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(Citation)
Research Quarterly for Exercise and Sport,89(4):440-449

(Issue Date)
2018

(Resource Type)
journal article

(Version)
Accepted Manuscript

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This work was supported by the Program for Promoting the Reform of National Universities (Kobe University), Ministry of Education, Culture, Sports, Science, and Technology; and Grant-in-Aid for Scientific Research (17H04757), Japan Society for the Promotion of Science.

Abstract

Purpose: Although it is proposed that one spouse's health behaviors might correlate with the other spouse's health behavior among married couples, few studies have focused on sedentary behavior. This study examined whether objectively measured sedentary behavior and physical activity are correlated with each other, and whether attachment to one's spouse moderates such correlations among middle-aged and older married couples. **Methods:** Seventy-two couples participated in the survey. This study measured time engaged in sedentary behavior and moderate-to-vigorous physical activity (MVPA), and step counts by an accelerometer for 7 days, and attachment to one's spouse, age, education, and frailty by questionnaires. **Results:** Multiple regression analyses showed that the sedentary behaviors of one spouse statistically significantly regressed on those of the other spouse (β = .30 to .47). The regressions of husbands' MVPA and step counts on those of their wives were statistically marginally significant (β = .22 to .25), while the regressions of wives' MVPA and step counts on those of their husbands were not statistically significant (β = .15 to .18). The interaction terms of the attachment with one's spousal accelerometer variables on those of the other spouse were not statistically significant (β = -.02 to .16). **Conclusions:** This study found that sedentary behaviors were correlated with each other among couples, and that the attachment to one's spouse did not moderate these correlations. Sedentary behaviors of one spouse might influence the other, regardless of the attachment to one's spouse. The concordance for physical activity would be weaker than for sedentary behavior.

Keywords: Correlates, Gerontology, Physical activity, Social support

Spousal Concordance for Objectively Measured Sedentary Behavior and Physical Activity among Middle-aged and Older Couples

The health benefits of physical activity (Kyu et al., 2016) and the health risks of sedentary behaviors (Biswas et al., 2015) have been supported by substantial research evidence. Current physical activity guidelines recommend that adults engage in physical activity to promote health (Haskell et al., 2007; World Health Organization, 2010). Reducing sedentary behavior has also been recommended in several guidelines, such as those published in the United Kingdom (Department of Health, Physical Activity, Health Improvement and Protection, 2011) and Australia (Australia's Department of Health, 2014). However, people tend to become less physically active (Inoue et al., 2011) and spend more time engaged in sedentary activities (Harvey, Chastin, & Skelton, 2015) as they become older. Therefore, it is a public health priority to develop effective strategies to promote physical activity and reduce sedentary behavior among middle-aged and older populations. To develop effective strategies to promote physical activity and reduce sedentary behavior, the identification of modifiable factors associated with such behaviors is essential (Sallis, Owen, & Fotheringham, 2000).

Among married couples, one spouse's physical activity and sedentary behavior might be correlated with the other spouse's physical activity and sedentary behavior. Various correlates of physical activity and sedentary behaviors have been proposed (Bauman et al., 2012; Chastin et al., 2015; O'Donoghue et al., 2016). An advantage of examining spousal interactions as correlates is that spousal concordance for physical activity and sedentary behavior among couples indicates that positive changes in one spouse's behavior should have the desirable effect of causing changes in the other spouse's behaviors. Spousal concordance among married couples also illustrates how interpersonal networks influence physical activity and sedentary behaviors. Previous studies using self-report measures revealed that the physical activity among couple was influenced by each spouse (Cobb et al., 2016; Li,

Cardinal, & Acock, 2013; Pettee et al., 2006). However, for sedentary behavior, there is little evidence supporting concordance among married couples. To the best our knowledge, only one study (Wood, Jago, Sebire, Zahra, & Thompson, 2015) has found a correlation between parents of young children on measures of sedentary behavior. To establish evidence of spousal concordance for sedentary behavior, further studies of various populations, such as middle-aged and older adults, are essential.

Furthermore, to enhance our understanding of spousal concordance for physical activity and sedentary behavior, an examination of the moderators (effect modifiers) of concordance for these measures is necessary. Spousal concordance for physical activity and sedentary behavior might not be similar across couples. In other words, spouses of certain couples might have a greater influence on the physical activity and sedentary behavior of one another than those of other couples do. Factors leading to such differences can be conceptualized as moderators. Unfortunately, it is still unclear whether there are any moderators of spousal concordance for physical activity and sedentary behavior. Attachment to one's spouse might moderate spousal concordance for these variables. Meyler, Stimpson, and Peek (2007) introduced four potential mechanisms to explain the concordance for health behaviors among couples: assortative mating, social control, shared resources, and mood convergence or affective contagion. Among these potential mechanisms, mood convergence or affective contagion mechanism is based on the assumption that spousal concordance for health behaviors occurs because spouses have close emotional relationships. According to this potential mechanism, concordance should be more likely to occur among couples with a closer emotional attachment than among those with weaker attachments.

The purpose of the present study was to examine whether objectively measured sedentary behavior and physical activity were correlated with each other, and whether attachment to one's spouse moderated such correlations among middle-aged and older

married couples.

Methods

Participants and Procedures.

The present study targeted middle-aged and older married couples living in four areas located in Hyogo Prefecture, Japan: Nada Ward of Kobe City, Takasago City, Miki City, and Shiso City. Approximately 135,000 people reside in Nada Ward of Kobe City (4,684 persons/km^2), 90,000 people in Takasago City (2,645 persons/km^2), 77,000 people in Miki City (437 persons/km^2), and 37,000 people in Shiso City (57 persons/km^2). Drawing from the official register of residents of the four areas, we randomly selected 540 men (aged 59, 64, and 69 years in April 2016; 135 men per area) and their 540 wives. We sent the study's recruitment document to the 540 couples requesting their participation by postal mail, combined with a questionnaire survey, a 7-day accelerometer survey, and a 7-day diary survey (the data from the diary survey was not used in the present study). Seventy-nine couples responded to the combined survey. We provided book coupons worth 5,000 Japanese yen as incentives for each couple to complete the survey. Among the 79 couples, one or both spouses of 7 couples did not meet the inclusion criteria for the accelerometer survey. Thus, the present study analyzed the data of 72 couples.

Written informed consent was obtained from all participants for this project. The present study received prior approval from the Ethical Committee of the Graduate School of Human Development and Environment, Kobe University (No. 209). All procedures were carried out in accordance with the Helsinki Declaration.

Measures

Physical Activity and Sedentary Behavior. We used a triaxial accelerometer (HJA-750C, Active Style Pro, Omron Healthcare Co., Ltd., Kyoto, Japan) to measure participants' step counts and the amount of time they engaged in moderate-to-vigorous

physical activity and sedentary behavior. The period of the accelerometer survey was 7 days. We asked the couples to wear the accelerometer on their waists all day, except when bathing and sleeping, and to go about their normal routines. The dates for wearing the accelerometer were the same for all couples. The monitored results were blinded, so that the individual participants could not check their recorded data themselves.

We calculated wearing time by subtracting the non-wearing time from 24 hours. We defined non-wearing time as a period of at least 60 minutes in which the accelerometer data were not recorded. The epoch length of the accelerometer was set at 10 seconds. We defined an eligible day as wearing the accelerometer for10 to 20 hours over a one-day period. Previous studies have typically used wearing time ≥ 10 hours per day as an inclusion criterion (Gorman et al., 2014). Although we asked individuals to take off the accelerometer when sleeping, the data indicated that a few individuals wore it when sleeping. Thus, we excluded data that were collected on days that the wearing time was ≥ 20 hours. Following the criteria used in other studies (Gorman et al., 2014), participants with at least 4 eligible days met the study's inclusion criteria.

The algorithm of the accelerometer (HJA-750C) used in this study is identical to that of the older model (HJA-350IT) used in previous studies, although the body size and data-download system differ between the newest (HJA-750C) and older models (HJA-350IT). The validity of the HJA-350IT has been confirmed (Ohkawara et al., 2011). Compared with other types of accelerometers available in Japan, the HJA-350IT provides the most accurate estimate of total energy expenditures in free-living days using the doubly labeled water method (Murakami et al., 2016).

Following Pate, O'Neill, and Lobelo (2008), the present study defined moderate-to-vigorous physical activity as all activities involving ≥ 3 metabolic equivalents, and sedentary behavior as all activities involving ≤ 1.5 metabolic equivalents.

The present study analyzed sedentary behaviors and physical activity based on two approaches. The first approach examined the raw times of sedentary behavior and moderate-to-vigorous physical activity and raw step counts. As for the second approach, similar to previous studies (Healy et al., 2008; Helmerhorst, Wijndaele, Brage, Wareham, & Ekelund, 2009; Spittaels et al., 2012), We divided the daily data on physical activity and sedentary behavior by the wearing time of the accelerometer to eliminate the effect of the wearing time. Thus, in the second approach, we treated the average time engaged in sedentary behavior per hour of wearing time as the measure of sedentary behavior, and the average time engaged in moderate-to-vigorous physical activity per hour of wearing time and the average step count per hour of wearing time as the measures of physical activity.

Attachment to Spouse. In the questionnaire survey, we measured participants' emotional attachment to their spouses by using the Marital Love Scale (Ito & Sagara, 2012) developed in Japan. To avoid contamination of responses between the spouses, we asked them to refrain from viewing one another's answers. This scale consists of 16 items. Examples of the items are "I feel a sense of ease when I am with my spouse," "My spouse kindly takes care of me when I lose my energy," and "I want to do my best for my spouse." Individuals respond to each item using a 4-point Likert scale ranging from 1 (*never*), 2 (*rarely*), 3 (*usually*), and 4 (*always*). The items' ratings are summed and averaged to calculate a total score, with a higher score representing a stronger attachment to one's spouse. Ito and Sagara (2012) have confirmed the construct validity, criterion–related validity, and the internal consistency of this scale. With regard to the construct validity, the principal component analysis showed that this scale consists of one dimension and that the coefficients of principal component loadings of each item are 0.63 to 0.84 (Ito & Sagara, 2012). With regard to the criterion-related validity, Pearson's correlation coefficients between the score of this scale and marital satisfaction are 0.64 in men and 0.78 in women. In Ito and Sagara (2012), Cronbach's

alpha coefficient was 0.94. Among all the participants of our survey, Cronbach's alpha coefficient was 0.97.

Demographics and Frailty. We measured age and educational level (junior-high or high school, more than high school) as the participants' demographics in the questionnaire survey. We also measured frailty by using the *Kihon Checklist* (Arai & Satake, 2015; Japanese Ministry of Health, Labor and Welfare, 2009). The Japanese Ministry of Health, Labour and Welfare developed the *Kihon Checklist* in 2005 to screen older adults at risk of developing disabilities. The tool is composed of 25 items measuring instrumental and social activities of daily living, physical functions, nutritional status, oral functions, cognitive functions, and depressed mood. Respondents answer "yes" or "no' to each item. We calculated the summed scores for the answers to all the item. The scale's total score ranges from 0 to 25, with a higher score representing a higher risk of disability. The validity of the *Kihon Checklist* to screen frailty has been established (Sampaio, Sampaio, Yamada, & Arai, 2016). For example, Satake et al. (2016) showed that Spearman's correlation coefficient between the score of the *Kihon Checklist* and the number of frailty phenotypes is 0.66 and that the sensitivity and specificity to detect frailty status by its cut-off point (7/8) are 89.5% and 80.7%, respectively. Although Japanese studies have not confirmed the reliability of the *Kihon Checklist*, a Brazilian study (Sampaio et al., 2014) revealed that its Cronbach's alpha coefficient in the Portuguese version is 0.79. Among all the participants of our survey, Cronbach's alpha coefficient was 0.70.

Analyses

We calculated Pearson's correlation coefficients between the husbands' and wives' sedentary behavior (raw time, time per hour of wearing time), moderate-to-vigorous physical activity (raw time, time per hour of wearing time), step counts (raw counts, counts per hour of wearing time), demographics and frailty, and attachment to one's spouse (as measured by

scores on the Marital Love Scale). We treated educational level as a dummy variable: junior-high or high school = 0 and more than high school = 1.

We conducted multiple regression analyses by using husbands' and wives' sedentary behavior, moderate-to-vigorous physical activity, and step counts as the dependent variables. For these variables, we examined both raw values and divided values by the wearing time of the accelerometer. The independent variables were demographics and frailty, attachment to one's spouse, correspondent accelerometer variables of the spouse (sedentary behavior, moderate-to-vigorous physical activity, and step count), and the interaction terms of attachment to one's spouse and correspondent accelerometer variables of the spouse. We used standardized scores for these variables in the multiple regression analyses, and calculated the interaction terms by using standardized scores. We examined these variables simultaneously. The present study used the variance inflation factor as an indicator of multicollinearity. If the interaction terms were significant, we conducted stratified multiple regression analyses by attachment to one's spouse.

Statistical significance was set at $p < 0.05$. We used the Statistical Package for the Social Sciences (SPSS) for Windows 21.0 (IBM Japan, Ltd., Tokyo, Japan) to perform all analyses.

Results

Characteristics of the Couples

The mean eligible days per week was 6.61 days for the husbands and 6.56 days for the wives. The average wearing time of the accelerometer per eligible day was 14:23:41 (hours, minutes, and seconds) for the husbands and 15:01:38 for the wives. The mean total step count per eligible day was 6,799.6 steps for the husbands, and 6,630.7 steps for the wives. Table 1 presents the characteristics of the 72 couples. The times spent engaged in sedentary behavior and the physical activity and steps were shown by raw values and the divided values by the

wearing time of the accelerometer.

Concordance for Sedentary Behavior and Physical Activity

Pearson's correlation coefficients between the husbands' and wives' scores on the variables are summarized in Table 2. The husbands' age, educational level, frailty score, attachment to one's spouse measured by scores on the Marital Love Scale, and sedentary behavior were significantly correlated with the wives' age, educational level, frailty score, attachment to one's spouse, and sedentary behavior, respectively (r = .87 for age; r = .50 for educational level; r = .25 for frailty score; r = .61 for attachment to one's spouse; r = .39 for raw time in sedentary behavior; r = .31 for time per hour of wearing time in sedentary behavior). Figure 1 (raw time per day) and Figure 2 (time per hour of wearing time) show the plot of the husbands' and wives' concordance for sedentary behavior. However, statistically significant correlations between the husbands' and wives' moderate-to-vigorous physical activity (r = .19 for raw time; r = .19 for time per hour of wearing time) and step counts (r = .20 for raw counts; r = .17 for counts per hour of wearing time) were not found.

Tables 3 and 4 present the results of the multiple regression analyses. Among both husbands and wives, the sedentary behaviors of one spouse statistically significantly regressed on the sedentary behavior of the other spouse (regressions of wives' behaviors on husbands' behaviors were β = .42 for raw time and β = .30 for time per hour of wearing time; regressions of husbands' behaviors on wives' behaviors were β = .47 for raw time and β = .38 for time per hour of wearing time). The regression of the husbands' moderate-to-vigorous physical activity and step count on those of the wives were statistically marginally significant (β = .23 [p = .061] for raw time in moderate-to-vigorous physical activity; β = .25 [p = .065] for time per hour of wearing time in moderate-to-vigorous physical activity; β = .25 [p = .045] for raw step counts; β = .22 [p = .080] for step counts per hour of wearing time). The wives' moderate-to-vigorous physical activity (β = .17 for raw time; β = .17 for time per hour of

wearing time) and step count (β = .18 for raw counts; β = .15 for counts per hour of wearing time) did not statistically significantly regress on the husbands' respective behaviors.

None of the interaction terms of attachment to one's spouse with the accelerometer variables of one spouse did not statistically significantly regress on the accelerometer variables of the other spouse (β = -.02 to .09 on husbands' accelerometer variables; β = .03 to .16 on wives' accelerometer variables). Thus, stratified multiple regression analyses by attachment to one's spouse were not conducted.

Discussions

To the best our knowledge, this is the first study to examine the concordance of objective measures of both physical activity and sedentary behavior among middle-aged and older married couples. Only one study has reported concordance among couples on sedentary behavior. However, it targeted younger couples than the present study did (Wood et al., 2015). Thus, the present study contributes to a better understanding of spousal influences on physical activity and sedentary behavior among middle-aged and older married couples.

This study found that objectively measured sedentary behaviors of one spouse were correlated with that of the other spouse, and that the attachment to one's spouse did not moderate these correlations among middle-aged and older married couples. These findings indicate that sedentary behaviors of spouses might influence each other, regardless of the attachment to one's spouse. Several potential mechanisms have been proposed to explain the concordance for health behaviors among couples (Meyler et al., 2007): assortative mating, shared resources, social control, and mood convergence or affective contagion. Given that the moderating role of attachment to one's spouse in the concordance for sedentary behavior was not statistically significant in this study, mood convergence or affective contagion mechanism would not be a suitable explanation of spousal concordance for sedentary behavior. The assortative mating mechanism would be also unsuitable, because it assumes that spousal

concordances of health behaviors reflect the similarities among them before they got married. As the majority of middle-aged and older couples would have married for 30 years or more, the effects of assortative mating would have dissipated. Thus, shared resources and social control might be suitable to explain the mechanism that underlies our findings. The shared-resources hypothesis (Smith & Zick, 1994) proposes that concordance for health behaviors among couples occurs because they share the same environment, such as neighborhood characteristics and the same financial resources. Systematic reviews (Chastin et al., 2015; O'Donoghue et al., 2016) have found that socio-economic status and several neighborhood characteristics are determinants of sedentary behaviors among younger and older adults. Social control hypothesis (Umberson, 1992) premises that one spouse tries to control the health behaviors of the other spouse to maintain or improve their health status. According to a systematic review (O'Donoghue et al., 2016), subjective or social norms and social support, which share similar ideas with social control, are reported as the correlates of sedentary behaviors. However, no studies have directly investigated whether shared resources and social control can explain spousal concordance of sedentary behavior among middle-aged and older couples. Further studies are warranted to confirm these hypotheses.

Although statistically significant spousal concordance of sedentary behavior was observed, the present study noted that the absolute effect size of the concordance would not be large among middle-aged and older couples. In this study, the correlation coefficients of sedentary behavior among couples were less than 0.4, which implies absolutely low correlations (Zhu, 2012). In the multiple regression analyses, the values of R^2 were 0.14 to 0.23. As indicated in systematic reviews (Chastin et al., 2015; O'Donoghue et al., 2016), numerous multilevel factors are correlated with sedentary behavior. A spouse's behavior would just be one of various factors correlating with one's sedentary behavior, and would not have a predominant influence on it.

The present study found that the husbands' physical activity regressed on the wives' physical activity with marginal levels of statistical significance (standardized regression coefficients were 0.22 to 0.25, *p*-values were 0.045 to 0.080). However, the wives' physical activity did not statistically significantly regress on the husbands' physical activity (standardized regression coefficients were 0.15 to 0.18, *p*-values were 0.151 to 0.215). The present study also did not show a statistically significant moderating role of attachment to one's spouse on the concordance for physical activity between spouses. The results indicate that their concordance for physical activity was weaker than that for sedentary behavior. Compared with sedentary behavior, other factors, such as self-motivation and attitudes might have a stronger influence on physical activity than spousal characteristics. In contrast to the present study, other studies have found concordance for physical activity among married couples (Cobb et al., 2016; Li et al., 2013; Pettee et al., 2006) using self-report measures. Few studies have used objective measures to investigate concordance for physical activity among couples. However, we should note that studies showing significant concordance for self-reports of physical activity have also used larger samples (Cobb et al., 2016; Li et al., 2013; Pettee et al., 2006) than the present study. Due to the smaller sample size, the present study fails to show the clear and robust concordance for physical activity among couples.

A strength of the present study is its use of objective methods to measure physical activity and sedentary behavior. However, it has several limitations. First, as discussed above, the sample size is small compared with those of previous studies (Cobb et al., 2016; Li et al., 2013; Pettee et al., 2006). Second, the study has sampling bias. The mean daily step counts in the present study (6,799.6 steps for husbands and 6,630.7 steps for wives) were not remarkably different from a nationally representative dataset (7,162 steps/day for men aged 60 to 69 years and 6,559 steps/day for women aged 60 to 69 years: Inoue, et al., 2011). However, during the recruitment process, we asked the spouses to participate in the study

together. Couples in extremely bad relationships would not have participated in the study. Moreover, because the present study targeted middle-aged and older couples, the majority of them would have been married for a long time and their emotional attachment may be considered to be quite high. Indeed, as the standard deviation for attachment to one's spouse was 0.60, its variation was small in the present study, which could weaken the power to detect statistically significant interactive effects of the attachment and the spouses' behavior.

In conclusion, the present study found that the objectively measured sedentary behavior of one spouse was correlated with that of the other spouse among middle-aged and older couples. These findings indicate that the sedentary behaviors of spouses might influence each spouse. As for the practical implications of our findings, there is the possibility that a reduction of sedentary behavior in one spouse might have a desirable effect on the other spouse. For example, Maher, Sliwinski, and Conroy (2017) developed an intervention program that enhanced participants' awareness of their current status of sedentary behavior and its health effects and promoted them to make their plans to reduce it and share their plans with each other. Maher et al. (2017) showed that the program can reduce sedentary behavior among older adults. According to the indication of the present study, such intervention programs could have beneficial effects on the spouses of participants, indirectly mediated by reducing the sedentary behavior of the participants. Based on our findings, further research examining effective strategies to promote physical activity and reduce sedentary behavior among couples is recommended.

What Does This Article Add?

This study found that objectively measured sedentary behaviors of one spouse were correlated with that of the other spouse. This finding indicates that sedentary behaviors of spouses might influence each other.

It is well known that developing effective strategies to reduce sedentary behavior among middle-aged and older populations is a public health priority. To develop such strategies, identifying modifiable correlates of sedentary behavior is essential. For other health behaviors, previous studies have shown that one spouse's health behaviors correlate with the other spouse's health behavior among married couples. Similar to other health behaviors, one spouse's sedentary behavior might also be correlated with the other spouse's sedentary behavior among married couples. If so, it indicates that positive changes in one spouse's behavior should have the desirable effect of causing changes in the other spouse's behaviors. However, there is little evidence supporting concordance of sedentary behavior among married couples. To the best our knowledge, only one study has found a correlation between parents of young children on sedentary behavior. To establish evidence of spousal concordance for sedentary behavior, further studies of various populations, such as middle-aged and older adults, are essential. The present study contributes to a better understanding of spousal influences on sedentary behavior. As for the practical implications of our findings, there is the possibility that a reduction of sedentary behavior in one spouse might have a desirable effect on the other spouse.

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Table 1

Characteristics of the participants (72 couples)

	Mean or %	SD	Range
Husbands' variables			
Age, M (SD)	64.5	3.9	59 – 70
Educational level (more than high school), n (%)	47.2%	—	—
Frailty score (*Kihon Checklist*), M (SD)	4.2	2.9	0 – 12
Attachment to one's spouse (*Marital Love Scale*), M (SD)	3.1	0.6	1.5 – 4
Sedentary behavior (row time), M (SD)	8:40:03	1:42:52	4:02:10 – 11:44:45
Sedentary behavior (time per hour of wearing time), M (SD)	0:36:06	0:06:15	0:19:30 – 0:47:08
MVPA (row time), M (SD)	1:26:37	0:38:10	0:15:12 – 3:31:07
MVPA (time per hour of wear time), M (SD)	0:06:00	0:02:38	0:01:08 – 0:15:53
Steps (row step counts), M (SD)	6799.6	3280.9	2045.3 – 16631.4
Steps (step counts per hour of wearing time), M (SD)	469.1	219.1	140.31 – 1251.87
Wives' variables			
Age, M (SD)	61.6	4.8	53 – 70

Educational level (more than high school), n (%)	44.4%	—	—		
Frailty score (*Kihon Checklist*), M (SD)	3.0	2.4	0	–	13
Attachment to one's spouse (*Marital Love Scale*), M (SD)	3.0	0.6	1	–	4
Sedentary behavior (row time), M (SD)	7:49:16	2:00:24	3:21:52	–	15:11:35
Sedentary behavior (time per hour of wear time), M (SD)	0:31:11	0:07:08	0:13:40	–	0:50:29
MVPA (row time), M (SD)	1:40:22	0:42:11	0:32:02	–	3:58:00
MVPA (time per hour of wear time), M (SD)	0:06:40	0:02:42	0:01:56	–	0:16:06
Steps (row step counts), M (SD)	6630.7	3134.5	1374.3	–	14392.9
Steps (step counts per hour of wearing time), M (SD)	440.7	200.3	101.45	–	993.02

Note: M, Mean; SD, Standard Deviation; MVPA, moderate-to-vigorous physical activity.

Table 2

Pearson's correlation coefficients among the husbands' and wives' demographics and frailty, sedentary behavior, and physical activity

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Husbands' variables																				
1	Age																			
2	Educational level	-.07																		
3	Frailty score	-.26	-.07																	
4	Attachment to one's spouse	.10	-.07	-.45																
5	Sedentary behavior[a]	.02	.15	-.08	.00															
6	Sedentary behavior[b]	-.02	.11	-.08	.19	.88														
7	MVPA[a]	.00	.03	-.17	-.11	-.45	-.67													
8	MVPA[b]	-.02	.02	-.15	-.06	-.57	-.70	.97												
9	Steps[a]	-.02	.16	-.19	-.12	-.16	-.39	.79	.73											
10	Steps[b]	-.04	.15	-.19	-.08	-.28	-.43	.78	.77	.97										
Wives' variables																				
11	Age	.87	-.09	-.23	.12	.00	.00	-.02	-.03	-.03	-.04									
12	Educational level	-.07	.50	-.03	-.02	.35	.26	.01	-.05	.18	.14	-.15								

13	Frailty score	.04	.05	.25	-.18	.09	.06	-.07	-.08	-.15	-.17	.10	.01						
14	Attachment to one's spouse	.15	-.15	-.30	.61	.13	.24	-.25	-.25	-.10	-.1	.11	-.08	-.02					
15	Sedentary behavior[a]	-.11	.02	.02	-.14	.39	.26	-.04	-.12	.09	.01	-.11	.15	-.15	-.11				
16	Sedentary behavior[b]	-.08	.05	.00	.00	.34	.31	-.12	-.16	-.02	-.06	-.06	.18	-.21	-.05	.91			
17	MVPA[a]	-.10	-.01	-.04	-.03	-.25	-.30	.19	.19	.08	.08	-.14	-.15	.17	.02	-.63	-.78		
18	MVPA[b]	-.06	.00	-.06	.03	-.31	-.30	.16	.19	.03	.06	-.09	-.15	.13	.05	-.73	-.81	.98	
19	Steps[a]	-.16	.10	-.05	.05	-.01	-.07	.10	.08	.20	.19	-.21	-.05	-.01	.16	-.33	-.45	.72	.68
20	Steps[b]	-.12	.11	-.08	.12	-.06	-.07	.06	.06	.16	.17	-.16	-.05	-.04	.20	-.41	-.46	.69	.70	.98

Note: MVPA, moderate-to-vigorous physical activity.

Educational level was a dummy variable (junior-high or high school = 0, more than high school = 1). Absolute criterion for correlation coefficients (Zhu, 2012) was .00 to .19, no correlation; .20 to .39, low correlation; .40 to .59, moderate correlation; .60 to .79, moderately high correlation; ≥ .80, high correlation).

[a]Row time or step counts, [b]Time or step counts per hour of wearing time

Table 3

Multiple regression analyses of the correlates of sedentary behavior and physical activity of the husbands

	Husbands' accelerometer data																	
	Sedentary behavior[a] (R^2=.19)			Sedentary behavior[b] (R^2=.14)			MVPA[a] (R^2=.10)			MVPA[b] (R^2=.08)			Steps[a] (R^2=.15)			Steps[b] (R^2=.12)		
	β	*p*-value	VIF	β	*p*-value	VIF	β	*p*-value	VIF	β	*p*-value	VIF	β	*p*-value	VIF	β	*p*-value	VIF
Husbands' variables																		
Age	.07	.579	1.1	.00	.996	1.1	-.04	.759	1.2	-.05	.687	1.2	-.05	.705	1.2	-.08	.541	1.2
Educational level	.15	.194	1.0	.11	.342	1.0	-.01	.953	1.0	-.01	.918	1.0	.10	.411	1.0	.09	.455	1.1
Frailty score	-.06	.671	1.4	.01	.922	1.4	-.27	.058	1.4	-.24	.096	1.4	-.29	.035	1.4	-.28	.048	1.4
Attachment to one's spouse	.01	.949	1.5	.20	.169	1.5	-.22	.128	1.5	-.18	.230	1.5	-.25	.062	1.3	-.20	.146	1.3
Wives' accelerometer data																		
Sedentary behavior[a]	.42	.001	1.1		—			—			—			—			—	
Sedentary behavior[b]		—		.30	.011	1.0		—			—			—			—	
MVPA[a]		—			—		.17	.151	1.0		—			—			—	
MVPA[b]		—			—			—		.17	.169	1.0		—			—	

Steps[a]			—			—			—			—		.18	.132	1.0		—	
Steps[b]			—			—			—			—			—		.15	.215	1.1
Interaction of husbands' marital love scores and wives' accelerometer data																			
Attachment × sedentary behavior[a]	.09	.496	1.3			—			—			—			—			—	
Attachment × sedentary behavior[b]		—		.01	.937	1.2			—			—			—			—	
Attachment × MVPA[a]		—			—		.02	.883	1.3			—			—			—	
Attachment × MVPA[b]		—			—			—		-.02	.862	1.3			—			—	
Attachment × steps[a]		—			—			—			—		.05	.700	1.1			—	
Attachment × steps[b]		—			—			—			—			—		.06	.643	1.1	

Note: MVPA, moderate-to-vigorous physical activity; VIF, variance inflation factor.

Educational level was a dummy variable (junior-high or high school = 0, more than high school =1).

[a]Row time or step counts, [b]Time or step counts per hour of wearing time

Table 4

Multiple regression analyses of the correlates of sedentary behavior and physical activity of the wives

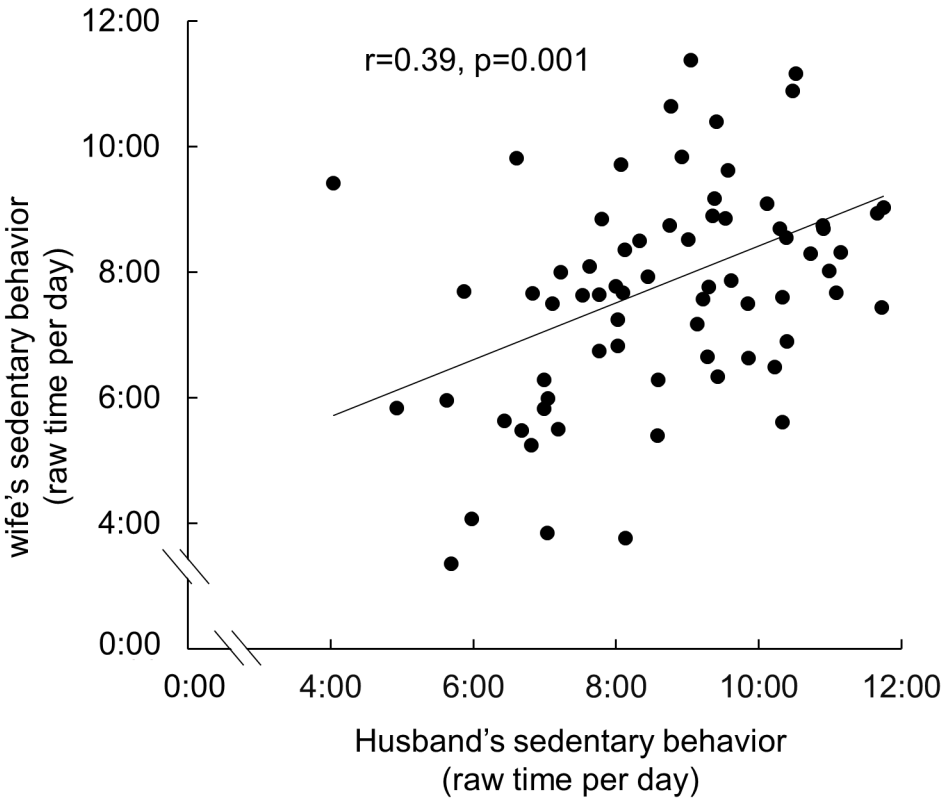
	Wives' accelerometer data																	
	Sedentary behavior[a] (R^2=.23)			Sedentary behavior[b] (R^2=.20)			MVPA[a] (R^2=.13)			MVPA[b] (R^2=.11)			Steps[a] (R^2=.14)			Steps[b] (R^2=.12)		
	β	*p*-value	VIF	β	*p*-value	VIF	β	*p*-value	VIF	β	*p*-value	VIF	β	*p*-value	VIF	β	*p*-value	VIF
Wive's variables																		
Age	-.07	.519	1.0	.00	.999	1.0	-.19	.106	1.1	-.14	.252	1.1	-.25	.041	1.1	-.20	.100	1.1
Educational level	-.02	.857	1.2	.10	.410	1.1	-.18	.132	1.1	-.17	.161	1.1	-.12	.324	1.1	-.10	.403	1.1
Frailty score	-.19	.098	1.0	-.23	.045	1.0	.20	.089	1.0	.17	.160	1.0	.05	.654	1.0	.02	.895	1.0
Attachment to one's spouse	-.15	.177	1.1	-.12	.310	1.1	.08	.490	1.1	.11	.372	1.1	.21	.088	1.1	.25	.041	1.1
Husbands' accelerometer data																		
Sedentary behavior[a]	.47	<.001	1.3		—			—			—			—			—	
Sedentary behavior[b]		—		.38	.004	1.3		—			—			—			—	
MVPA[a]		—			—		.23	.061	1.1		—			—			—	
MVPA[b]		—			—			—		.25	.065	1.2		—			—	

Steps[a]		—			—			—			—		.25	.045	1.1		—	
Steps[b]		—			—			—			—			—		.22	.080	1.1
Interaction of Wives' marital love scores and Husbands' accelerometer data																		
Attachment × sedentary behavior[a]	.11	.363	1.1		—			—			—			—			—	
Attachment × sedentary behavior[b]		—		.16	.203	1.2		—			—			—			—	
Attachment × MVPA[a]		—			—		.04	.742	1.3		—			—			—	
Attachment × MVPA[b]		—			—			—		.08	.534	1.2		—			—	
Attachment × steps[a]		—			—			—			—		.03	.779	1.1		—	
Attachment × steps[b]		—			—			—			—			—		.08	.525	1.2

Note: MVPA, moderate-to-vigorous physical activity; VIF, variance inflation factor.

Educational level is a dummy variable (junior high or high school = 0, more than high school =1).

[a]Row time or step counts, [b]Time or step counts per hour of wearing time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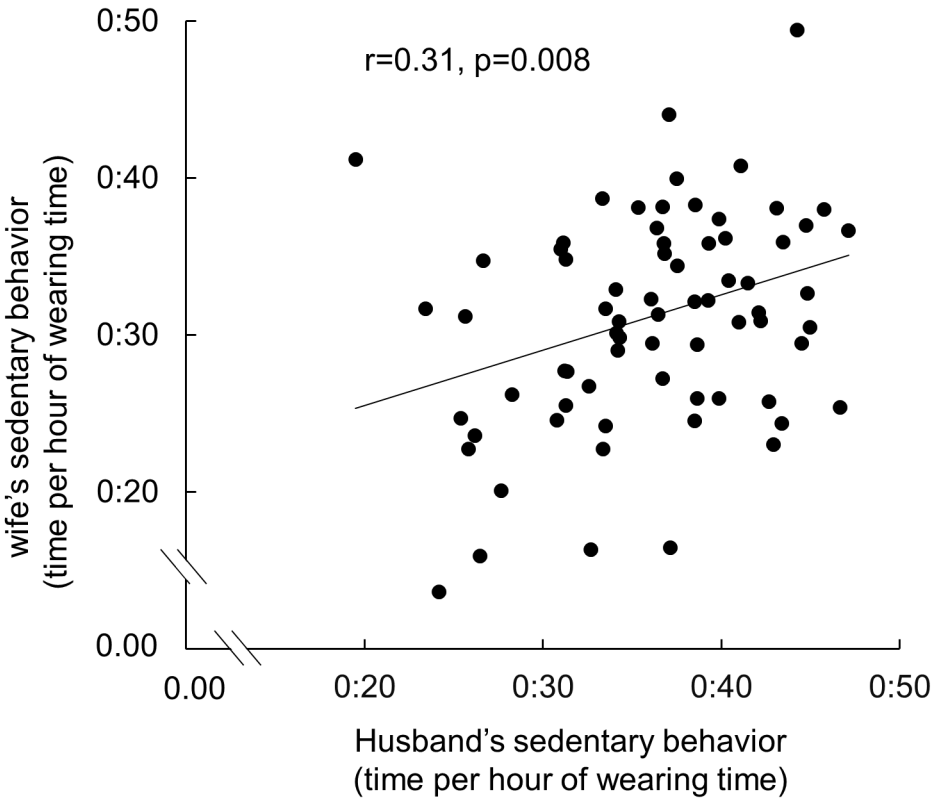
12:00
10:00
8:00
6:00
4:00
0:00
wife's sedentary behavior
(raw time per day)
0:00
4:00
6:00
8:00
10:00
12:00
Husband's sedentary behavior
(raw time per day)


r=0.31, p=0.008
0:50
0:40
0:30
0:20
0.00
0.00
0:20
0:30
0:40
0:50
wife's sedentary behavior
(time per hour of wearing time)
Husband's sedentary behavior
(time per hour of wearing time)