Functional Disability and Depressive Symptoms in Middle-Aged and Older Couples: A Dyadic Examination of Bidirectional Influences and Temporal Dynamics

Abstract

Objectives: This study examines the bidirectional influences between functional disability and depressive symptoms in middle-aged and older couples, emphasizing the temporal dynamics and co-development of partners' experiences.

Methods: Longitudinal data were drawn from the *Health and Retirement Study* (2002-2020), focusing on married couples (N = 4,109 couples). Dyadic cross-lagged panel models and latent trajectory analyses were employed.

Results: Functional disability has a stronger influence on depressive symptoms than the reverse. Spouses' disability trajectories were synchronized with similar baseline levels and rates of change, but synchrony did not predict depressive symptoms. Husbands' disability disproportionately affected wives' mental health, not vice versa.

Conclusions: The findings elucidate the directionality underlying the relationship between depressive symptoms and functional limitations. Couples' functional disability development is synchronous. Tailored and targeted disability preventive interventions may have mental health benefits for both partners.

Keywords: dyad health, functional disability, depressive symptoms, couples, bidirectional

Introduction

The Functional Disability – Depressive Symptoms Link

Disability and depression are prevalent conditions in later life. Prior studies have identified disability as a risk factor for depression, while depression can result in or intensity functional disability. Emerging studies have advanced to examine the bidirectional and reciprocal links between disability and depression. Yet, this body of research has predominately focused on individuals rather than couples. Consequently, the interplay between disability and depression within couples remains understudied. This study aims to bridge this gap by investigating the bidirectional relationships between depressive symptoms and disability within couples spanning an 18-year period. Leveraging dyadic analytical techniques, this study examined the temporal dynamics and co-development of these constructs, advancing a nuanced understanding of the bidirectional disability-depression link within marital contexts.

Epidemiological studies of depression have consistently identified functional disability, often operationalized as the limitations in activities of daily living (ADLs) and instrumental activities of daily living (IADLs), as a risk factor for depression (Cole & Dendukuri, 2003). Two potential explanations have been proposed for why functional disability predicts depression. The first posits that disability is a prodromal indicator of underlying physical, cognitive, or emotional dysfunctions that leads to the onset of depression (Bruce, 2001). The second, grounded in the stress process theory, suggests that disability acts as a stressor, which could be acute (e.g., a new disability) or chronic (e.g., an ongoing disability). This stressor can disrupt daily life and lead to psychological distress. Depression could also be a part of the emotional response to the disability event (Bruce, 2001).

Conversely, longitudinal population-based studies have demonstrated that depression can cause or exacerbate functional disability (Beekman et al., 2002; Kong et al., 2019). One study reported that depression increased the risk for incident disability by 67% in ADLs and 73% in mobility (Rai et al., 2012). Even mild depressive symptoms can cause long-term disability (Murphy et al., 2016). Based on the overwhelming evidence, the World Health Organization (WHO) reports that depression is the leading cause of disability as measured by years lived with disability (World Health Organization, 2017). Several hypotheses have been proposed and examined to explain why depression leads to disability. One group of hypotheses link specific aspects of depression, such as fatigue, sleep disturbance, and lack of motivation, to unhealthy behaviors and poor daily functioning (Bruce, 2001). Others have highlighted the pathways between depression and chronic physical conditions such as diabetes and cardiovascular diseases, which, in turn, can lead to functional impairments that progress to disability (Egede, 2004; Fiore et al., 2015). In addition, the disablement process considers depression as an intra-individual risk factor for the progression from pathology to disability (Verbrugge & Jette, 1994).

Research has increasingly moved beyond the unidirectional relations to examine the reciprocal relationship between depression and disability to clarify the temporal and directional features of this relationship (Chen et al., 2012). One of the first studies of this kind, conducted in the Netherlands, reported that the disability-depression could be decomposed into three parts: (a) a strong simultaneous association between changes in disability and depressive symptoms, (b) a weaker lagged effect of changes in depression on disability, and (c) a weak correlation between the stable trait components of depression and disability (Ormel et al., 2002). In a Taiwanese study, Chen et al. (2012) confirmed the bidirectional temporal relationship using parallel latent growth curve modeling. They also reported that rates of progression (slopes) in disability and

depression influenced each other. Collectively, these studies suggest that disability and depression are mutually reinforcing over time, with disability having a stronger and more immediate impact on depressive symptoms, while the impact of depression on disability is weaker and more delayed.

The Need for a Dyadic Perspective

However, this body of research examining bidirectional relationships is confined to the individual level only. The directionality of these associations within married partners remains poorly understood. Marital relationships provide an imperative social context for health and aging (Kiecolt-Glaser & Wilson, 2017). A growing body of research consistently documents the interdependence of married partners' physical and psychological well-being, demonstrating how one partner's health-related issues exert significant cascading effects on the other partner, especially in the context of physical decline and chronic illnesses (Falconier et al., 2015). For instance, couples' health behaviors (Pauly et al., 2020), psychological distress (Lu & Shelley, 2019), and health conditions (Meyler et al., 2007) are often interdependent and covary over time. Such marital interdependence underscores the necessity to incorporate the marital context when investigating health dynamics.

The marital context introduces unique pathways through which one's functional disability impacts the other's depressive symptoms, and vice versa. First, the caregiving burden presents a primary mechanism. Specifically, disability in one spouse may require the other to assume caregiving responsibilities, which can lead to physical strain, stress, and depressive symptoms over time (Han et al., 2021; Pinquart & Sörensen, 2011). Depressive symptoms, on the other hand, can constrain one's ability to provide instrumental support, potentially exacerbating one's partner's physical decline (Stafford et al., 2019). Second, the shared resources hypothesis posits

that spouses often share common living environments, financial resources, and social networks (K. Smith & Zick, 1994). These shared resources can affect health behaviors, coping styles, and access to resources, which can produce either protective or damaging effects on husbands' and wives' mental health and physical functioning in mutually reinforcing ways. These mechanisms highlight the dynamic interplay between spouses, calling for dyadic analytical approaches to clarify actor and partner effects and the temporal directionality.

Two Important Research Gaps

A thorough review of the literature identified two knowledge gaps. First, although the bidirectional relationship between depression and disability has been examined at the individual level, the temporal dynamics and directionality underlying this relationship within the context of married couples remain underexplored. Clarifying the directionality and temporal dynamics among marital dyads is critical not only for advancing our theoretical knowledge but also for providing valuable insights for the development of couple-level interventions (i.e., which issue to tackle first in the intervention).

Second, the present study aims to move beyond the intra-individual approach to exploring the bidirectional associations and temporal dynamics underlying the disability-depression link in marital dyads. Undertaking the dyadic investigation is important. The linked lives perspective from life course theory emphasizes that partners' experiences are interconnected, and one spouse's circumstances can directly influence the other's well-being (Carr, 2018; Elder, 1994). Integrating the linked lives perspective with existing evidence linking disability and depression, we expect that individuals' disability levels, both baseline levels and rate of change, will influence not only their own depressive symptoms but those of their spouses, and vice versa. Existing dyadic studies further reveal gendered partner effects. Generally, studies

have reported that women are more likely to be affected by their husbands' health conditions given their socialized caregiving roles (Pinquart & Sörensen, 2005). The dyadic design (i.e., actor and partner effects) of this study enables us to capture these gendered dynamics.

The Present Study

To address these gaps and extend literature, this study is among the first to examine the bidirectional relationships between depressive symptoms and disability and how these relationships are intertwined within couples. Drawing from population-based data spanning over an 18-year period, we investigated two research aims as follows. It is important to note that ADLs and IADLs capture different levels of dependence: ADLs encompass basic self-care tasks, while IADLs involve more complex independent living activities that demand higher cognitive and social abilities (Verbrugge & Jette, 1994). As such, they may affect mental health in distinct ways. Therefore, instead of combining them into a composite score, we analyzed them separately for each research aim.

Aim 1: To investigate the temporal directionality of the association between functional disability and depressive symptoms among married couples (i.e., whether functional disability predicts depressive symptoms or whether depressive symptoms predict functional disability or both). **Aim 2:** Building on results from Aim 1 to examine how the developmental trajectories of the identified predictor—as well as the between-spouse synchronization of these developmental trajectories—are associated with the identified outcomes. Investigating trajectories is critical because it extends beyond the link established at a specific time point to advance the understanding of the over-time development of identified predictors (e.g., faster versus slower progression) as well as how these developments relate to the identified outcomes. This approach aligns with the aging process, which focuses not only on disability or mental health at a given

time point but also on the pace and patterning of change over time (Moffitt et al., 2017). Additionally, modeling the between-spouse synchronization allows us to investigate how two partners' co-development (e.g., synchronized versus unsynchronized) in identified predictors links to outcomes above and beyond individual-level changes. Such investigation aligns with the linked lives of two spouses in couple relationships (Kiecolt-Glaser & Wilson, 2017). Therefore, the findings of Aim 2 can yield insightful guidelines for practices tailored to individuals' trajectories (e.g., targeting those experiencing faster progression) while leveraging couple-level co-development (e.g., joint progression).

In sum, this study reveals how disability and depression in married couples are deeply interconnected over 18 years, highlighting the temporal dynamics and co-development of partners' experiences. Such dyadic, dynamic approaches allow us to uncover complexities that are not otherwise apparent in studies focused solely on individual partner and/or static experiences at a certain time point (Carr, 2018).

Methods

Data and Sample

This study utilized data from the RAND Health and Retirement Study (HRS) longitudinal dataset, spanning 2002 to 2020. HRS is a nationally representative panel survey of adults over age 50 in the United States, along with their spouses, conducted biennially. It provides comprehensive information on individuals' socioeconomic status, health, and family dynamics, making it an invaluable resource for understanding aging and related phenomena. We included participants who had complete data on key study variables at the baseline survey in 2002. To ensure the integrity of dyadic analysis, we further verified that couples remained classified as a single economic unit by HRS throughout the study period (2002–2020). Following this selection

process, we constructed a dyadic dataset, comprising matched data from both spouses within each couple (See Figure 1). The final sample included 3,972 dyads.

Figure 1 goes here.

Measures

Depressive Symptoms

Depressive symptoms were measured using the Center for Epidemiologic Studies Depression (CESD) scale, drawing data from HRS 2002–2020. This measure included six negative indicators—frequent experiences of depressive symptoms, feelings of everything being an effort, restless sleep, loneliness, sadness, and difficulty getting going—along with two positive indicators: feelings of happiness and enjoyment of life. Positive indicators were reverse coded for consistency. Responses were summed to produce a total CESD score, ranging from 0 to 8, with higher scores reflecting greater severity of depressive symptoms. For CESD, the analytical sample completed an average of 6.77 waves (SD = 3.04) between 2002 and 2020 (see Supplementary Table B).

Functional Disability

Limitations Activities of Daily Living (ADLs) were measured by participants' self-reported difficulty in six domains: bathing, dressing, eating, getting in and out of bed, walking across a room, and using the toilet (1 = *yes*, 0 = *no*). Each reported difficulty contributed one point to the summary score, with higher scores indicating greater difficulty in performing daily living tasks. Participants also indicated whether they had any difficulty with each of the following Instrumental Activities of Daily Living (IADLs): using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals. A sum score was created ranging from 0 to 5, with higher scores indicate greater difficulty in performing instrumental daily tasks. For ADL and IADL, the analytical sample completed an average of 7.01 (SD = 2.94)

and 7.01 (SD = 2.94) waves, respectively, between 2002 and 2020 (also see Supplementary Table B).

Covariates

Baseline individual-level demographic, health, and household-level characteristics measured in 2002 were included as covariates in the analysis. Individual-level demographic variables included age (continuous, in years), race (a four-category variable that were transformed into three dummy codes: Black, Other, and Hispanic versus non-Hispanic White), educational attainment (continuous, measured in years), and retirement status (0 = *no*, 1 = *yes*). Individual-level health variables included: the number of chronic conditions (sum of conditions including high blood pressure, diabetes, cancer, lung disease, heart problem, stroke, psychological problem, and arthritis, ranging from 0 to 8) and memory performance. Memory was assessed as a summary score of the immediate and delayed word recall (continuous, ranging from 0 to 20).

Household-level characteristics included the length of marriage (continuous, calculated as the average of the husband's and wife's self-reported length of current marriage), household size (continuous, measured as the number of individuals living in the household), and household income (calculated as the sum of respondent and spouse earnings, employer pension and annuities, Social Security benefits, other government transfers, household capital income, and other income, log-transformed for analysis).

Analytic Procedures

We proceeded with analyses in Mplus 8.8. Missing values in the present study were handled using multiple imputations with auxiliary variables (all assessed at baseline), and five imputed data were generated (Nicholson et al., 2017). The two research aims are investigated as follows.

Aim 1: Directionality in Associations Between ADL/IADL and Depressive Symptoms (2002-2020)

We conducted actor-partner interdependence, cross-lagged panel models (APIM-CLPM) to test the uni- versus bi-directional associations (1) between husbands' and wives' ADL and depressive symptoms, and (2) between husbands' and wives' IADL and depressive symptoms (Fallis et al., 2016). A two-level structural equation model (SEM) approach was implemented to account for 10 waves (from 2002 to 2020) nested within each couple (Yu et al., 2015). As seen in Figure 2, autoregressive pathways were specified from the same variable at an earlier wave (t) to the following wave (t+1). Cross-lagged paths were specified from one variable at an earlier wave to another variable at the next wave (e.g., from husbands' ADL at wave t to husbands' or wives' depressive symptoms at wave t+1, respectively). Covariance among variables at the same wave was also estimated. Results of cross-lagged effects allowed the determination of whether longitudinal associations occur in one or both directions (i.e., unidirectional vs. bidirectional). If longitudinal associations happened in both directions, we tested the relative strength of the cross-lagged paths, and temporal order was determined according to the statistically significantly stronger cross-lagged path (Schuurman et al., 2016). To ensure the comparability of cross-lagged paths, ADL, IADL, and depressive symptoms were all linearly transformed into 0-1 (e.g., transformed depressive symptoms score = original depressive symptoms score ÷ 8). For an accurate estimation of associations of research interest, we controlled for covariates (centered around grand mean to ease interpretation; Lewis & Yoneda, 2021) listed in the measures section.

Figure 2 goes here.

Aim 2: Synchronized Developmental Trajectories of Predictor* (2002-2020) *to Outcome in 2020

The investigation of Aim 2 was built upon Aim 1, and the predictors and outcomes were identified according to temporal order reflected in statistically significant cross-lagged paths (or statistically significantly stronger ones if cross-lagged paths occurred in both directions). Temporal orders from ADL/IADL to depressive symptoms indicate ADL/IADL as predictor and depressive symptoms as outcome or, vice versa, temporal order from depressive symptoms to ADL/IADL suggested depressive symptoms as predictor and ADL/IADL as outcome.

Following Lewis & Yoneda (2021), the synchronized developmental trajectories of the identified predictors across 2002-2020 were modeled in dyadic growth models. Intercepts, slopes, and occasion-specific residuals (OSRs) were allowed to covary between the two spouses in a relationship. For each spouse, the intercept reflected the baseline level of the predictor; the slope reflected the rate of change in the predictor across time; OSRs reflected the deviation from the values expected given the initial level and change across time. Between the two spouses, the covariance of intercepts and the covariance of slopes represent the extent to which they exhibited similar baseline levels and change over time. The OSR covariance indicated the extent to which they similarly deviated from their expected values on a specific occasion. Covariance values were converted to Pearson correlation to ease interpretation.

We then extracted the following parameters for the synchronized developmental trajectories of the identified predictors: each spouse's intercepts, each spouse's slope, and the between-spouse covariance in intercept, slope, and OSR (Lewis & Yoneda, 2021). To answer the question proposed in Aim 2, we regressed the outcome (measured in 2020) on these extracted parameters, while also controlling covariates listed in the measures section and the outcome variable assessed at baseline. To ensure the comparability of pathway coefficients, we followed Lewis and Yoneda (2021) and standardized parameters extracted from the synchronized developmental trajectories, covariates, and outcome variables assessed at baseline.

Results

Descriptive Characteristics

Table 1 summarizes the descriptive statistics of study variables. Compared to husbands, wives consistently reported more depressive symptoms on average across all waves from 2002 to 2020, with statistically significant differences ($p < 0.001$). The mean CESD scores ranged from 1.11 (*SD* = 1.71) to 1.29 (*SD* = 1.83) in the total sample. For ADLs and IADLs from 2002 to 2020, mean scores increased over time, indicating worsening functional limitations. Gender differences in ADLs were significant in 2002 ($p < 0.001$) but diminished in later waves. IADL differences between genders were not statistically significant.

Baseline characteristics indicate that the sample's average age was 66.36 years old (*SD* = 9.03), with wives being younger on average than husbands (64.65 < 68.07, $p < 0.001$). The sample reported an average of 12.69 years of education (*SD* = 3.01). The majority of husbands (*n* =3,326, 83.7%) and wives (*n* =3,312, 83.4%) were non-Hispanic White, followed by smaller proportions of non-Hispanic Black, Hispanic, and other non-Hispanic participants. A higher percentage of husbands were retired (*n* = 2,661, 67.0%), compared to 44.1% (*n* = 1,750) of wives. Husbands reported a greater number of chronic conditions (1.77 > 1.61, $p < 0.001$) and lower memory scores (9.55 < 11.02, $p < 0.001$) compared to wives.

Participants reported an average household size of 2.40 (*SD* = 0.89), ranging from 2 to 12 members, and an average marriage length of 38.07 years (*SD* = 14.37), ranging from 1 to 74.7 years. Household income showed substantial variability, with a mean of $67,258 (*SD* = $80,858).

Table 1 is here.

Aim 1: Directionality in Associations Between ADL/IADL and Depressive Symptoms (2002-2020)

Table 2 displays the results of the two-level APIM-CLPMs to test the directionality in the associations between ADL/IADL and depressive symptoms. As seen in Panel A, we found four cross-lagged paths from ADL at wave t to depressive symptoms at wave t + 1. Two cross-lagged paths emerged from depressive symptoms at wave t to ADL at wave t + 1. Overall, we found more evidence for the temporal order from ADL to depressive symptoms (four statistically significant pathways) than for the temporal order from depressive symptoms to ADL (two statistically significant pathways), suggesting the plausibility of specifying ADL as a predictor and depressive symptoms as an outcome in Aim 2 analyses.

Additionally, Wald test comparisons were conducted on two pairs of cross-lagged paths that were statistically significant in both directions. Wald test comparison was a statistical method used to evaluate whether the pathway parameters in each pair significantly differed from each other by calculating a test statistic based on the ratio of the parameter discrepancy to the pooled standard error. **Pair 1** included the path from husbands' ADL at wave t to wives' depressive symptoms at wave t+1 and the path from wives' depressive symptoms wave t to husbands' ADL wave t +1. The statistical equivalence of these two paths indicated bidirectionality between husbands' ADL and wives' depressive symptoms. **Pair 2** included the path from wives' ADL at wave t to husbands' depressive symptoms at wave t + 1 and the path from husbands' depressive symptoms at wave t to wives' ADL at wave t+1. The statistical equivalence of these two paths indicated bidirectionality between wives' ADL and husbands' depressive symptoms.

As shown in Panel B, four cross-lagged paths were identified from IADL at wave t to depressive symptoms at wave t + 1. Two cross-lagged paths emerged from depressive symptoms

at the prior wave to IADL at the next wave. Overall, we found more evidence for the temporal order from IADL to depressive symptoms (four pathways) than from depressive symptoms to IADL (two pathways), suggesting the plausibility of specifying IADL as a predictor and depressive symptoms as an outcome in Aim 2 analyses.

Furthermore, we again conducted Wald test comparisons on two pairs of cross-lagged paths that were statistically significant in both directions. **Pair 1** included the path from husbands' IADL at wave t to wives' depressive symptoms at wave t + 1 and the path from wives' depressive symptoms at wave t to husbands' IADL at wave t + 1. The statistical equivalence of two paths in pair 1 indicated bidirectionality between husbands' IADL and wives' depressive symptoms. **Pair** 2 included the path from wives' IADL at wave t to husbands' depressive symptoms at wave t + 1 and the path from husbands' depressive symptoms at wave t to wives' IADL at wave t + 1. The statistical equivalence of two paths in pair 2 indicated bidirectionality between wives' IADL and husbands' depressive symptoms.

Table 2 is here.

Aim 2: Synchronized Developmental Trajectories of Predictor (2002-2020) to Outcome in 2020

Following the analyses in Aim 1, we specified ADL and IADL as predictors in subsequent analysis. The synchronized developmental trajectories of ADL (Panel A) and IADL (Panel B) from 2002 to 2020 are presented in Table 3. Husbands' and wives' ADL and IADL increased over time. The statistically significant variability in the intercept and slope parameters indicated notable across-couple variations in initial levels and changes over time. For between-spouses similarity in intercepts and slopes, the statistically significant Pearson's *r*'s revealed concordance such that the two spouses started with similar levels and experienced similar changes over time for both ADL and IADL. The OSRs were also significantly correlated for

ADL and IADL, suggesting that husbands' and wives' fluctuations from expected ADL/IADL levels were also synchronized.

Table 3 is here.

Table 4 displays how the synchronized developmental trajectories of ADL and IADL across from 2002 to 2020 predicted depressive symptoms in 2020. Husbands' slope in both ADL and IADL, and wives' slope in IADL predicted husbands' depressive symptoms, with faster increases being related to more depressive symptoms in 2020. The slopes of both spouses in ADL, as well as wives' slopes in IADL, predicted wives' depressive symptoms, with faster increases being related to more depressive symptoms in 2020. Conversely, wives' higher initial level of IADL was associated with their own fewer depressive symptoms in 2020. Similarities in intercepts, slopes, and OSRs were not associated with either spouse's depressive symptoms.

Table 4 is here.

Discussions

This study examined the longitudinal relationship between functional disability and depressive symptoms in older married couples using data from the *HRS* over an 18-year period. We found a stronger temporal order from ADL/IADL limitations to depressive symptoms in cross-lagged panel models. In other words, extending individual-level evidence, our findings clarify that increasing functional limitations predicted depressive symptoms more than the reverse in couples. We also found evidence of the interconnected nature of physical and mental health within couples. Significant bidirectional effects were observed between spouses, particularly between husbands' (I)ADLs and wives' depressive symptoms and wives' (I)ADLs and husbands' depressive symptoms. This interconnectedness was further supported in analyses of synchronized developmental trajectories. Spouses experienced parallel declines in physical

functioning over time, but the degree to which these declines were synchronized between couples did not significantly predict depressive symptoms. Instead, it was the individual's own trajectory of worsening functional disability that influenced their depressive symptoms. Specifically, faster increases in (I)ADLs limitations over time were associated with higher depressive symptoms 18 years later for both husbands and wives.

Our primary finding from the cross-lagged panel model indicated a stronger temporal relationship from (I)ADLs limitations to depressive symptoms than the reverse. This finding aligns with the growing body of literature on the bidirectional relationship between disability and depressive symptoms (Chen et al., 2012; Ormel et al., 2002; Zhou et al., 2024; Zhu et al., 2024). Similar to our study, prior studies have often used population-based data and utilized longitudinal data analysis techniques such as RI-CLPM, latent growth curve modeling, and latent state-trait models. These studies consistently suggest that while disability and depressive symptoms are mutually reinforcing, disability tends to have a more immediate and stronger impact on depressive symptoms, while depressive symptoms have a delayed and weaker influence on disability progression (Chen et al., 2012; Ormel et al., 2002; Zhu et al., 2024). For example, a population-based study found that change in outdoor mobility was a stronger predictor of depressive symptoms ($b = .19$, $p < .001$) than the reverse ($b = .06$, $p < .001$) (Xiang et al., 2020). Increasing disability can have an immediate impact on depressive symptoms, given that depressive symptoms can fluctuate significantly in a relatively short amount of time (Keller et al., 2014). In contrast, the disablement process is typically a slower process that unfolds over several years.

Aligning with the linked lives concept, we found that husbands' ADLs had a delayed effect on wives' depressive symptoms, and that wives' ADLs also had a delayed effect on

husbands' depressive symptoms in the cross-lagged model. Interestingly, a spouse's depressive symptoms but not their own depressive symptoms predicted changes in their partner's ADLs two years later. It's possible that as one spouse's physical functioning declines, the other may take on additional caregiving responsibilities, which can increase stress and depressive symptoms (Smith et al., 2014). This finding aligns with previous research indicating that family caregivers of older adults with ADL limitations are susceptible to adverse outcomes, such as distress and deteriorating health (Chan et al., 2013). When the spouse is depressed, they may be less capable of providing emotional and instrumental support, which can lead to further decline in their partner's physical functioning. Consistent with the presence of interdependence among married couples (Hoffman et al., 2019; Meyler et al., 2007), these findings suggest that spouses do not experience depressive symptoms and disability in isolation and that their experiences are interdependent.

We found that trajectories of functional disability within couples were synchronized. Specifically, the spouses' ADLs and IADLs limitations started at similar levels and changed at comparable rates over time. Furthermore, the deviations from the general trajectory, as predicted by the initial level and rate of change, were also similar between partners. In other words, when one partner's ability to manage daily life exhibited unexpected improvements or declines, the other partner's ability tended to follow a similar pattern, either improving or deteriorating in a comparable manner. This aligns with previous studies documenting synchronized trajectories within spouse dyads in health, mental health, cognition, health behaviors, and quality of life outcomes (Bourassa et al., 2015; Liu et al., 2024; Pauly et al., 2020; Weber & Hülür, 2021). For example, in a population-based study in Europe, Bourassa et al. (2015) found that husbands' and

wives' baseline levels and rates of change in health-related quality of life covaried significantly over time. These findings reinforce the idea that spouses' health and well-being are intertwined.

While we identified these shared patterns in the trajectories of spouses, the degree to which their trajectories overlapped did not predict depressive symptoms. This finding suggests that while partners influence each other's health, individuals retain a degree of agency over their own well-being. We postulate that factors such as personal coping strategies may play a stronger role in shaping depressive symptoms than the extent to which a spouse's physical functioning decline mirrors one's own. This aligns with the life course theory's emphasis on human agency – the notion that people make choices and actively shape their own life trajectories (Elder, 1994). Instead, six out of all seven (85.8%) statistically significant findings identified in the current study that a faster progression of disability is a significant predictor of depressive symptoms in both husbands and wives. Collectively, these findings suggest that individual disability progression, rather than couple synchrony, is more salient in predicting depressive symptoms.

Interestingly, initial functional disability exhibited gendered effects. That is, wives' higher initial IADL levels were associated with their own fewer depressive symptoms 18 years later (as indicated by the statistically significant intercept). This unexpected pathway may have indicated the disability paradox, which suggests that individuals with severe disabilities report stable or high levels of life satisfaction, sometimes even surpassing what able-bodied individuals might expect (Albrecht & Devlieger, 1999; Campbell et al., 2021). One possible explanation is that wives who started with more functional restrictions might have adapted to their impairments and developed social support networks and coping strategies. These practical and psychological adaptations could have fostered their resilience and thereby buffer the adverse effects of disability (Manning et al., 2016; Martz & Livneh, 2016). However, this explanation remains

speculative, as the 2002 baseline mean levels of limitations for both ADL and IADL were relatively low, with only modest average increases observed over the 18-year period.

Several limitations warrant acknowledgement. First, the analytic sample consists of American couples who are predominantly non-Hispanic White (nearly 84%), with limited representation of racial/ethnic minority groups. Consequently, the generalizability of the findings to couples from diverse racial/ethnic backgrounds and other sociocultural contexts is uncertain. Second, there potentially exists selection bias in the analytic sample. For instance, the sample may be relatively healthier than those who dropped out. Third, while our results indicate that disability predicts depressive symptoms rather than the reverse, studies with longer durations are needed to corroborate our findings, as the disablement process requires a longer period to manifest (Ormel et al., 2002). Additionally, depressive symptoms were relatively low at baseline and remained modest throughout the study period, which could affect the findings. Moreover, our results are correlational in nature. The specific mechanism underlying the link between functional disability and depressive symptoms among couples remains unaddressed. Future studies should employ mediation analyses or other advanced methods to elucidate potential mechanisms. Fourth, our sample is restricted to heterosexual married couples only. Thus, our results may not capture the experiences of diverse types of partnerships (e.g., cohabitating couples, same-sex couples). Moreover, the data are self-reported, future studies using objective and/or clinical measures of functional disability and depression diagnosis need to validate our results. Furthermore, we treated health characteristics (e.g., chronic conditions, memory performance) as time invariant covariates in our analysis, assessed only at baseline in 2002, potentially overlooking the dyadic nature of these health indicators. Lastly, the biennial HRS data may miss shorter-term fluctuations in functional disability and depressive symptoms.

Implications

Despite the limitations, the study findings have significant implications for research, practice, and policy development. First, given the interconnected nature and mutual influence of functional disability and depressive symptoms, couple-level intervention strategies present a promising approach to enhance the well-being of both partners. Second, the couple-level interdependence of functional disability can be leveraged to design more effective physical activity interventions, such as dyadic physical activity interventions to improve the physical function of both partners. Third, given faster increases in (I)ADLs limitations over time were associated with higher depressive symptoms for both partners, targeted mental health interventions for those experiencing rapid functional decline might be helpful. Particularly, our results highlight the need for additional support for spouses of those with ADL limitations (regardless of gender). Fourth, the long arm of functional decline on mental health indicates that rehabilitation and exercise programs benefit both partners' mental health.

Conclusions

Our findings extend existing literature by clarifying temporal orders underlying the depressive symptoms – functional disability link (i.e., functional limitations are stronger predictors of depressive symptoms, rather than the reverse) among middle-aged and older married couples. One's ADLs had a delayed effect on their partner's depressive symptoms. Our results reveal that couples exhibit synchronized functional disability trajectories over time. The findings indicate the need for early and integrated interventions addressing both physical and emotional well-being, and the value of a dyadic approach that leverages interdependence within married couples.

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Figure 1. Sample Selection Flowchart

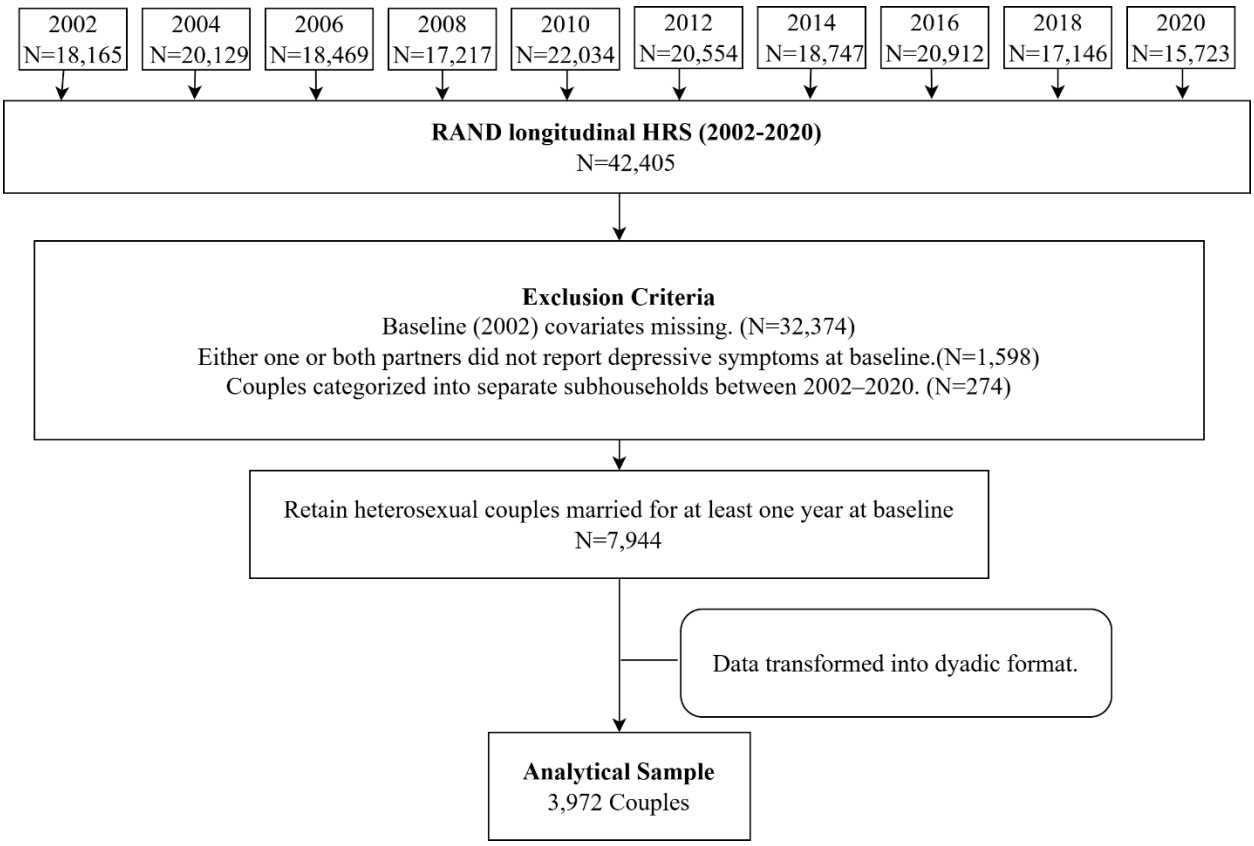
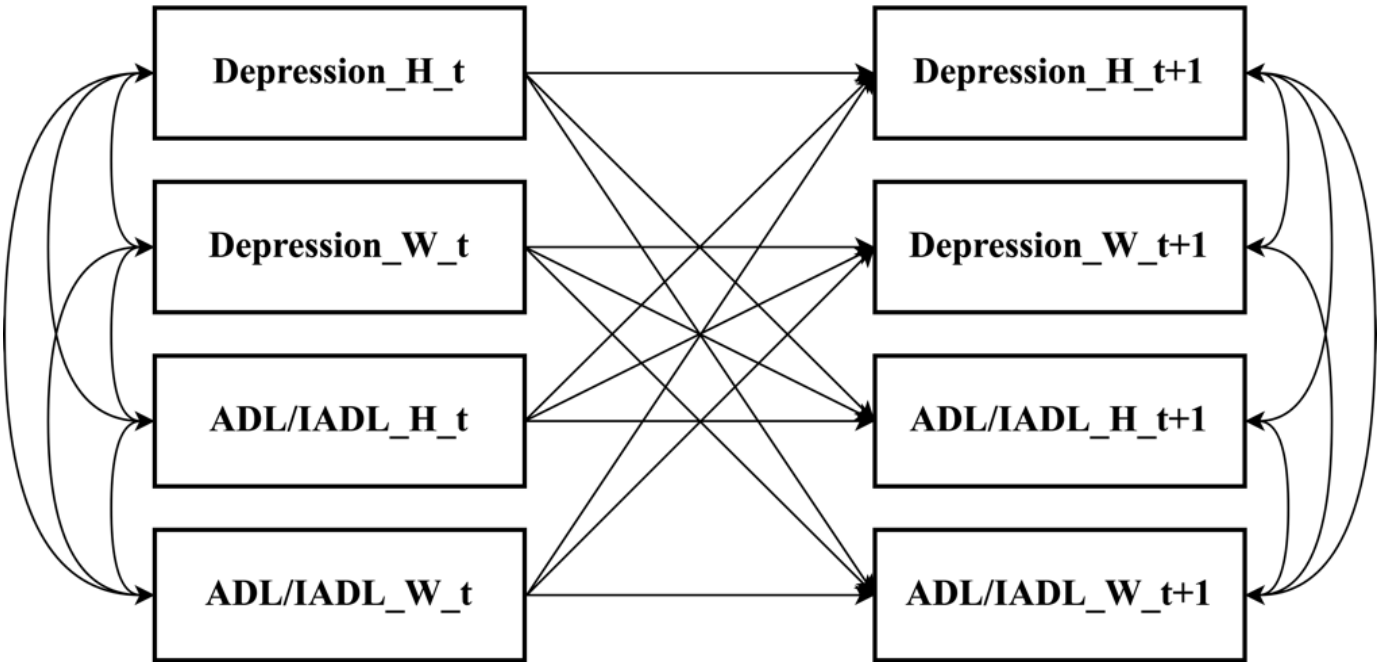


Figure 2. Analytic Framework



ADL and IADL were included in two separate models.

H = husbands, W = wives, t = Wave t, and t+1 = Wave t +1.

Table 1. Descriptive statistics of study sample

	Husbands (n = 3,972)	Wives (n = 3,972)	Total (n = 7,944)	p-value*
CESD score from 2002 to 2020				
CESD score in 2002				<0.001
Mean (SD)	0.99 (1.56)	1.32 (1.84)	1.15 (1.71)	
CESD score in 2004				<0.001
Mean (SD)	0.98 (1.56)	1.35 (1.89)	1.17 (1.75)	
CESD score in 2006				<0.001
Mean (SD)	0.98 (1.56)	1.40 (1.92)	1.19 (1.77)	
CESD score in 2008				<0.001
Mean (SD)	0.98 (1.55)	1.34 (1.90)	1.17 (1.75)	
CESD score in 2010				<0.001
Mean (SD)	0.92 (1.52)	1.28 (1.84)	1.11 (1.71)	
CESD score in 2012				<0.001
Mean (SD)	0.97 (1.55)	1.31 (1.85)	1.16 (1.73)	
CESD score in 2014				<0.001
Mean (SD)	1.01 (1.64)	1.34 (1.88)	1.19 (1.78)	
CESD score in 2016				<0.001
Mean (SD)	1.00 (1.57)	1.33 (1.87)	1.19 (1.75)	
CESD score in 2018				<0.001
Mean (SD)	1.01 (1.59)	1.32 (1.88)	1.19 (1.76)	
CESD score in 2020				<0.001
Mean (SD)	1.06 (1.67)	1.46 (1.93)	1.29 (1.83)	
ADL from 2002 to 2020				
ADLs in 2002				<0.001
Mean (SD)	0.20 (0.68)	0.26 (0.82)	0.23 (0.76)	
ADLs in 2004				0.775
Mean (SD)	0.26 (0.86)	0.27 (0.87)	0.27 (0.86)	
ADLs in 2006				0.888
Mean (SD)	0.33 (0.98)	0.34 (0.97)	0.33 (0.98)	
ADLs in 2008				0.621
Mean (SD)	0.34 (1.02)	0.34 (1.00)	0.34 (1.01)	
ADLs in 2010				0.400
Mean (SD)	0.41 (1.10)	0.43 (1.17)	0.42 (1.14)	
ADLs in 2012				0.439
Mean (SD)	0.39 (1.06)	0.43 (1.20)	0.41 (1.14)	
ADLs in 2014				0.462
Mean (SD)	0.47 (1.20)	0.52 (1.28)	0.50 (1.25)	
ADLs in 2016				0.887
Mean (SD)	0.48 (1.19)	0.49 (1.27)	0.48 (1.24)	
ADLs in 2018				0.537
Mean (SD)	0.44 (1.09)	0.51 (1.28)	0.48 (1.21)	
ADLs in 2020				0.792
Mean (SD)	0.45 (1.13)	0.52 (1.29)	0.49 (1.22)	

IADL from 2002 to 2020				
IADLs in 2002				0.195
Mean (SD)	0.14 (0.51)	0.15 (0.57)	0.14 (0.54)	
IADLs in 2004				0.487
Mean (SD)	0.20 (0.69)	0.19 (0.66)	0.19 (0.67)	
IADLs in 2006				0.658
Mean (SD)	0.24 (0.80)	0.25 (0.79)	0.24 (0.79)	
IADLs in 2008				0.930
Mean (SD)	0.27 (0.86)	0.29 (0.89)	0.28 (0.87)	
IADLs in 2010				0.128
Mean (SD)	0.35 (0.97)	0.37 (1.02)	0.36 (1.00)	
IADLs in 2012				0.151
Mean (SD)	0.35 (0.98)	0.37 (1.04)	0.36 (1.01)	
IADLs in 2014				0.031
Mean (SD)	0.39 (1.05)	0.43 (1.12)	0.41 (1.09)	
IADLs in 2016				0.116
Mean (SD)	0.43 (1.08)	0.45 (1.11)	0.44 (1.10)	
IADLs in 2018				0.814
Mean (SD)	0.39 (1.01)	0.44 (1.10)	0.42 (1.06)	
IADLs in 2020				0.918
Mean (SD)	0.39 (0.98)	0.48 (1.17)	0.44 (1.10)	
Individual-level Covariates (2002)				
Age				<0.001
Mean (SD)	68.07 (8.54)	64.65 (9.18)	66.36 (9.03)	
Min, Max	38, 96	29, 100	29, 100	
Years of Education				0.004
Mean (SD)	12.75 (3.21)	12.63 (2.79)	12.69 (3.01)	
Min, Max	0, 17	0, 17	0, 17	
Race				<0.001
NH White	3326 (83.7%)	3312 (83.4%)	6638 (83.6%)	
NH Black	333 (8.4%)	326 (8.2%)	659 (8.3%)	
NH Other	61 (1.5%)	65 (1.6%)	126 (1.6%)	
Hispanic	252 (6.3%)	269 (6.8%)	521 (6.6%)	
Retirement Status				<0.001
Not retired	1311 (33.0%)	2222 (55.9%)	3533 (44.5%)	
Retired	2661 (67.0%)	1750 (44.1%)	4411 (55.5%)	
Number of Chronic Conditions				<0.001
Mean (SD)	1.77 (1.33)	1.61 (1.28)	1.69 (1.31)	
Min, Max	0, 7	0, 8	0, 8	
Memory Score				<0.001
Mean (SD)	9.55 (3.41)	11.02 (3.43)	10.28 (3.50)	
Min, Max	0, 20	0, 20	0, 20	
Household-level Covariates (2002)				
Average Length of Marriage				
Mean (SD)			38.07 (14.37)	
Min, Max			1, 74.7	

Household Size	
Mean (SD)	2.40 (0.89)
Min, Max	2, 12
Household Income	
Mean (SD)	67258.46 (80858.10)
Min, Max	0, 1521304

**Notes:* Results of paired t-test and Chi-squared test are reported.

Table 2. Directionality in the Associations Between ADL/IADL and Depressive Symptoms

Pathways	Estimate	SE	*t*	*p*
Panel A: ADL and Depression				
Depression_H_t+1 ON				
Depression_H_t	-0.01	0.01	-1.46	.144
ADL_H_t	0.05	0.01	5.84	<.001
ADL_W_t	0.03	0.01	4.53	<.001
Depression_W_t+1 ON				
Depression_W_t	-0.01	0.01	-0.78	.434
ADL_H_t	0.03	0.01	3.40	.001
ADL_W_t	0.08	0.01	8.04	<.001
ADL_H__t+1 ON				
ADL_H_t	0.10	0.01	8.58	<.001
Depression_H_t	0.01	0.01	1.44	.150
Depression_W_t	0.02	0.01	3.14	.002
ADL_W_t+1 ON				
ADL_W_t	0.16	0.01	13.30	<.001
Depression_H_t	0.03	0.01	3.94	<.001
Depression_W_t	<0.001	0.01	-0.01	.995
Panel B: IADL and Depression				
Depression_H_t+1				
Depression_H_t	-0.01	0.01	-1.31	.189
IADL_H_t	0.04	0.01	5.31	<.001
IADL_W_t	0.03	0.01	4.02	<.001
Depression_W_t+1				
Depression_W_t	-0.01	0.01	-0.61	.543
IADL_H_t	0.03	0.01	3.75	<.001
IADL_W_t	0.06	0.01	7.07	<.001
IADL_H__t+1 on				
IADL_H_t	0.12	0.01	11.07	<.001
Depression_H_t (now n.s.)	0.01	0.01	1.46	.144
Depression_W_t	0.02	0.01	3.30	.001
IADL_W_t+1 on				
IADL_W_t	0.19	0.01	15.44	<.001
Depression_H_t	0.03	0.01	3.78	<.001
Depression_W_t	0.01	0.01	1.09	.274

H = husbands, W = wives, t = Wave t, and t+1 = Wave t +1.

Table 3. Synchronized Developmental Trajectories of ADL and IADL

	Husbands		Wives	
Panel A: ADL				
For partners	***Estimate***	***SE***	***Estimate***	***SE***
Intercept	0.24***	0.01	0.25***	0.01
Slope	0.04***	0.002	0.04***	0.002
Intercept variance	0.36***	0.03	0.44***	0.03
Slope variance	0.004***	<0.001	0.01***	0.001
Residual variance	0.60***	0.02	0.61***	0.02
For couples			***Pearson r***	
Similarity in intercepts			.20***	
Similarity in slopes			.26***	
Similarity in OSR			.09***	
Panel B: IADL				
For partners	***Estimate***	***SE***	***Estimate***	***SE***
Intercept	0.17***	0.01	0.15***	0.01
Slope	0.04***	0.00	0.04***	0.00
Intercept variance	0.21***	0.02	0.24***	0.02
Slope variance	0.004***	<0.001	0.006***	<0.001
Residual variance	0.46***	0.01	0.48***	0.01
For couples			***Pearson r***	
Similarity in intercepts			.23***	
Similarity in slopes			.36***	
Similarity in OSR			.17***	

*** $p < .001$

We also accessed the correlations between intercepts and slopes for husbands and wives. In the ADL model, the correlation between husbands' intercept and slope was $r = .05$ ($p = .496$), and for wives, it was $r = -.06$ ($p = .133$). In the IADL model, the correlation for husbands was $r = .12$ ($p = .133$), and for wives, it was r = -.06 ($p = .223$). None of these correlations were statistically significant (ps > 0.05), indicating no significant relationships between intercepts and slopes in either model for either spouse.

Table 4. Relationship between Synchronized Developmental Trajectories of Functional Disability and Depressive Symptoms

	Husbands		Wives	
	Estimate	***SE***	***Estimate***	***SE***
ADL_Intercept_H	-0.04	0.04	-0.02	0.02
ADL_Intercept_W	0.00	0.03	-0.03	0.03
ADL_Intercept_Similarity	-0.01	0.02	0.003	0.03
ADL_Slope_H	0.09***	0.02	0.05*	0.02
ADL_Slope_W	0.02	0.03	0.08***	0.02
ADL_Slope_Similarity	0.01	0.03	-0.03	0.03
ADL_Residual_Similarity	0.01	0.02	-0.01	0.02
IADL_Intercept_H	-0.07	0.03	-0.05	0.03
IADL_Intercept_W	-0.03	0.04	-0.05*	0.02
IADL_Intercept_Similarity	0.01	0.03	0.02	0.03
IADL_Slope_H	0.08***	0.03	0.04	0.02
IADL_Slope_W	0.05***	0.02	0.06*	0.03
IADL_Slope_Similarity	-0.03	0.04	0.00	0.02
IADL_Residual_Similarity	-0.01	0.02	0.002	0.02

* $p < .05$, ** $p < .01$, and *** $p < .001$.

H = husbands, and W = wives.