores (4–20)</i> *	11.21±1.52	9.91±1.65	7.77±1.22	13.04±1.96	203.930	<.01	c<b<a<d
	Household/caregiving (1–5) *	2.49±0.60	3.09±0.58	2.42±0.58	3.08±0.79	36.983	<.01	a,c<b,d
	Occupational activity (1–5) *	2.23±0.46	3.21±0.50	2.20±0.56	3.71±0.49	189.922	<.01	a,c<b<d
	Active living activity (1–5) *	2.90±0.68	2.68±0.65	1.94±0.60	3.26±0.61	78.994	<.01	c<a,b<d
	Sports/exercise (1–5) *	3.69±0.73	2.01±0.73	1.38±0.38	3.82±0.60	466.048	<.01	c<b<a,d

Note: Cluster 1 = those with high active living and sports/exercise activities, Cluster 2 = those with high household/caregiving and occupational activities, and Cluster 3 = those with low active living and sports/exercise activities.

* Possible ranges of the scores.

Table 3

Differences in background characteristics among the three clusters (N=542).

Characteristics	Cluster 1 (n=260)		Cluster 2 (n=144)		Cluster 3 (n=138)		Total (n=542)		χ^2	p
	n	%	n	%	n	%	n	%		
Education										
High school	13	5.0	27	18.8	12	8.7	52	9.6	46.72	<.01
Partial college	43	16.5	50	34.7	39	28.3	132	24.4		
More than college	204	78.5	67	46.5	87	63.0	358	66.1		
Employment										
No	37	14.2	61	42.4	26	18.8	124	22.9	43.27	<.01
Yes	223	85.8	83	57.6	112	81.2	418	77.1		
Family income *										
Very hard	20	7.7	43	29.9	26	18.8	89	16.4	62.77	<.01
Somewhat hard	86	33.1	64	44.4	66	47.8	216	39.9		
Not hard	154	59.2	37	25.7	46	33.3	237	43.7		
Marital status										
Married/partnered	179	68.8	101	70.1	88	63.8	368	67.9	1.52	.47
Non married/separated	81	31.2	43	29.9	50	36.2	174	32.1		
Number of children										
None	65	25.0	19	13.2	23	16.7	107	19.7	14.80	.01
1-2	135	51.9	71	49.3	70	50.7	276	50.9		
More than 3	60	23.1	54	37.5	45	32.6	159	29.3		
Race/ethnicity										
White	70	26.9	47	32.6	40	29.0	157	29.0	4.17	.65
N-H African American	67	25.8	30	20.8	38	27.5	135	24.9		
Hispanic	66	25.4	30	20.8	31	22.5	127	23.4		
N-H Asian	57	21.9	37	25.7	29	21.0	123	22.7		
Country of birth										
The United States	199	76.5	105	72.9	106	76.8	410	75.6	.80	.67
Other countries	61	23.5	39	27.1	32	23.2	132	24.4		
BMI(Kg/m ²)										
Underweight(<18.5)	9	3.5	3	2.1	2	1.4	14	2.6	30.83	<.01
Normal (18.5-24.9)	111	42.7	58	40.3	31	22.5	200	36.9		
Overweight(25-29.9)	68	26.2	33	22.9	30	21.7	131	24.2		
Obese(≥ 30)	72	27.7	50	34.7	75	54.3	197	36.3		
Diagnosed diseases										
No	142	54.6	75	52.1	66	47.8	283	52.2	1.667	.44
Yes	118	45.4	69	47.9	72	52.2	259	47.9		
Access to health care										
No	21	8.1	28	19.4	17	12.3	66	12.2	11.20	<.01
Yes	239	91.9	116	80.6	121	87.7	476	87.8		

Characteristics	Cluster 1 (n=260)		Cluster 2 (n=144)		Cluster 3 (n=138)		Total (n=542)		χ^2	p
	n	%	n	%	n	%	n	%		
Menopausal status	96	36.9	35	24.3	45	32.6	176	32.5	10.88	.05
Pre-menopausal										
Early/late peri-menopausal	47	18.1	34	23.6	36	26.1	117	21.6		
Post-menopausal	117	45.0	75	52.1	57	41.3	249	45.9		

*.The difficulties in paying basics such as food, clothing and shleter with family income

Table 4

Differences in age and the factors related to perceived health, menopausal status, and physical activity among the three clusters (N=542).

Characteristics(range)	Cluster 1 ^a (n=260) M±SD	Cluster 2 ^b (n=144) M±SD	Cluster 3 ^c (n=138) M±SD	Total (n=542) M±SD	F	p	Scheffe test
Age (years)	48.96±5.91	48.38±6.00	49.88±6.30	49.01±6.05	2.23	.11	
Perceived general health ^{**}	(1-5) [*] 3.97±0.92	3.53±0.98	3.41±1.09	3.71±1.01	18.45	<.01	b,c<a
Total score of MSI	(0-73) [*] 13.43± 9.54	20.25±13.72	19.43±12.27	16.77±11.91	21.27	<.01	a<b,c
Perceived barriers [¶]	(1-4) [*] 1.56± 0.38	1.93±0.53	1.94±0.40	1.76±0.47	53.69	<.01	a<b,c
Self-efficacy [§]	(0-100) [*] 61.21±21.37	50.14±22.22	46.97±23.24	54.64±22.96	22.83	<.01	b,c<a
Social influences [¥]	(1-7) [*] 6.29± 0.96	5.79±1.27	5.87±1.23	6.05±1.14	11.64	<.01	b,c<a
Attitudes [¥]	(-3~+3) [*] 2.41±0.85	1.84±1.05	1.38±1.11	2.00±1.07	51.97	<.01	c<b<a

Note. Cluster 1= those with high active living and sports/exercise activities, Cluster 2= those with high household/caregiving and occupational activities, Cluster 3=those with low active living and sports/exercise activities, NH=Non-Hispanic, MSI= Menopausal Symptom Index.

^{*} Possible ranges of the scores

^{**} On a 5 point Likert scale (1=*very unhealthy* to 5 = *very healthy*).

[¶] On a 4-point Likert scale (1=*never* to 4=*routinely*)

[§] On a 100-point scale (0=can not do at all to 100 = certain can do)

[¥] On 7-point Likeert scales (-3 to +3 for the attitudes and 1 to 7 for the social influence scale)

Table 5

The factors related to being in Clusters 2 and 3 (ref. Cluster 1)(N=542).

Variables	Cluster 2		Cluster 3	
	Adjusted OR	95% CI	Adjusted OR	95% CI
<i>Employment</i>				
No	2.32 **	1.30–4.12		
Yes				
<i>Family income</i>				
Low	3.18 **	1.44–7.01		
Middle	1.62	0.92–2.86		
High				
<i>Access to health care</i>				
No	2.63 *	1.20–5.75	2.41 *	1.02–5.74
Yes				
<i>BMI</i>				
Overweight			1.95	0.97–3.92
Obese			3.07 **	1.64–5.75
Normal				
<i>Perceived barriers</i>	1.07 **	1.03–1.11	1.05 *	1.01–1.10
<i>Self efficacy</i>			0.90 **	0.84–0.96
<i>Social influences</i>	0.91 *	0.84–0.99		
<i>Attitudes</i>			0.91 **	0.87–0.96

Note. Cluster 1= the high active living and sports/exercise group, Cluster 2= the high household/caregiving and occupational activity group, Cluster 3= the low active living and sports/exercise group/ Thirteen independent variables (education, employment, family income, number of children, access to health care, perceived general health, BMI, menopausal status, menopausal symptoms, perceived barriers, self-efficacy, social influences, and attitudes) were adjusted. Only significant variables are presented in this table. Menopausal symptoms, perceived barriers, self-efficacy, social influences, and attitudes were treated as continuous variables. OR = Odds Ratio

* $p < .05$,

** $p < .01$

Table 6

Racial/ethnic differences in physical activity scores in each cluster (N=542).

Cluster		NH White ^a (n=157) M±SD	NH African ^b American (n=135) M±SD	Hispanic ^c (n=127) M±SD	NH Asian ^d (n=123) M±SD	F ^{**}	p	Scheffe test
Cluster 1	<i>Total Physical activity (4–20)</i> *	11.17±1.38	11.29±1.62	11.45±1.66	10.89±1.33	0.76	.52	
	Household/caregiving (1–5) *	2.40±0.55	2.54±0.64	2.59±0.64	2.44±0.55	1.05	.37	
	Occupational activity (1–5) *	2.36±0.46	2.28±0.45	2.18±0.43	2.08±0.44	3.44	.02	d<b b,c,d<a
	Active living activity (1–5) *	2.81±0.67	2.87±0.71	3.09±0.70	2.85±0.62	1.02	.38	
	Sports/exercise (1–5) *	3.67±0.69	3.73±0.72	3.67±0.85	3.70±0.65	0.87	.46	
Cluster 2	<i>Total Physical activity (4–20)</i> *	10.99±1.92	10.72±2.38	11.17±2.08	10.22±2.31	1.13	.34	
	Household/caregiving (1–5) *	2.79±0.68	3.11±0.68	3.21±0.67	3.20±0.42	1.53	.21	
	Occupational activity (1–5) *	3.39±0.61	3.46±0.58	3.30±0.42	3.20±0.51	1.11	.35	
	Active living activity (1–5) *	2.86±0.61	2.80±0.73	2.89±0.70	2.81±0.70	0.72	.54	
	Sports/exercise (1–5) *	2.66±1.12	2.63±1.11	2.47±0.93	2.19±1.03	0.65	.59	
Cluster 3	<i>Total Physical activity (4–20)</i> *	7.74±1.18	7.97±1.10	7.75±1.32	7.59±1.32	0.64	.59	
	Household/caregiving (1–5) *	2.38±0.52	2.52±0.58	2.43±0.64	2.35±0.60	0.16	.92	
	Occupational activity (1–5) *	2.45±0.54	2.21±0.58	2.02±0.58	2.03±0.44	5.36	<.01	c,d<a,b
	Active living activity (1–5) *	1.89±0.59	1.84±0.58	2.03±0.65	2.05±0.59	.66	.58	
	Sports/exercise (1–5) *	1.33±0.35	1.50±0.48	1.27±0.25	1.41±0.37	1.13	.34	

Note: Cluster 1=the high active living and sports/exercise group, Cluster 2=the high household/caregiving and occupational activity group, and Cluster 3=the low active living and sports/exercise group.

* Possible ranges of the scores.

** F scores after controlling for education, employment, family income, marital status, number of children, country of birth, BMI, perceived general health, diagnosed diseases, access to health care, menopausal status, menopausal symptoms, perceived barriers, and attitudes toward physical activity using ANCOVA.