



Spousal health and older adults' biomarker change over six years: Investigation of gender differences

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ABSTRACT

Objective: Relationship of spousal health and biomarkers over six years were examined.

Methods and materials: Nationally representative sample of 483 adults aged 54+ in Taiwan were followed for six years. Four classes of spousal health changes and three categories of biomarker indexes were examined. Biomarkers were assessed by counting the adverse progression on items of allostatic load (AL), cardiovascular disease biomarkers (CVD), and metabolic syndromes, respectively.

Results: When the health status of an individual's spouse became worse, women increased their AL by 0.48 ($P < 0.05$), CVD by 0.56 ($P < .001$), and metabolic syndrome by 0.43 ($P < 0.05$). If the health status of a woman's spouse remained poor, it increased her allostatic load by 0.60 ($P < 0.05$). These effects were only observed in women. In addition, when the health status of a men's spouse became better, man's biomarker profile on AL significantly improved by 0.80 ($P < 0.05$). No significant moderating effect of education was observed in this sample.

Conclusions: Married couples display concordance in both physical and mental health-related biomarkers, specifically, allostatic load. Women were more likely than men to experience adverse biomarker progress on all the biomarkers examined in this study when the status of their spouse became worse based on their subjective judgment, and men were more sensitive to positive health changes in their spouse than women.

1. Introduction

Health concordance means that the emotional and physical health of a couple are similar to each other (Lu, Chiou, Chen, & Hsiao, 2016; Pruchno, Wilson-Genderson, & Cartwright, 2009; Valle, Weeks, Taylor, & Eberstein, 2013). Compared with older adults with a healthy spouse, those whose spouse has been diagnosed with hypertension, depression, or peptic ulcer disease will experience an increased risk of at least 70 percent of the onset of chronic conditions (Hippisley-Cox, Coupland, Pringle, Crown, & Hammersley, 2002; Valle et al., 2013). Moreover, poor spousal health is a significant risk factor in physical activities, daily activity disability and depressive symptoms (Lu et al., 2016). Studies have indicated that as couples become older, their health concordance increases (Meyler, Stimpson, & Peek, 2007). Because of the global growing population of older adults, investigations of how spousal health affects individual health may provide insight into promoting the well-being of older adults.

Investigations of spousal concordance, however, generally have been focused on spousal disease status and individual health outcomes. Existing studies have generally ignored the possible effects of a change

in a spouse's health on the well-being of another individual. Tracing downstream changes in a spouse's well-being at the micro-level of the health status of an individual, such as changes in biomarkers, may provide insight into the ways in which spouses contribute to an individual's health status in the early stages of such changes.

The fact that a spouse can have poorer health and disease after the onset of disease in a partner can be attributed to similar health behavior and assortative mating. First of all, in terms of health behavior, the main assumption is that spouses share their resources and living environment with each other, so they are exposed to the same risk factors (Bloch, Klein, Nogueira, & Salis, 2003; Di Castelnuovo, Quacquarello, Donati, de Gaetano, & Iacoviello, 2009; Falba & Sindelar, 2008; Hippisley-Cox et al., 2002; Kavanagh et al., 2010; Meyler et al., 2007; Okuda et al., 2013). In studies on health behavior and spousal health, it has been found that often both the husband and the wife are obese and have cardiovascular disease problems due to the having same diet and exercise habits (Di Castelnuovo et al., 2009; Falba & Sindelar, 2008; Meyler et al., 2007). As these spouses become older and live together longer, their health conditions will tend to become more similar, which may cause both of them to suffer from the same diseases and mental

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health problems one after another. When one party has a cardiovascular disease or a metabolic disease, the other party may also be at risk of developing the same disease (Kim et al., 2006; Meyler et al., 2007; Okuda et al., 2013). As a result, the husband and the wife can have growing similarities in their health conditions owing to their similar circumstances and shared hobbies.

2. Women, health, and care in Taiwan

When one party takes care of another ill or disabled person, the party acting as the caregiver may develop worse health due to the stress of giving care to the other party, this may be due to negative changes in health-related activities and the physiological effects of psychological distress (Bevans & Sternberg, 2012; Pinguart & Sørensen, 2007; von Kanel et al., 2012). In Taiwan, spouse's functional and mental health outcome is the potential threats of party (Lu et al., 2016).

Under a patriarchal ideology, women, who are viewed as caring, and men, who are viewed as having masculine qualities, are constructed so that the caregivers are mostly women, and the pressure on women to be the caregiver is much higher than it is on men (Abbott, Wallace, & Tyler, 2008; Pinguart & Sørensen, 2006). In the issue of elderly care, Taiwan's Ministry of the Interior conducted a survey on the Living Conditions of the Elderly in 2009 and found that 43.95% of elderly people aged between 55 and 64 are taken care of by their spouse or cohabitant when they are admitted to the hospital, while only 20.24% of those over 65 are taken care of by their spouse or cohabitant when they are admitted to the hospital. When there is a need for assistance in daily life activities, most men are assisted by their spouse or cohabitant, but women are mostly cared for by their sons or daughters-in-law. Overall, most responsibilities are assumed by women (Ministry of the Interior, 2010). This shows that Taiwanese society is still accustomed to viewing women as caregivers. This also conforms to the common belief that women should be responsible for the health of their families and should serve as unofficial, unpaid caregivers by taking care of the sick, the disabled, and the elderly.

3. Social status and spousal health

Social status affects the support that individuals obtain from society. Those with a higher social status are more likely to have access to the resources they need, such as care resources, quality of care and care support, while those with a lower social status lack opportunities to obtain or learn about care resources and obtain related information (Bloch et al., 2003; Pinguart & Sørensen, 2006). Thus, people in different social and economic positions have different views and reactions when they face the issue of care. Usually, it is harder for spouses with a lower social status to enter the care system, and thus their health is worse than that of those with a higher social status. Under the influence of socio-economic status, there are different ways for people to cope with the poor health of their partners, and health inequalities have been corroborated, where spouses with a higher social status have better health than those with a lower social status.

4. Biomarkers and health

A biomarker is a predictor of health and mortality at the micro-level. Biomarkers are generally objectively measured and evaluated as indicators of normal biological or pathogenic processes (Crimmins, Vasunilashorn, Kim, & Alley, 2008; Eckel, Grundy, & Zimmet, 2005). Research on the connection between health concordance and biomarkers began metabolic syndromes such as diabetes (Jee, Suh, Won, & Kim, 2002; Katzarzyk, Hebebrand, & Bouchard, 2002; Kim et al., 2006; Okuda et al., 2013). Increased HbA1c levels have been observed in women when the health of their husband declines (Lee, Rodríguez, Glej, Weinstein, & Goldman, 2014). In a study of caregivers, it was found that providing care to a spouse with Alzheimer's disease may

increase the level of inflammation biomarkers and cardiovascular disease, such as CRP levels (von Kanel et al., 2012). However, no studies in the existing literature have examined changes in a spouse's health status or the different domains of biomarker profile changes at the individual level in a single study.

A review of the results of past studies on biological indicators shows that performance on and changes in biological indicators can both affect health conditions. In addition to the impact of diseases on biological indicators, socio-economic status and family caregivers can affect the performance on biological indicators. However, there has not been much research on the combination of spousal health and biological indicators. The mutual influence of spouses on each other is a long-term phenomenon, and this influence on each other may not result in the same disease. In this regard, existing research has seldom discussed the impact of changes in spousal health on the health of their partners, and fewer researchers have used biological indicators as the health outcome variables by which to explore the impact of changes in spousal health on the health of their partners. As long as there is a change in the spousal health, the partner's health performance will be affected.

This study investigated the association between changes in self-reported spousal health and individual biomarker progression using a nationally representative panel sample in Taiwan. Three domains of biomarkers were examined: the allostatic load (AL), cardiovascular disease (CVD), and metabolic syndrome. According to gender role socialization (Pinguart & Sørensen, 2006) and social status affects, personal behavior is different based on gender and social status, which is women had more expectations and pressure to be a caregiver and more that caregivers with higher socioeconomic status have been shown to have more social resources to help them with the health care system and relieve health-related distress (Navaie-Waliser et al., 2002). The following hypotheses are thus proposed:

Hypothesis I. Health concordance has different impacts on the biomarker profiles for cardiovascular disease, allostatic load, and metabolic syndrome at the individual level.

Hypothesis II. Gender and education each may moderate the relationship between changes in a spouse's health and individual biomarker change profiles.

5. Method

5.1. Participants

The panel data for this study came from the Social Environment and Biomarkers of Aging Study (SEBAS, 2000–2006) in Taiwan. SEBAS is based on a random sub-sample of respondents from a nationally representation survey - Taiwan Longitudinal Study on Aging (TLSA). The TLSA began to examine adults aged 50 and older in 1996. The SEBAS survey interviewed participants aged 54 and older at home in 2000 ($n = 1023$) and followed the participants in 2006 ($n = 757$). In addition to a face-to-face interview that included a social life and well-being questionnaire, an in-hospital collection of a broad panel of biomarkers were administered. Several weeks after the in-home interview, the participants collected a 12-hour overnight urine sample, fasted overnight, and visited hospital the following morning for a physical examination, where medical professionals also collected blood samples. Blood and urine specimens were analyzed at the Union Clinical Laboratories in Taipei |City, Taiwan.

In this study, we used data from those who participated in the 2006 follow-up interview ($n = 757$). We excluded participants who had more than one limitation in ADL at baseline ($n = 22$), poor self-reported health at the follow-up ($n = 14$), and those who didn't live with their spouses (or companions) ($n = 238$), resulting a total of 483 participants analyzed in this research.

Table 1
Characteristics of four spousal health change groups.

	Entire Sample	Remained Well (N = 31,565.2%)	Became worse (N = 6614%)	Became better (N = 5211%)	Remained poor (N = 5010%)	P-value
Gender						0.009
Men	65.6	63.5	56.1	82.7	74.0	
Women	34.4	36.5	43.9	17.3	26.0	
Education						0.010
No schooling	24.2	24.4	30.3	9.6	30.0	
Elementary	43.3	39.1	45.5	61.5	48.0	
> = High school	32.5	36.5	21.2	28.9	22.0	
Chronic conditions						0.513
0	40.4	40.3	34.9	44.2	44.0	
1	31.5	33.0	36.4	23.1	24.0	
2	20.7	20.0	21.2	26.9	18.0	
> = 3	7.4	6.7	7.6	5.8	14.0	
Allostatic load	2.42(0.80)	2.39(0.73)	2.27(0.77)	2.35(0.90)	2.90(0.99)	< 0.001
Cardiovascular Disease	1.63(0.94)	1.58(0.85)	1.41(0.93)	1.52(0.78)	2.34(1.29)	< 0.001
Metabolic syndrome	1.21(0.57)	1.18(0.50)	1.23(0.72)	1.23(0.55)	1.30(0.81)	0.528

Note. Numbers are percentage or mean (SD).

Metabolic syndrome: SBP, DBP, HDL, triglycerides, fasting glucose, and waist circumferences.

5.2. Measures

The participants self-reported spousal health status in 2000(T1) and 2006(T2). Both were measured using a 4-point Likert scale (5 = excellent, 4 = good, 3 = average, 2 = not so good and 1 = poor). In this study, scores of 3–5 and 1–2 were recoded as healthy and unhealthy, respectively. We then grouped the participants' changes in spousal health status into four groups: "remained good," defined as the participant's spouse remained healthy on both occasions, "remained poor," defined as participant's spouse remains unhealthy on both occasions, "became better," defined as an improvement in spousal health from T1 to T2, and "became worse," defined as a decline in spousal health declined from T1 to T2. Three biomarker domains were assessed: allostatic load (AL), biomarkers of cardiovascular disease (CVD), and biomarkers of metabolic syndrome. The AL (Seeman, McEwen, Rowe, & Singer, 2001) includes 10-items: systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol, high-density lipoprotein (HDL) cholesterol, Triglycerides, Hba1c, cortisol, Epinephrine, Norepinephrine, waist-to-hip ratio (WHR), and Dehydroepiandrosterone sulfate (DHEA-s). The CVD-risk indicator comprises 11-items: SBP, DBP, body mass index (BMI), WHR, Triglycerides, total cholesterol, HDL, fasting glucose, HbA1c, cortisol and IL-6. The metabolic syndrome consists of 6-items: SBP, DBP, HDL, triglycerides, fasting glucose, and waist circumferences. The three biomarkers were examined with regard to their changes in status over the six-year period. If the change in each item within the three biomarker domains was more than one standard deviation worse from 2000 to 2006, it was coded as "adverse biomarker progression." We then added the number of items within each biomarker domain together that fell in the "adverse biomarker progression," thus arriving at CVD ranges from 0 to 11, metabolic syndrome ranges from 0 to 6, and AL ranges from 0–10. Higher scores was interpreted as more risk of getting CVD, metabolic syndrome, and AL-related diseases.

Covariates included chronic diseases and the age of the participant. Age was treated as a continuous variable. *Chronic diseases* include self-reported high blood pressure, diabetes, heart disease, stroke, cancer, lung disease/asthma, arthritis/rheumatism, liver/gall bladder disease, and gout at baseline. They were treated by adding the number of conditions. We also examined the moderating effects of gender and education. There were three levels of *education*: no schooling, elementary school, and above high school, with no-schooling as a reference group.

5.3. Statistics

A one-way analysis of variance (ANOVA) was used to examine the differences among the four spousal health groups. Two hierarchical multiple regressions were employed for each dependent variable to explore if gender and education moderated the link between spousal health and the total adverse changes in each biomarker domain. In Model 1, we adjusted comorbidity and age to examine the effect of changes in spousal health on predicting adverse progression of biomarkers. The moderating effect of gender and education were tested in Model 2, with the interaction of gender, by changes in spousal health status and education using estimated changes in spousal health status. We used SAS 9.3 to perform all analyses, with the significance level set as $\alpha = 0.05$.

6. Results

6.1. Characteristics of the study participants

A total of 483 people aged 54–80 years old (mean = 64.7, SD = 7.07) were enrolled in this study, including 317 men (65.6 percent) and 166 women (34.4 percent). The education level of the participants was low: 43.3 percent had completed elementary school, and 24.2 percent had no schooling. The majority of the participants answered that their spouses' health status had remained good across the 6-year period (65.2 percent); however, 14 percent reported that their spouses' health status had become worse; 11 percent had become better, and 10 percent had remained poor. 40.4 percent of the participants reported they had not been diagnosed with chronic diseases, and 31.5 percent had been diagnosed with one chronic disease. However, the group in which spousal health had become worse had a low proportion of health status with no chronic disease and a large proportion of diagnosis of one chronic disease. The participants who had reported their spouse's health had remained poor had a high proportion diagnosed with three or more chronic diseases.

6.2. Characteristics of the four spousal health change groups

Table 1 shows the bivariate analyses examining the characteristics of the four spousal health status groups and their baseline socio-demographic and biomarker change profiles. Compared to other spousal health change groups, those who reported their spousal health status to have become better were largely men; those who reported their spousal health status to have become worse had a larger percent of

Table 2
Coefficients from multiple regression models predicting count of adverse bio-marker changes in AL, CVD, and metabolic syndrome.

	Allostatic Load	CVD	Metabolic Syndrome
Model 1			
Spousal health became worse.	−1.12	−0.17	0.04
Spousal health became better.	−0.05	−0.06	0.05
Spousal health remained poor.	0.51^{***}	0.76^{***}	0.12
R ²	0.046	0.077	0.01
Model 2			
Became worse	−0.40	−0.26	0.01
Became better	− 0.80[*]	−0.52	−0.11
Remained poor	0.11	0.21	−0.20
Elementary	−0.10	−0.04	−0.09
> =High school	−0.16	−0.16	−0.04
Female	−0.11	−0.06	−0.04
Female x SH became worse	0.48[*]	0.17	0.19
Female x SH became better	0.35	0.30	0.36
Female x SH remained poor	0.60[*]	0.56^{**}	0.43[*]
Elementary x SH became worse	0.09	0.04	−0.001
Elementary x SH became better	0.61	0.29	0.03
Elementary x SH remained poor	0.29	0.24	0.23
> =High school x SH became worse	0.08	−0.11	−0.18
> =High school x SH became better	1.08	0.73	0.28
Senior and graduate school x SH remained poor	0.30	0.79	0.40
R ²	0.078	0.103	0.036

Note. All the models adjusted for age and comorbidity status.

* p < .05.

** p < .01.

*** p < .001.

females (p = .001). The spousal health had remained good group also had higher education (p = .01). All four groups had experienced increased burden on all three biomarker domains. The participants' AL and CVD levels tended to progress to a worse profile if their spouses' health status had remained poor during the 6-year observation (p < .001).

6.3. Relationships between changes in spousal health and changes in biomarkers

The results shown in Table 2 indicate an independent effect of changes in spousal health in predicting the summed scores for worsening biomarkers on AL, cardiovascular disease biomarkers, and metabolic syndrome, respectively. Compared to those whose spouse had stayed well, the participants' spouses who had remained in poor health significantly increased the allostatic load by 0.51 (p < .001) and the cardiovascular load by 0.76 (P < .001) over six years. Model 2, with the interaction effects of gender by spousal health status groups and education by spousal health status groups being modeled further, indicated that if the health status of a men's spouse became better, man's biomarker profile on allostatic load significantly improved by 0.80 (P < 0.05). Compared to those whose spouse stay well, when the health status of an individual's spouse became worse, women increased their AL by 0.48 (P < 0.05), CVD by 0.56 (P < .001), and metabolic syndrome by 0.43 (P < 0.05). If the health status of a woman's spouse remained poor, it increased her AL by 0.60 (P < 0.05). These effects were only observed in women. However, no significant moderating effect of education level was observed in this sample.

7. Discussion

Few studies have investigated the effect of changes in spousal health status on changes in different biomarker domains for older adults living

in communities. Among the existing studies, clinical sample size or a single biomarker domain were used (Jee et al., 2002; Katzmarzyk et al., 2002; Kim et al., 2006; Lee et al., 2014; Okuda et al., 2013). In the present study, a nationally representative middle-aged and older adults living with their spouse was followed over six years. Changes in spousal health and the participants' individual biomarker changes were examined. Our results showed that after adjusting for age, education, and comorbidity, a poor or worsening spousal health status increased the risk of a worsening profile in terms of cardiovascular diseases and the allostatic load biomarker. In addition, in the case of women, when they experienced their spouses health remaining poor, their allostatic load, cardiovascular diseases, and metabolic syndrome significantly progressed to a worsening profile within six years. In the case of men, they improved their allostatic load when they experienced their spouses' health become better. These findings indicate that married couples not only display concordance in terms of physical disease-related biomarkers but also mental health-related biomarkers, and there exist distinct gender differences.

Spousal health issues have not been widely examined with biomarkers and self-reported spousal health. Previous studies have demonstrated that couples exhibit health concordance when facing chronic diseases and frailty (Di Castelnuovo et al., 2009; Kim et al., 2006; Lu et al., 2016; Meyler et al., 2007; Small, Margrett, & Russell, 2013; Stimpson & Peek, 2005). However, these studies failed to subjectively assess spousal health status changes and the relationship with a pre-disease index, such as biomarkers (Vaupel, 2010). We found that an individual who experiences changes in the health of a spouse may in turn experience an increased risk of negative cardiovascular disease and depression-related changes in biomarkers. Therefore, health concordance is not limited to post-chronic disease effects, and subjective well-being is closer to the real picture of an individual's health status. An individual experiencing weakness on the part of a partner is a warning of a future biological burden. This is especially true in older adulthood as health-related stressors accumulate, and spouses become the most important source of support and caregiving.

The present study supports previous literature suggesting that having ill spouse during one's old age has a greater negative impact on the other spouse, especially in the case of women with sick husbands (Neri et al., 2012; Pinquart & Sörensen, 2006; Vitaliano, Zhang, & Scanlan, 2003). These findings support the gender role socialization theory and the neurobiological process. Women tend to become more stressed as a result of having an unhealthy partner. Moreover, we find that women have different biomarkers profile between the "spousal health became worse" group and the "ill spouse" group. Women have worse progression of AL (but not CVD and metabolic syndrome) when they are faced with deteriorating health in their spouse. However, women didn't experience improvement in their spouse's health, who had ill spouses in both waves, exhibited increased the risk of worse biomarker profiles for AL, CVD, and metabolic syndrome. The AL represents cumulative biological stress in the body, and it may help to explain the progression of changes in mental health for women who undergo declining spousal health (Gersten, 2008; Pinquart & Sörensen, 2006). A stressed spouse with higher AL has been shown to be related to poor cognitive function, weaker physical performance impaired immunity, obesity, and CVD and mortality (Hwang et al., 2014; Juster, McEwen, & Lupien, 2010). Moreover, compared with men, the effects of marital functioning on physiology may be stronger for women, and neuroendocrine biomarkers are more often dysregulated in females (Juster et al., 2010). AL interpreted the reflection of the hypothalamic-pituitary-adrenal axis (HPA axis), the sympathetic nervous system, the cardiovascular system, and metabolic processes. The HPA axis is a major part of the neuroendocrine system that reacts to stress and impacts the immune system, mood, and emotions (Seeman et al., 2001). Stressor responses interacts with neurohumoral, endocrine, and immune functioning and have been linked to cardiovascular disorders (Grippe & Johnson, 2009). Therefore, especially in the case of women,

experiencing a decline in a partner’s health will result in a worse AL profile, but if the partner’s health declined over a long period of time, the spouse is undergoing chronic stress that will lead to changes in neuroendocrine function that have been shown to reflect worse cardiovascular system and metabolic processes. In addition to changes in neuroendocrine functioning causing a decline in the health of women, there are biological gender differences in AL.

Previous studies have indicated that men’s well-being can be predicted by their wives’ health functioning and wellbeing (Ruthig, Trisko, & Stewart, 2012). We found men would release stress when their spouses health became better, but there has not been evidence showing that an ailing wife may impact an older man’s biomarkers. Although men’s biomarkers have not been shown to be impacted by an unhealthy partner, men will have better psychological well-being when their partner’s health becomes better. The possible explanation for these findings is that older men may be more dependent on their wives since their wives are the primary source of support functions for them (Antonucci & Akiyama, 1987). Women may provide emotional support, reduce household expenses, and contribute to satisfaction with the marriage, all of which are important to man’s health (Antonucci & Akiyama, 1987; Ruthig et al., 2012). Accordingly, having a recovered spouse may be heartening to men, so they will expect their life to gradually get back on track. This will help them cope with various kinds of stress. These types of support are good for men’s health and help release the progression of psychological stress biomarkers.

Our study has several limitations. First, this data was from ten years ago, and society has since been changed by rising feminine consciousness, an increase in educational levels, female labor force participation, correct health literacy, and care policies in Taiwan. Our findings are based on an older cohort who have traditional caregiving attitudes and less public health policies by which to promote their health. Cohort differences may cause different results related to spousal concordance because of the long-term care policies in place for older people (Ten year Long-Term plans) established in 2008 and 2016, health promotion programs, and the availability of health information.

Appendix A. Definition of adverse biomarker progression cutoff

Items in each biomarker	
Body mass index (BMI)	$\Delta_{BMI} \geq 3.31$
Waist-to-hip ratio (WHR)	$\Delta_{WHR} \geq 0.08$
Waist size	$\Delta_{waist} \geq 9.18$ cm
Systolic blood pressure (SBP)	$\Delta_{SBP} \geq 19.76$ mmHg
Diastolic blood pressure (DBP)	$\Delta_{DBP} \geq 10.67$ mmHg
triglycerides	$\Delta_{triglycerides} \geq 77.19$ mg/dl
total cholesterol	$\Delta_{total\ cholesterol} \geq 37.98$ mg/dl
High-density lipoprotein (HDL) cholesterol	$\Delta_{HDL} \leq 12.83$ mg/dl
fasting glucose	$\Delta_{fasting\ glucose} \geq 32.21$ mg/dl
HbA1c	$\Delta_{HbA1c} \geq 1.28\%$ of Hb
cortisol	$\Delta_{cortisol} \geq 22.05$ μ g/g creatinine
IL-6	$\Delta_{IL-6} \geq 3.33$ pg/ml
Epinephrine	$\Delta_{epinephrine} \geq 1.62$ μ g/L
Norepinephrine	$\Delta_{norepinephrine} \geq 12.72$ μ g/L
DHEA-S	$\Delta_{DHEA-S} \leq 59.57$ μ g/dl

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Thus, these results may not be generalized to a younger cohort in Taiwan. The second limitation is that personal judgments related to gender are rather subjective. Previous research has indicated gender differences in terms of subjective well-being, self-concept, and different health perceptions. Women tend to be more astute and aware of their health status than men.

With the aforementioned caveats, our findings provide evidence that the health status of an individual’s spouse may affect that individual’s health over time. Specifically, it indicates that health concordance occurs not only during post-chronic disease events, but occurs even with self-reported awareness of changes in spousal health. In addition, married couples not only display concordance in terms of physical disease-related biomarkers (e.g., cardiovascular disease and metabolic syndrome) but also mental health-related biomarkers, specifically, allostatic load. A moderating effect of education was not observed in this study. However, women were more likely than men to experience adverse biomarker progress on all the biomarkers examined in this study when the status of their spouse became worse based on their subjective judgment, and men were more sensitive to positive health changes in their spouse than women. Our findings highlight the importance of conducting further examination of the mechanisms that explain the vulnerability of women to adverse biomarker changes associated with spousal health, and well as well as the possibility of a positive effect of changes in the health of elderly males in protecting their biomarker profiles over time.

Disclosure statement

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