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Chronic Condition Discordance and Physical Activity Among Midlife and Older Couples

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Abstract

Objective: Chronic conditions in middle and later life are associated with lower physical activity. Yet little is known about chronic condition discordance (i.e., the extent to which conditions have non-overlapping self-management requirements) within older individuals and couples and its implications for physical activity. We determined how the degrees of chronic condition discordance at the individual level and the couple level (i.e., between spouses) were linked to moderate physical activity across an 8-year period.

Methods: The U.S. sample included 1,621 couples from five waves of the Health and Retirement Study (2006 – 2014). Dyadic growth curve models estimated how individual-level and couple-level chronic condition discordance were linked to initial levels of and rates of change in moderate activity. Models controlled for age, minority status, education, and own and partner reports of baseline negative marital quality, time-varying depressive symptoms, and time-varying number of chronic conditions.

Results: A considerable proportion of wives (25.4%) and husbands (18.9%) reported moderate activity less than once a week. When individuals (wives: $\beta = -0.10$; husbands: $\beta = -0.09$) or their spouses (wives: $\beta = -0.04$; husbands: $\beta = -0.05$) had greater individual-level chronic condition discordance, lower initial moderate activity was reported. When husbands had greater individual-level discordance, both wives ($\beta = -0.16$) and husbands ($\beta = -0.19$) had a faster rate of decline in moderate activity over time. Couple-level chronic condition discordance was not significantly linked to moderate activity.

Conclusions: These findings suggest the importance of promoting physical activity among individuals and couples managing complex chronic conditions.

Keywords

chronic illness; couples; marriage; multimorbidity; physical activity

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Chronic health conditions are highly prevalent among adults in the United States, with roughly half of those aged 45–64 and more than 80% of individuals aged 65 and older managing two or more conditions such as arthritis, diabetes, and hypertension (Buttorff et al., 2017). Multiple chronic conditions can be difficult to manage and may interfere with critical self-management behaviors including physical activity (Morris et al., 2011; Riegel et al., 2019). Although a causal link remains unclear, having multiple chronic conditions or greater disease burden is associated with lower levels of physical activity in middle and later life (Dhalwani et al., 2016; Martinez-Gomez et al., 2017; Vancampfort et al., 2017).

The presence of multimorbidity can be synergistic or subtractive in its consequences for engagement in healthy behaviors such as physical activity (Riegel et al., 2019). Older adults with multiple chronic health conditions may be especially likely to reduce their physical activity when they have a more complex range of self-management requirements. The concordant-discordant model of comorbidities proposes that multiple chronic conditions are more challenging when they require discordant self-management strategies that do not directly overlap (Bowling et al., 2017; Boyd & Fortin, 2010; Lagu et al., 2008; Piette & Kerr, 2006). Concordant conditions such as heart disease and hypertension share a common treatment emphasis on strategies to lower cardiovascular risk including adherence to a low-salt diet, which allows for more synergistic self-management. Discordant conditions such as heart disease and arthritis, however, involve a wider range of requirements that can increase self-management burden. For example, an individual with arthritis and heart disease may need to focus on activities to reduce arthritis pain such as physical therapy exercises, which might take time and energy away from some activities needed to manage heart disease such as following a low-salt diet. Although physical activity is beneficial for all chronic conditions, the wider range of self-management activities for discordant conditions often complicates decisions about which activities to prioritize (Boyd & Fortin, 2010; Piette & Kerr, 2006). Moreover, discordant conditions place a strain on limited time and resources that may contribute to poorer self-management over time (Lagu et al., 2008).

Physical activity is linked to key health outcomes in midlife and later life. For example, systematic reviews suggest that participation in exercise interventions of various types, intensities, and durations is linked to improved physical and cognitive function (Falck et al., 2019) and reduced depressive symptoms (Catalan-Matamoros et al., 2016). Other studies have found that regular and moderate physical activity is associated with a lower risk of cardiovascular disease (see Penedo & Dahn, 2005 for a review). Yet, little is known about how discordance in chronic conditions is linked to physical activity in middle and later life. More frequent self-reported physical activity may attenuate the increased risk of death related to multiple chronic conditions (Martinez-Gomez et al., 2017). As a consequence, it is crucial to enhance knowledge about aspects of multiple chronic conditions that may have adverse implications for physical activity.

Most middle-aged and older adults with one or more chronic conditions are married and have a spouse who is also chronically ill (Piette et al., 2010). Spouses are interdependent in their physical activity levels (e.g., Li et al., 2013; Monin et al., 2016) and show lasting mutual influences involving a variety of related health indicators including chronic conditions, pain intensity, functional limitations, and depressive symptoms (e.g., Hoppmann

et al., 2011; Polenick et al., 2017; Polenick et al., 2018; Thomeer, 2016). Consequently, it is important to consider discordance in chronic conditions at both the individual level (i.e., within individuals) and the couple level (i.e., between spouses), along with links to physical activity over time.

The link between discordant chronic conditions and physical activity is valuable to consider in a couple context for several reasons. Consistent with interdependence theory (Rusbult & Van Lange, 2008), couples who are married or living together typically share daily routines and influence one another's health habits. Specific to physical activity, individuals are more likely to start exercising rather than never exercise if their spouses start exercising or continually exercise (Falba & Sindelar, 2008). Additionally, spouses' perceptions of readiness to get more exercise are positively associated (Franks et al, 2012), and wives and husbands have higher levels of physical activity when their partners report having greater exercise self-efficacy (Ayotte et al, 2013). Physical activity within couples in which at least one partner has chronic conditions may also have implications for self-management. For instance, older adults with osteoarthritis have been found to achieve greater moderate activity and daily steps when their partners are more active (Martire et al., 2013).

Prior research suggests that greater chronic condition discordance within individuals and between spouses may be linked to initial levels of and changes in physical activity. A wife, for example, may manage both cancer and diabetes (i.e., own discordance) and help her husband manage both diabetes and arthritis (i.e., partner discordance). Her husband's arthritis also involves self-management strategies (e.g., managing pain and stiffness) that do not directly align with her own self-management plan (i.e., couple-level discordance). Such complexity may complicate self-management routines in the marriage, leading to distinct consequences for the wife's level of and rate of change in physical activity. Indeed, the presence of individual- and couple-level discordant chronic conditions has been linked to greater depressive symptoms over time (Polenick, Birditt, Turkelson, Bugajski, & Kales, 2019), suggesting that chronic condition discordance may impact both spouses' feelings and behaviors. Individual-level and couple-level discordant conditions have also been associated with higher levels of functional disability among both wives and husbands (Polenick, Birditt, Turkelson, & Kales, 2019), which indicates the need to understand potential behavioral pathways that might explain these associations.

Wives and husbands often vary in how they affect their own and their partners' health outcomes over time (e.g., Ayotte et al., 2013; Franks et al., 2012; Li et al.,2013; Polenick et al., 2017; Polenick et al., 2018; Thomeer, 2016). We posit that own and partner individual-level chronic condition discordance and couple-level chronic condition discordance may be more strongly linked to physical activity among wives than husbands. Relative to men, women have more family-related barriers to self-management (Rosland et al., 2010; Thomeer et al., 2015), potentially rendering them more susceptible to reductions in physical activity when they have greater chronic condition discordance. Women also provide more frequent health-related spousal assistance than do men (Monin & Clark, 2011; Thomeer et al., 2015). Caring for a spouse limits the available time to engage in physical activity (Fredman et al., 2006), perhaps especially in more intensive care situations (Burton et al., 1997). Spousal assistance may be more complicated and time-consuming when husbands

have greater chronic condition discordance and when there is greater chronic condition discordance between spouses. As such, middle-aged and older wives might be particularly vulnerable to reduced levels of moderate activity in the presence of greater individual- and couple-level chronic condition discordance.

Study Aims and Hypotheses

This study evaluated how the degrees of individual-level and couple-level discordance in chronic health conditions are linked to physical activity among middle-aged and older couples over 8-year period. Drawing from a nationally representative U.S. sample, we considered seven major chronic conditions that are strongly linked to morbidity and mortality (Fisher et al., 2005): arthritis, cancer, diabetes, heart disease, hypertension, lung disease, and stoke. We focused on moderate activity (e.g., walking at a moderate pace, dancing) because this type of physical activity is preferred and most common among older adults (Amireault et al., 2019; DiPietro, 2001). Furthermore, moderate activities such as walking are important targets in middle and later life because they are associated with a lower risk of cardiovascular disease and mortality (Shiroma & Lee, 2010), and these health benefits can occur independently of vigorous activities (e.g., running, swimming) that improve physical fitness (DiPietro, 2001). We hypothesized that wives and husbands would report lower initial levels of moderate activity and faster rates of decrease in moderate activity when they (actor effect) or their spouses (partner effect) had greater chronic condition discordance and when greater chronic condition discordance was present between spouses (couple-level effect). We predicted that these links would be found when controlling for factors linked to physical activity including sociodemographic characteristics such as age, minority status, and education (Rhodes et al., 2012; Loprinzi, & Davis, 2018; Notthoff et al., 2017), negative marital quality (Johnson et al., 2017), number of chronic health conditions (Dhalwani et al., 2016), and depressive symptoms (Catalan-Matamoros et al., 2016). We further predicted that these links would be stronger for wives than for husbands.

Methods

Sample and Procedures

We used a U.S. sample of 1,621 heterosexual married or cohabiting couples drawn from five waves (2006 – 2014) of the nationally representative Health and Retirement Study (HRS). Since 1992, the HRS has collected data biennially with response rates of over 80% at each wave. Participants received study information in the mail before each interview. Immediately prior to the interview, participants are read a confidentiality statement and orally consent to participate. Beginning in 2006, an enhanced face-to-face interview and self-administered psychosocial questionnaire (SAQ) with questions including the assessment of marital quality has also been conducted biennially with half of the panel respondents. The enhanced face-to-face interview and self-administered psychosocial questionnaire (SAQ) include different variables from the main HRS interviews. Given this, it is not possible to compare differences between these modes of data collection. Participants mail their completed SAQs to the main field office at the University of Michigan. Ethical approval was not required for this paper because we used publicly available secondary data with no individual identifiers.

In 2006, phone interviews and SAQs were completed with 7,635 participants. Of these, 4,936 (65%) were married and 256 (3%) had a cohabiting partner. A total of 4,692 (90%) had a partner who also completed a phone interview and SAQ in 2006. We removed 20 individuals in same-sex couples because the small sample did not permit meaningful comparisons with opposite-sex couples, and because the present study aimed to understand potential gender differences within couples. In total, 4,346 participants (2,173 couples) had complete data on all study variables in 2006. Of these, 3,390 individuals (in 1,695 couples) were married/cohabiting in at least two other waves and completed interviews between 2008 and 2014.

Of the 3,390 individuals, not all had complete data on study variables in at least two waves after baseline. We selected 3,242 individuals in which both partners (hereafter referenced as spouses) in the couple had complete data on study variables at baseline and in at least two later waves, which yielded an analytic sample of 1,621 couples (see Table 1). We included couples in which both partners reported any frequency of baseline moderate activity to maximize the generalizability of the sample. Most couples (96%) were married at baseline. We tested whether the 1,621 couples in this study were significantly different from the 552 married or partnered HRS couples (1,104 individuals) who were not included because they were not married/cohabiting in later waves or because one or both spouses did not have complete data in at least two waves after baseline. Individuals who were younger (wives: $t = -11.14$, $p < .001$; husbands: $t = -12.21$, $p < .001$), had more years of education (wives: $t = 4.54$, $p < .001$; husbands: $t = 4.30$, $p < .001$), reported fewer chronic conditions (wives: $t = -4.90$, $p < .001$; husbands: $t = -6.94$, $p < .001$), reported fewer depressive symptoms (wives: $t = -5.31$, $p < .001$), reported lower negative marital quality (wives: $t = -5.37$, $p < .001$; husbands: $t = -2.43$, $p = .015$), reported a lower degree of individual-level discordance (wives: $t = -3.03$, $p = .002$; husbands: $t = -3.33$, $p = .001$), reported a lower degree of couple-level chronic condition discordance (wives: $t = -2.50$, $p = .013$; husbands: $t = -2.60$, $p = .009$), and reported higher moderate physical activity (wives: $t = 5.20$, $p < .001$; husbands: $t = 6.79$, $p < .001$) were significantly more likely to be included in this study.

Measures

Moderate physical activity.—Participants reported on their perceived amount of moderate physical activity in their daily life with a single item asking: “And how often do you take part in sports or activities that are moderately energetic such as, gardening, cleaning the car, walking at a moderate pace, dancing, floor or stretching exercises?” Responses ranged from 1 = *every day*, 2 = *more than once a week*, 3 = *once a week*, 4 = *one to three times a month*, to 5 = *hardly ever or never*. This item was reverse coded so that higher scores indicated greater activity.

Time.—Time (year centered at baseline in 2006 and ranging from 2006 to 2014) was considered as a predictor to examine rate of change in physical activity across the 8-year period.

Individual-level and couple-level degree of chronic condition discordance.—Participants reported whether they had been diagnosed by a physician with seven major

chronic health conditions at each wave: arthritis, cancer, diabetes, heart disease, hypertension, lung disease, and stroke. These conditions were selected because of their prevalence and strong links to morbidity and mortality among older adults (Fisher et al., 2005). There were 21 possible pairs of chronic health conditions. Twelve board-certified geriatricians from a total of eight academic institutions (Harvard University, Indiana University, New York University, University of Colorado, University of Massachusetts, University of Michigan, University of Minnesota, and University of Pennsylvania) rated their perceptions of the degree to which each condition pair is concordant. We used Piette and Kerr's (2006) definition of concordant conditions as condition pairs that represent parts of the same overall pathophysiologic risk profile and generally have similar treatment goals and management strategies. Rather than categorize pairs of conditions as concordant or discordant, raters were asked to report their perceptions of the degree of concordance for each condition pair (1 = *not at all*, 2 = *a little*, 3 = *somewhat*, 4 = *quite a bit*, 5 = *a great deal*). Raters were told that our primary interest was in the extent to which each pair has similar treatment goals and self-management strategies. The raters had excellent inter-rater reliability on average (ICC = 0.97).

Given the high reliability across raters, we averaged the 12 raters' individual scores to create mean degree of concordance scores for each of the 21 condition pairs. We calculated scores for the degree of chronic condition discordance at the individual level (i.e., pairs of conditions occurring within individuals, such as a wife with both arthritis and diabetes) and at the couple level (i.e., pairs of conditions occurring between spouses, such as a wife with arthritis and a husband with diabetes). When both spouses had the same condition, the couple-level score for this pair of conditions was coded as a 5 to represent the highest concordance. To test our hypothesis that greater degrees of individual-level and couple-level chronic condition discordance are associated with lower physical activity, we reverse coded the scores such that higher scores reflected greater discordance. When a participant had zero or one condition, the individual-level discordance score was coded as zero because there was not one or more pairs of conditions within the individual to assess the degree of discordance within the individual. When both spouses had zero conditions or one spouse had one chronic condition and the other spouse had zero conditions, the couple-level discordance score was coded as zero because there was not one or more pairs of conditions between the spouses to assess the degree of discordance between the spouses. We averaged the mean scores for each pair of chronic conditions within individuals and between spouses to determine the total mean degree of chronic condition discordance at the individual and couple levels. For instance, if an individual reported having arthritis, diabetes, and heart disease, the individual-level discordance score averaged the discordance scores of all possible condition pairs within the individual (i.e., arthritis-diabetes, arthritis-heart disease, diabetes-heart disease). Similarly, if one spouse reported having arthritis and the other spouse reported having diabetes and heart disease, the couple-level discordance score averaged the discordance scores of all possible condition pairs between the spouses (i.e., arthritis-diabetes, arthritis-heart disease). Table 2 shows the 21 pairs of chronic conditions, their mean degree of discordance scores, and baseline prevalence at the individual and couple levels.

Covariates.—Covariates included baseline sociodemographic characteristics: age, minority status (1 = *racial/ethnic minority*, −1 = *non-Hispanic White*), and education in years. We also controlled for own and partner reports of baseline negative marital quality and number of chronic health conditions at each wave. Negative marital quality was assessed with four brief, but commonly used items that have been shown to produce responses that have good reliability and validity (Schuster et al., 1990; Walen & Lachman, 2000). Participants reported how often their spouse makes too many demands on them; criticizes them; lets them down when counted upon; and gets on their nerves from 1 (*a lot*) to 4 (*not at all*). Items were reverse coded and averaged (wives: $\alpha = 0.79$; husbands: $\alpha = 0.76$).

To account for the potential confounding effects of depressive symptoms on physical activity (Catalan-Matamoros et al., 2016), we controlled for own and partner depressive symptoms at each wave. Depressive symptoms were measured with the 8-item Center for Epidemiologic Studies Depression Scale (CES-D), which has generated responses with good reliability and validity among older adults (Karim et al., 2015).

Participants reported whether they had experienced the following symptoms much of the time during the past week: felt everything was an effort, had restless sleep, could not get going, felt depressed, felt lonely, felt sad, was happy, enjoyed life. The two positive items were reverse coded and the items were summed (wives: α range = 0.79 to 0.81; husbands: α range = 0.73 to 0.78). At baseline, depressive symptoms were significantly correlated with individual-level chronic condition discordance (wives: $r = .13$, $p < .001$; husbands: $r = .11$, $p < .001$), couple-level chronic condition discordance (wives: $r = .06$, $p = .010$; husbands: $r = .06$, $p = .022$), and moderate activity (wives: $r = -.24$, $p < .001$; husbands: $r = -.23$, $p < .001$).

Statistical Analysis

We estimated dyadic growth curve models using MIXED in SPSS version 24 (Kenny et al., 2006). The multilevel models included the recommended two levels for longitudinal dyadic data, with the lower level representing variability due to within-person repeated measures for wives and husbands and the upper level representing between-couple variability. Models estimated robust standard errors and allowed correlated errors among individuals and between spouses in a given wave using an unstructured correlation matrix.

Actor effects in this study represented how wives' and husbands' own chronic condition discordance was linked to their own physical activity, whereas partner effects represented how their spouses' chronic condition discordance was linked to their own physical activity. We also determined the couple-level effect of how couple-level chronic condition discordance was linked to physical activity. For both outcomes, Model 1 considered time and individual-level degree of chronic condition discordance as predictors and then Model 2 added couple-level degree of chronic condition discordance as a predictor. Step 1 examined how baseline individual-level (Model 1) and couple-level (Model 2) degrees of discordance were associated with initial levels of physical activity. Step 2 evaluated how baseline individual-level (Model 1) and couple-level (Model 2) degrees of discordance were linked to rates of change in physical activity over time. Interaction terms (time X actor degree of discordance and time X partner degree of discordance in Model 1; time X couple degree of

discordance was added in Model 2) tested whether baseline degree of chronic condition discordance was associated with rates of change in physical activity. Models controlled for age, minority status, education, and own and partner reports of baseline negative marital quality, time-varying depressive symptoms, and time-varying number of chronic conditions. Statistical significance was set at $p < .05$. For Steps 1 and 2, we assessed whether there was a significant difference between the fit of Model 1 relative to Model 2 by subtracting their −2 log likelihood estimations and examining differences on a chi-square distribution with degrees of freedom equaling the change in number of parameters (Singer & Willett, 2003).

We used a distinguishing variable to estimate separate intercepts and slopes for wives and husbands (1 = *wife*, −1 = *husband*). Continuous baseline predictors and covariates were grand mean centered and continuous time-varying covariates were person-level mean centered (Kenny et al., 2006). We evaluated significant interactions between time and degree of chronic condition discordance predicting moderate activity by estimating simple slopes at high (i.e., sample maximum score of 4.5) and low (i.e., sample minimum score of 0) discordance.

Results

Table 1 shows baseline characteristics and scores on study variables. We found that 25.4% of wives and 18.9% of husbands reported engaging in moderate physical activity less than once a week (i.e., one to three times a month or hardly ever or never), which suggests that a considerable proportion of the sample had low levels of physical activity.

Paired t tests and McNemar tests were used to test gender differences. Compared with husbands, wives were significantly younger, reported higher negative marital quality, had fewer chronic conditions, had more depressive symptoms, and reported lower moderate activity.

Table 2 displays the discordance scores for the 21 condition pairs and their individual- and couple-level baseline prevalence. Relative to husbands, wives had significantly lower rates of arthritis-heart disease, cancer-heart disease, diabetes-heart disease, heart disease-lung disease and heart disease-hypertension; but wives had significantly higher rates of arthritis-hypertension.

To identify sociodemographic characteristics linked to the degrees of individual- and couple-level chronic condition discordance, we tested associations with baseline age, minority status, and education. Older age was significantly linked to higher own discordance (wives: $b = 0.06$, $p < .001$; husbands: $b = 0.07$, $p < .001$), higher partner discordance (wives: $b = 0.06$, $p < .001$; husbands: $b = 0.05$, $p < .001$), and higher couple-level discordance (wives: $b = 0.05$, $p < .001$; husbands: $b = 0.05$, $p < .001$). More education was significantly linked to lower own discordance (wives: $b = −0.04$, $p = .012$) and lower partner discordance (husbands: $b = −0.05$, $p = .002$). Relative to non-Hispanic White participants, minority participants had higher partner discordance (wives: $b = 0.15$, $p = .027$).

Dyadic growth curve model parameters are shown in Table 3. On average, there was a significant linear decrease over time in moderate activity (wives: $b = −0.11$, $\beta = −0.12$, p

< .001, 95% CI [−0.13, −0.09]; husbands: $b = -0.12$, β = −0.14, $p < .001$, 95% CI [−0.14, −0.10]). The fit for Step 2 was significantly better than Step 1 in Model 1 (χ^2 (2) = 25.170, $p < .001$) and in Model 2 (χ^2 (3) = 28.059, $p < .001$). Thus, the moderating effects of degree of chronic condition discordance on the rate of change in moderate activity accounted for a significantly greater amount of variance beyond that explained by the main effects of time and degree of chronic condition discordance.

Individual- and Couple-Level Chronic Condition Discordance and Moderate Activity

Wives' moderate physical activity.—As shown in Table 3, when wives had a greater degree of individual-level chronic condition discordance ($b = -0.07$, β = −0.10, $p < .001$, 95% CI [−0.09, −0.04]) and when husbands had a greater degree of individual-level chronic condition discordance ($b = -0.03$, β = −0.04, $p = .008$, 95% CI [−0.06, −0.01]) at baseline, wives reported significantly lower initial moderate activity. There was a significant interaction between husbands' baseline degree of individual-level chronic condition discordance and time predicting wives' moderate physical activity ($b = -0.02$, β = −0.07, $p = .003$, 95% CI [−0.03, −0.01]). A simple slope analysis showed that when husbands had higher discordance, wives' moderate activity declined more rapidly ($b = -0.15$, β = −0.16, $p < .001$, 95% CI [−0.18, −0.12]) than when husbands had lower discordance ($b = -0.08$, β = −0.09, $p < .001$, 95% CI [−0.11, −0.06]). The interaction between wives' own baseline degree of discordance and time did not significantly predict wives' moderate activity. Baseline degree of couple-level chronic condition discordance was not significantly associated with wives' initial moderate activity, and the interaction between couple-level discordance and time did not significantly predict wives' moderate activity.

Husbands' moderate physical activity.—When husbands ($b = -0.06$, β = −0.09, $p < .001$, 95% CI [−0.09, −0.04]) and their wives ($b = -0.03$, β = −0.05, $p = .019$, 95% CI [−0.05, −0.00]) had a greater baseline degree of individual-level chronic condition discordance, husbands reported significantly lower initial moderate physical activity. There was a significant interaction between husbands' baseline degree of individual-level chronic condition discordance and time predicting husbands' moderate activity ($b = -0.02$, β = −0.07, $p < .001$, 95% CI [−0.03, −0.01]). A simple slope analysis showed that when husbands had higher discordance, their own moderate activity declined more rapidly ($b = -0.17$, β = −0.19, $p < .001$, 95% CI [−0.20, −0.14]) than when they had lower discordance ($b = -0.09$, β = −0.10, $p < .001$, 95% CI [−0.11, −0.06]). The interaction between wives' baseline degree of individual-level chronic condition discordance and time was not significantly linked to husbands' moderate activity. Baseline degree of couple-level chronic condition discordance was not significantly linked to husbands' initial moderate activity, and the interaction between couple-level discordance and time was not significantly associated with husbands' moderate activity.

Post Hoc Tests

To test whether one's own greater degree of individual-level chronic condition discordance was more strongly linked to physical activity when one's partner had a greater degree of individual-level chronic condition discordance, we added one interaction term in Model 1, Step 1 (actor degree of discordance X partner degree of discordance) and another additional

interaction term in Model 1, Step 2 (time X actor degree of discordance X partner degree of discordance). Neither of these interaction terms was significant.

We also tested whether the results changed with modeling maximum degree of individual-level and couple-level chronic condition discordance as predictors instead of mean degree of individual-level and couple-level discordance. The results did not change.

Discussion

This study extends the literature on multiple chronic conditions and physical activity by showing that chronic condition discordance among older couples is linked to lower moderate activity. For both wives and husbands, their own greater chronic condition discordance was significantly linked to lower initial moderate activity. Over and above these links, when their spouses had greater chronic condition discordance, wives and husbands reported significantly lower initial moderate activity. Notably, when husbands had greater chronic condition discordance, both husbands and their wives had a significantly faster rate of decline in moderate activity over time. As a whole, the present findings highlight the value of considering individual and couple patterns of chronic condition discordance, as well as long-term implications for physical activity in middle and later life.

Degree of Individual-Level Chronic Condition Discordance and Physical Activity

The finding that both wives and husbands reported significantly lower initial moderate activity when they had greater individual-level chronic condition discordance suggests that having little overlap in one's own illness self-management requirements may be linked to reductions in physical activity. This is in line with our hypothesis and with previous research demonstrating links between low levels of physical activity and multimorbidity (Dhalwani et al., 2016; Martinez-Gomez et al., 2017; Vancampfort et al., 2017). Of note, this association was independent of wives' and husbands' number of chronic health conditions. Consistent with the concordant-discordant model of comorbidities (Piette & Kerr, 2006), wives and husbands may have less available time and energy to dedicate to physical activity when there is greater chronic condition discordance that requires a wider range of self-management activities.

Wives and husbands also reported significantly lower initial moderate activity when their spouses had greater individual-level chronic condition discordance. Prior work has found that individuals' physical activity is significantly associated with their spouses' physical activity (e.g., Berli et al., 2018; Li et al., 2013). Considering the increase in incident chronic conditions and concomitant decrease in physical activity with age (Dhalwani et al., 2016), a spouse's chronic condition discordance may hinder his or her own physical activity and, in turn, reduce activity levels within the couple.

Husbands' greater chronic condition discordance was also significantly associated with steeper declines in moderate activity over time for both husbands and their wives. These findings are in line with our hypothesis and indicate that more complex combinations of chronic health conditions among husbands have adverse implications for moderate activity levels within the couple. When husbands have greater chronic condition discordance, they

may engage less often in moderate activity as their conditions become more complex and severe with age. At the same time, given wives' more frequent provision of health-related spousal support and caregiving relative to husbands (e.g., Monin & Clark, 2011), wives likely provide an increasing amount of spousal care that ultimately interferes with their time to engage in moderate activity (Burton et al., 1997; Fredman et al., 2006; Queen et al., 2019).

Counter to our hypothesis, wives' greater chronic condition discordance was not associated with accelerated declines in moderate activity for wives or husbands. This indicates that wives are generally able to sustain their own physical activity levels when they face more complicated patterns of multimorbidity, which might also help to preserve husbands' levels of physical activity. These findings are encouraging and underscore the potential for resilience among couples when wives manage complex health problems.

Degree of Couple-Level Chronic Condition Discordance and Physical Activity

We predicted that greater couple-level chronic condition discordance would be linked to significantly lower initial moderate activity and significant declines in moderate activity over time; but this was not found to be the case. Therefore, on average, midlife and older couples may maintain their physical activity levels even though they manage chronic conditions with little direct overlap between spouses. This might suggest that most couples are able to adapt to this discordance as they age, thereby protecting themselves from worsening trajectories of physical activity that pose additional health threats. For instance, a wife with arthritis and a husband with lung disease may be able to sustain their own activity levels despite differences in illness self-management needs within the couple such that neither partner shows an accelerated rate of decline in moderate activity.

Limitations and Future Directions

We acknowledge seven main limitations. First, chronic health conditions and physical activity were self-reported, which may introduce bias. Second, we were limited to seven major chronic health conditions that are regularly assessed in the HRS. This may have underestimated the degree of individual- and couple-level chronic condition discordance. We also lacked information to differentiate across types of conditions (e.g., arthritis, cancer) that can be highly heterogeneous and may differ in their implications for physical activity. Third, the discordance scores were created from the perspective of health care providers and may be different from how individuals view discordance in their own illness self-management. Fourth, the assessment of moderate activity in the HRS does not closely align with established guidelines on the duration and intensity of physical activity (e.g., Kikuchi et al., 2018). Moreover, some activities included in this measure (e.g., stretching, gardening) may reflect lower-intensity activities. Future studies should use more precise measures of moderate activity that correspond with established guidelines. Fifth, although there were significant differences between wives and husbands in baseline characteristics (e.g., number of chronic conditions, moderate activity), these differences appear small and may not be clinically significant. Additionally, the effect sizes in this study (standardized coefficients ranging from −0.04 to −0.19) were relatively small and may not have clinical significance. Even small effects, however, may have a substantial public health impact (Rutledge & Loh,

2004). It is worth noting that about one in four wives and nearly one in five husbands in this sample engaged in moderate activity less than once a week at baseline. Sedentary behavior is linked to a multitude of health risks (Rhodes et al., 2012), and so any further decrease in activity may have important health implications.

Sixth, several sample characteristics limit the generalizability of this study. Couples in this study were mostly non-Hispanic White, limiting generalizability to more racially and ethnically diverse couples. Because of the small number of same-sex couples and our focus on gender differences within couples, this study was also limited to heterosexual couples. Future work is needed to understand how the findings may be similar and different among same-sex couples. In addition, there were significant differences in several sociodemographic and health characteristics between couples in this study and couples who were excluded due to missing data. Couples in this study, for example, were younger, had fewer chronic conditions and fewer depressive symptoms, had lower individual-level and couple-level chronic condition discordance, and reported higher moderate physical activity than those who were excluded. As such, the findings may not generalize to couples who have greater difficulty in managing their health. For instance, older adults with a higher number of chronic conditions may have poorer care coordination and outcomes than their healthier peers. Finally, as is the case with all research studies, the findings may be confounded by unmeasured variables. Nonetheless, the present study lays the groundwork for future research to gain more complete knowledge of individual- and couple-level discordance in chronic conditions and related links to physical activity.

Future research should consider more proximal processes that might partly explain the associations in this study. Intensive repeated measures designs (e.g., ecological momentary assessments) that elucidate daily associations between the management of greater chronic condition discordance and physical activity within couples would be informative, particularly regarding condition combinations that have high discordance at the individual and couple levels (e.g., arthritis-heart disease, arthritis-hypertension). Future work would also benefit from using objective indicators of physical activity (e.g., accelerometers or pedometers, in-home sensors) that may capture more nuanced differences in activity patterns. In addition, it will be important to pinpoint factors that buffer or exacerbate associations between greater individual- and couple-level chronic condition discordance and physical activity. For instance, individual characteristics (e.g., depressive symptoms) and couple characteristics (e.g., empathy, communication, intimacy, commitment, marital quality) may moderate the links between chronic conditions discordance and physical activity among older couples. This work will help to identify individuals and couples in greatest need of clinical support and resources to improve and maintain physical activity, along with modifiable characteristics that can be targeted during physical activity interventions.

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Table 1

Baseline Characteristics and Scores on Study Variables for Wives and Husbands

	Wives			Husbands		
Variable	***M***	***SD***	***Range***	***M***	***SD***	***Range***
Age	55.4***	9.2	22–81	58.7	8.9	23–84
Education in years	13.1	2.7	0–17	13.2	3.1	0–17
Negative marital quality[a]	2.0**	0.7	1–4	1.9	0.6	1–4
Depressive symptoms[b]	1.1***	1.7	0–8	0.9	1.5	0–8
Number of chronic health conditions	1.7**	1.2	0–7	1.8	1.3	0–6
Individual-level mean degree of chronic condition discordance[c]	1.9	1.9	0–4.5	1.9	1.8	0–4.5
Couple-level mean degree of chronic condition discordance[d]	2.0	1.5	0–4.5	2.0	1.5	0–4.5
Moderate physical activity[e]	3.3***	1.3	1–5	3.5	1.1	1–5
		%			%	
Minority status[f]		11.7			11.8	
Frequency of moderate physical activity						
Every day		10.8			11.8	
More than once a week		49.7			52.8	
Once a week		14.1			16.5	
One to three times a month		8.4			7.5	
Hardly ever or never		17.0			11.4	

Note.

[a]Mean of four items ranging from 1 = *not at all* to 4 = *a lot*.

[b]Sum of eight symptoms.

[c]Mean of all possible pairs of conditions within individuals ranging from 1 = *not at all* to 5 = *a great deal*.

[d]Mean of all possible pairs of conditions between spouses ranging from 1 = *not at all* to 5 = *a great deal*.

[e]One item ranging from 1 = *hardly ever or never* to 5 = *every day*.

[f]1 = *racial/ethnic minority*, −1 = *non-Hispanic White*.

N = 1,621 couples.

*Significant gender difference at $p < .05$.

**Significant gender difference at $p < .01$.

***Significant gender difference at $p < .001$.

Table 2

Degree of Chronic Condition Discordance Scores and Prevalence of Chronic Condition Pairs at the Individual and Couple Level Among Wives and Husbands at Baseline

	Degree of Discordance		Wife	Husband	Couple
Pairs of Conditions	***M***	***SD***	***%***	***%***	***%***
Heart Disease-Hypertension	1.3	0.7	10.9***	16.2	21.1
Diabetes-Heart Disease	1.5	1.0	4.3**	6.5	7.0
Heart Disease-Stroke	1.5	1.0	1.5	2.2	1.7
Hypertension-Stroke	1.5	1.0	2.8	3.1	4.5
Diabetes-Stroke	1.8	1.1	1.3	1.4	1.6
Diabetes-Hypertension	1.9	1.0	12.3	14.4	17.3
Heart Disease-Lung Disease	2.8	0.5	1.7*	2.9	3.4
Hypertension-Lung Disease	3.8	0.7	4.3	4.3	7.8
Arthritis-Heart Disease	4.0	0.9	12.0***	17.6	23.6
Arthritis-Diabetes	4.1	0.8	11.1	12.2	19.6
Arthritis-Hypertension	4.1	0.8	36.4**	31.7	49.1
Cancer-Diabetes	4.1	0.8	1.7	2.3	3.8
Cancer-Lung Disease	4.1	0.9	1.5	1.1	1.8
Cancer-Heart Disease	4.2	0.6	2.3**	4.6	5.6
Lung Disease-Stroke	4.2	0.7	0.5	0.4	0.7
Arthritis-Lung Disease	4.3	1.0	5.2	5.4	10.0
Cancer-Stroke	4.3	0.8	0.5	0.9	1.2
Diabetes-Lung Disease	4.3	0.7	1.3	1.2	2.8
Arthritis-Cancer	4.4	1.2	7.6	9.4	15.9
Arthritis-Stroke	4.4	0.8	2.5	3.0	5.0
Cancer-Hypertension	4.5	0.5	6.5	8.0	15.1

Note. Twenty-one possible pairs of discordant conditions are presented to show the mean degree of discordance for each condition pair as well as the baseline prevalence of each pair at the individual level (i.e., within wives and husbands) and the couple level (i.e., between wives and husbands).

N = 1,621 couples.

*Significant gender difference at $p < .05$.

**Significant gender difference at $p < .01$.

***Significant gender difference at $p < .001$.

Table 3

Dyadic Growth Curve Model Examining the Effects of Individual- and Couple-Level Discordant Conditions on Wives' and Husbands' Moderate Physical Activity

Parameter	Wives				Husbands			
	Model 1		Model 2		Model 1		Model 2	
	b	*SE*	*b*	*SE*	*b*	*SE*	*b*	*SE*
Step 1								
Time	−0.11***	0.01	−0.11***	0.01	−0.12***	0.01	−0.12***	0.01
Age	−0.01***	0.00	−0.01**	0.00	−0.01**	0.00	−0.01*	0.00
Minority status	−0.12**	0.04	−0.12**	0.04	−0.05	0.03	−0.05	0.03
Education in years	0.07***	0.01	0.07***	0.01	0.04***	0.01	0.04***	0.01
Actor Negative marital quality	0.01	0.04	0.01	0.04	−0.06	0.04	−0.06	0.04
Partner Negative marital quality	−0.11**	0.04	−0.11**	0.04	−0.10**	0.04	−0.10**	0.04
Actor Depressive symptoms	−0.03**	0.01	−0.03**	0.01	−0.06***	0.01	−0.06***	0.01
Partner Depressive symptoms	−0.01	0.01	−0.01	0.01	−0.03**	0.01	−0.03**	0.01
Actor Number of chronic conditions	0.00	0.03	0.00	0.03	−0.01	0.03	−0.01	0.03
Partner Number of chronic conditions	0.07*	0.03	0.07*	0.03	−0.01	0.03	−0.01	0.03
Actor Total mean degree of chronic condition discordance	−0.07***	0.01	−0.06***	0.01	−0.06***	0.01	−0.06***	0.01
Partner Total mean degree of chronic condition discordance	−0.03**	0.01	−0.03*	0.01	−0.03*	0.01	−0.02	0.01
Couple Total mean degree of chronic condition discordance			−0.03	0.02			−0.03	0.02
−2 Log Likelihood	44462.215		44457.587					
Change in −2 Log Likelihood (Model 1 → Model 2)			4.628					
Step 2								
Time X Actor Total mean degree of discordance	−0.00	0.00	−0.00	0.01	−0.02***	0.00	−0.02**	0.01
Time X Partner Total mean degree of discordance	−0.02**	0.01	−0.01**	0.01	−0.00	0.00	−0.00	0.00
Time X Couple Total mean degree of discordance			−0.00	0.01			−0.01	0.01
−2 Log Likelihood	44437.045		44429.528					
Change in −2 Log Likelihood (Step 1 → Step 2)	25.170***		28.059***					

Note. Estimates are presented from each step in the analysis.

$N = 1{,}621$ couples.

* $p < .05$.

** $p < .01$.

*** $p < .001$.