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Longitudinal Associations Between Cognitive Functioning and Depressive Symptoms Among Older Adult Spouses in the Cardiovascular Health Study

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Abstract

Objective—To examine the bidirectional associations between older adult spouses' cognitive functioning and depressive symptoms over time.

Design—Longitudinal, dyadic path analysis with the actor-partner interdependence model.

Setting—Data were from visit 5 (1992/1993), visit 8 (1995/1996), and visit 11 (1998/1999) of the Cardiovascular Health Study, a multisite, longitudinal, observational study of risk factors for cardiovascular disease in adults 65 years or older. Demographic information was from the 1989/1990 original and 1992/1993 African American cohort baseline visits.

Participants—Husbands and wives from 1,028 community-dwelling married couples (N = 2,065).

Measurements—Cognitive functioning was measured with the Modified Mini-Mental State Exam. Depressive symptoms were measured using the 10-item Center for Epidemiologic Studies Depression Scale. Age, education, and disability (activities of daily living and instrumental activities of daily living) were included as covariates.

Results—Cross-partner associations (partner effects) revealed that one spouse's greater depressive symptoms predicted the other spouse's lower cognitive functioning, but a spouse's lower cognitive functioning did not predict the other spouse's greater depressive symptoms over

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time. Within-individual associations (actor effects) revealed that an individual's lower cognitive functioning predicted the individual's greater depressive symptoms over time, but greater depressive symptoms did not predict lower cognitive functioning over time. Effects did not differ for husbands and wives.

Conclusion—Having a spouse who is depressed may increase one's risk of cognitive decline as well as one's risk of depression. Interventions for preventing cognitive decline and depression among older adults may be enhanced by considering the marital context.

Keywords

Cognitive functioning; depression; dyadic analysis; marriage

INTRODUCTION

Clinicians working with older adults are increasingly paying attention to social factors that influence the health of their clients. One salient factor is marriage. Many older adult marriages are emotionally close,¹ and spouses often share the same environment, experiences, and health behaviors.² A growing body of literature shows that spousal interdependence impacts a variety of health conditions in late life.^{3–5} Of particular importance to older adults' mental health is cognitive functioning, with studies showing that older adults' cognitive functioning and depressive symptoms are reciprocally and dynamically related over time.^{6–8} The current study examines the longitudinal associations between cognitive functioning and depressive symptoms among older adult spouses in the Cardiovascular Health Study (CHS).⁹ The present study is novel in the following ways: First, while there is a small body of research examining longitudinal associations between spouses' cognitive functioning and mental health, past studies have either examined specific cognitive factors, such as episodic memory and perceptual speed, or less precise global measures of cognition (e.g., the Mini-Mental State Exam¹⁰ or the Short Portable Mental Status Questionnaire¹¹). The present study used the Modified Mini-Mental State Exam (3MS) measure, a clinical measure that has more standardized administration and more graded scoring.¹² The 3MS assesses a variety of cognitive domains, covers a wider range of difficulty levels, and has more sensitivity than other measures in detecting within-individual changes over time. Recent normative 3MS data aids in its clinical application.¹³ Second, there remain inconsistent findings regarding whether husbands' cognitive functioning is more impactful on wives' depressive symptoms or vice versa. More research is needed to examine these inconclusive gender effects. This study addresses these gaps using a large longitudinal sample of married couples spanning 7 years. Ultimately, this study seeks to provide further evidence that spouses' mental and cognitive health is inter-related, which has important implications for how interventions are designed and tailored for older adult husbands and wives.

A small body of research shows that spouses' cognitive factors and depressive symptoms are associated over time. Using 10-year longitudinal data of 1,599 married couples in the study of Asset and Health Dynamics Among the Oldest Old (AHEAD), Gerstorf et al.⁶ found that husbands' better episodic memory, as measured with a composite of performances on the immediate and delayed free recall tests,¹⁴ was associated with less subsequent memory

decline among wives. In the AHEAD study, wives' depressive symptoms predicted husbands' subsequent depressive symptoms and memory decline,⁶ The opposite was found in the Yale Health and Aging Project, where wives' cognitive decline predicted husbands' greater depressive symptoms.¹⁵ More recently, a study of 2,684 married couples in the Korean Longitudinal Study of Aging found that spouses' cognitive functioning was related and depressive symptoms were related, but depressive symptoms did not predict a partner's cognitive functioning or vice versa.⁸

Evidence for whether wives' or husbands' cognitive decline is more impactful for the other's cognitive functioning or depression remains mixed. In terms of depressive symptoms, research shows that wives are more likely to be influenced by their husband's symptoms than vice versa.^{16,17} Theorists suggest that this is because women are socialized to be interdependent, more sensitive to others emotions, and feel more responsible for maintaining relational harmony.¹⁸ Also, women are more likely to be spousal caregivers, a risk factor for depression.¹⁹

Thus, the present study examined the following hypotheses: First, we hypothesized that within each individual lower cognitive functioning would predict future decreases in cognitive functioning and greater depressive symptoms would predict increases in depressive symptoms over time (H1a and b; actor effects). Second, we hypothesized that one spouse's lower cognitive functioning would predict decreases in the other spouse's cognitive functioning and one spouse's greater depressive symptoms would predict increases in the other spouse's depressive symptoms over time (H2a and b; partner effects). Third, we hypothesized that within individuals there would be a bidirectional association between cognitive functioning and depressive symptoms over time (H3; actor effects). Fourth, we hypothesized a bidirectional association between an individual's cognitive functioning and the spouse's depressive symptoms over time (H4; partner effects). Finally, we hypothesized gender differences for partner effects such that husbands' cognitive functioning and depressive symptoms would be more predictive of wives' cognitive functioning and depressive symptoms than vice versa.

METHODS

Data and Sample Characteristics

Data was from the CHS, a population-based longitudinal study designed to determine risk factors for cardiovascular disease in adults 65 years or older. The CHS recruited participants from four U.S. communities: Forsyth County, NC; Sacramento County, CA; Washington County, MD; and Pittsburgh, PA. Participants underwent annual clinical examinations and interviews. The CHS sample included 5,201 individuals enrolled in 1989/1990, with an additional cohort of 687 African Americans enrolled in 1992/1993. The present study includes data from visit 5 (1992/1993), visit 8 (1995/1996), and visit 11 (1998/1999), as well as demographics for the original cohort from the 1989/1990 baseline visit. We used these three timepoints because the 3MS was measured in visits 5, 6, 7, 8, 9, 10, and 11 for both the original and the African American cohorts. To simplify the models, we used the baseline, the midpoint, and the last measurement of the 3MS. See Fried et al.⁹ for more information about the design and sample.

Measures

Cognitive functioning—The Mini-Mental State Examination (3MS), which is based on the Mini-Mental State Exam (MMSE),¹⁰ was used to assess cognitive functioning.¹² The 3MS modified the 0–30 MMSE scale with four additional items, some additional stimuli within items, and more graded scoring to create a 0–100 scale. A score below 78 is often considered cognitively impaired.²⁰

Depressive symptoms—A modified, validated version of the Center for Epidemiologic Studies Depression Scale assessed self-reported depressive symptoms experienced during the preceding 7 days of the clinic visit.²¹ The scale consists of 10 symptoms, each scored 0–3, for a maximum of 30 points. Higher scores indicate greater frequency of symptoms.

Covariates—Age, sex, race, education, activities of daily living (ADLs), and instrumental activities of daily living (IADLs)^{22,23} were examined as potential covariates. ADLs were defined for the CHS as difficulty or inability with walking around the home, getting out of bed, eating, dressing, bathing, or using the toilet. IADLs were defined as difficulty or inability with doing heavy housework, doing light housework, shopping, preparing meals, and managing money. Each ADL and IADL item was rated as zero (no difficulty) or one (any difficulty). Sums were calculated for ADLs and IADLs separately.

Analysis—To examine covariates, we calculated Pearson correlations among baseline cognitive functioning, depressive symptoms, ADLs, IADLs, age, and race (0 = white, 1 = nonwhite). Spearman rank correlations were calculated for associations with years of education. Covariates were included in the models at a $p < 0.10$ threshold. We calculated means and standard deviations of husbands' and wives' cognitive functioning and depressive symptoms at each visit and conducted mixed models in SPSS Statistics for Windows, Version 24.0 (International Business Machines Corporation, Armonk, NY), to examine changes over time.

To test the hypotheses, path analyses were conducted with Mplus, Version 7.3 (StatModel, Los Angeles), which employs full information maximum likelihood estimation to use all available data.²⁴ Participants' data were included in the model even when one partner's data were missing (e.g., for bereaved participants), and we assumed the missing values were missing at random. We used the actor–partner interdependence model (APIM), which incorporates spouses' interdependence by combining data from both partners into one analysis and providing information about whether wives influence husbands and husbands influence wives.²⁵

To examine bidirectionality of the association between cognitive functioning and depression, we estimated two structural equation models. In model 1, cognitive functioning variables of both spouses were entered as predictors of changes in both spouses' depressive symptoms and cognitive functioning at visit 8 and visit 11. Our focus was on the influence of one's cognitive functioning on changes in his or her own and the spouse's subsequent depression over the study period. We did not hypothesize that these relationships would be different at each visit. However, we compared models in which all paths were tested separately with models with all like effects (visit 5 to visit 8; visit 8 to visit 11) set equal,^{4,5} and then

performed χ^2 difference tests between the models. In model 2, depressive symptoms of both partners were set to predict changes in their own and their partner's cognitive functioning and depressive symptoms at visit 8 and visit 11 (controlling for covariates). To examine gender differences, we performed χ^2 difference tests comparing the fit of the models with husbands' and wives' paths constrained to be equal with models that included unconstrained separate paths for husbands and wives. If the models did not significantly differ, we planned to use the constrained models.

R^2 values were calculated to determine the amount of variance that the predictors accounted for in the outcomes and as an indicator of effects sizes. We report three model fit indices: the confirmatory fit index, the Tucker-Lewis index, and the root mean square error of approximation.²⁶ Values of greater than 0.95 for the confirmatory fit index, values of greater than 0.90 for the Tucker-Lewis index,²⁷ and values of less than 0.08 for the root mean square error of approximation²⁷ reflect good fit of a specified model to the data.

RESULTS

The Sample

Complete baseline cognitive and depressive symptoms data for this analysis were available for 1,028 couples. One hundred forty husbands and 37 wives were deceased at visit 8, and 294 husbands and 116 wives were deceased at visit 11. Couples were evenly distributed among the CHS sites (Forsyth County, NC: $n = 249$; Sacramento County, CA: $n = 284$; Washington County, MD: $n = 254$; Pittsburgh, PA: $n = 241$). Four hundred fifty-three (44.1%) couples reported an annual income of less than \$25,000; 333 (32.4%) reported between \$25,000 and \$49,999; and 180 (17.5%) reported greater than \$50,000. Sixty-two couples did not report income; income may appear low because some participants were currently employed and some were retired. See Table 1 for participant characteristics at baseline.

Missing Data

One-way analyses of variance examining differences in baseline demographics between participants who had data from all three, two, or one visit showed that participants who had more missing data were older (husbands: $F[2, 1,025] = 34.04$, $p < 0.0001$; wives: $F[2, 1,025] = 27.70$, $p < 0.001$), less educated (husbands: $F[2, 1,024] = 11.96$, $p < 0.001$; wives: $F[2, 1,025] = 9.48$, $p < 0.001$), had more ADLs (husbands: $F[2, 1,025] = 6.93$, $p = 0.001$; wives: $F[2, 1,025] = 7.05$, $p = 0.001$) and IADLs (husbands: $F[2, 1,025] = 20.16$, $p = 0.001$; wives: $F[2, 1,025] = 6.68$, $p = 0.001$), had lower cognitive functioning (husbands: $F[2, 1,025] = 38.58$, $p < 0.001$; wives: $F[2, 1,025] = 28.66$, $p < 0.001$), and were more depressed (husbands: $F[2, 1,025] = 21.44$, $p < 0.001$; wives: $F[2, 1,025] = 18.27$, $p = 0.001$).

Covariates

Baseline age, race, education, ADLs, and IADLs were included in the structural equation models. As shown in Table 2, Pearson correlations showed that older participants experienced greater depression and lower cognitive functioning. Participants with more ADLs were more depressed and had lower cognitive functioning. Participants with more

IADLs were more depressed and had lower cognitive functioning. According to the Spearman rank analysis, less educated participants were more depressed (wives: $\rho[1,028] = -0.12$, $p < 0.001$; husbands: $\rho[1,028] = -0.19$, $p < 0.001$) and had lower cognitive functioning (wives: $\rho[1,027] = 0.33$, $p < 0.001$; husbands: $\rho[1,027] = 0.40$, $p < 0.001$).

In terms of differences between whites and nonwhites, a t-test showed that white husbands ($n = 932$, $M = 4.10$, standard deviation [SD] = 3.94) had less depressive symptoms than nonwhite husbands ($n = 94$, $M = 5.14$, $SD = 4.60$; $t[1,024] = -2.39$, $p = 0.017$). White husbands ($n = 932$, $M = 90.37$, $SD = 9.49$) had greater cognitive functioning than nonwhite husbands ($n = 94$, $M = 82.69$, $SD = 13.50$; $t[1,024] = 7.15$, $p < 0.001$). White wives ($n = 933$, $M = 5.21$, $SD = 4.74$) were not significantly less depressed than nonwhite wives ($n = 92$, $M = 6.15$, $SD = 4.95$; $t[1,023] = -1.81$, $p = 0.07$), but white wives ($n = 933$, $M = 92.68$, $SD = 7.87$) had significantly less cognitive impairment than nonwhite wives ($n = 92$, $M = 87.75$, $SD = 8.57$; $t[1,023] = 5.69$, $p < 0.001$).

Husbands' and Wives' Cognitive Functioning and Depressive Symptoms Over Time

SPSS mixed models showed that cognitive functioning decreased for participants over time (husbands: $F[2, 988.65] = 28.13$, $p < 0.001$; wives: $F[2, 1,004.13] = 22.46$, $p < 0.001$; see Table 3 for differences between each visit). Depressive symptoms increased for both husbands ($F[2, 1,201.37] = 23.73$, $p < 0.001$) and wives ($F[2, 1,690.36] = 22.45$, $p < 0.001$).⁴

Twenty-three percent of wives and 9% of husbands had clinical cutoff scores for depression at visit 5, 18% of wives and 12% of husbands at visit 8, and 16% of wives and 11% of husbands at visit 11 using a score of 10 or greater—the 10-item Center for Epidemiologic Studies Depression Scale cutoff.²⁸ Six percent of wives and 11% of husbands at visit 5, 7% of wives and 12% of husbands at visit 8, and 12% of husbands and 9% of wives at visit 11 had cognitive impairment using a 3MS cutoff score of 78.²⁰

Main Hypothesis Testing

χ^2 difference tests between the constrained models (combining paths for husbands and wives) and the unconstrained models (separate paths for husbands and wives) were not significant (model 1: $\chi^2 = 2.74$, degrees of freedom [df] = 1, $p = 0.10$ for cognitive functioning predicting depression and $\chi^2 = 1.47$, $df = 1$, $p = 0.23$ for one partner's depression predicting the other partner's depression; model 2: $\chi^2 = 0.51$, $df = 1$, $p = 0.48$ for one partner's depression predicting the other partner's cognitive functioning). Therefore, we used the constrained models.

The final model estimates are presented in Table 4, and the significant paths are shown in Figures 1 and 2. Supporting hypothesis 1a (actor effects), an individual's own lower cognitive functioning predicted their own lower cognitive functioning over time. Likewise, an individual's greater depressive symptoms predicted greater depressive symptoms over time (hypothesis 1b; actor effects). Hypothesis 2a (partner effects) was not supported; neither individual's lower cognitive functioning predicted their spouse's lower cognitive functioning over time. Supporting hypothesis 2b (partner effect), one spouse's greater depressive symptoms predicted the other's greater depressive symptoms.

For hypothesis 3 (actor effects), an individual's lower cognitive functioning predicted their own greater depressive symptoms (model 1); however, an individual's greater depressive symptoms did not predict their own lower cognitive functioning (model 2). For hypothesis 4 (partner effects), an individual's depressive symptoms predicted their spouse's lower cognitive functioning (model 2); however, an individual's cognitive functioning did not predict their spouse's depressive symptoms (model 1).

The r^2 values showed that model 1 accounted for 33% and 39% of the variance in wives' visit 8 and visit 11 depressive symptoms, respectively; 64% and 68% for wives' cognitive functioning; 30% and 39% for husbands' depressive symptoms; and 70% and 77% for husbands' cognitive functioning. Model 2 accounted for 33% and 39% of the variance in wives' visit 8 and visit 11 depressive symptoms, respectively; 63% and 67% for wives' cognitive functioning; 29% and 38% for husbands' depressive symptoms; and 69% and 76% for husbands' cognitive functioning.

To examine the magnitude of the significant effects, we reran the model with z scores, using a stacked data set, to determine the standardized betas. Using the standard deviations for cognitive functioning and depressive symptoms (10.09 and 4.85 for wives and 11.13 and 4.37 for husbands), the standardized coefficient for the actor effect of cognitive impairment on depression ($\beta = -0.08$, standard error [SE] = 0.02, $p < 0.001$) indicates that for one standard deviation decrease in cognitive impairment, there is an increase of 0.39 and 0.35 in depressive symptoms in wives and husbands, respectively. The standardized coefficient for the partner effect of depression on cognition ($\beta = -0.02$, SE = 0.01, $p = 0.04$) indicates that for one standard deviation change in depressive symptoms, the partner's cognitive impairment score increases 0.20 and 0.22 in wives and husbands, respectively. The standardized coefficient for partner effect of depression ($\beta = 0.05$, SE = 0.02, $p = 0.004$) indicates that for one standard deviation change in depressive symptoms, the partner's depressive symptoms increased 0.24 in wives and 0.22 in husbands.

DISCUSSION

This study is one of the first to examine reciprocal associations in clinical measures of spouses' cognitive functioning and psychological health in a large longitudinal sample. Here, we found support for the hypothesis that one spouse's greater depressive symptoms predict the other spouses' lower cognitive functioning. It should be noted that although the effect size was small, these results provide evidence supporting the theory that spouses' health and well-being are interdependent.²⁹ Even small partner influences over an extended period are important to document, as it is possible that these influences have additive effects.

We also replicated the well-established finding that one spouse's greater depressive symptoms predict the other spouse's greater depressive symptoms. Theory and past research suggest that these associations are due to spouse selection effects (i.e., people tend to marry similar others), emotional contagion, and shared social environments and stressors.¹⁶ It should be noted that the r^2 values for depressive symptoms were lower than for cognition, which may suggest that there are more factors influencing depressive symptoms not accounted for in our models. In contrast to significant partner associations with depressive

symptoms, we did not find that spouses' cognitive functioning was associated. We also did not find gender differences.

The lack of gender differences in partner associations contrasts with previous findings and theory that wives' mental health and health behaviors are influenced more by their husbands' than vice versa.^{6,8} However, previous studies on partner associations in cognition and depression have shown inconsistent gender differences. For example, the AHEAD study showed that wives' depressive symptoms predicted husbands' worse memory, and the Korean Longitudinal Study of Aging showed no gender differences in spousal associations in cognitive functioning. Discrepancies in gender effects across studies may be influenced by contextual factors, such as cultural or historical cohort differences in samples.³⁰

Finally, this study showed that within individuals, cognitive decline predicted greater depressive symptoms over time, which is also consistent with past research.⁶ Researchers have suggested that cognitive decline may negatively affect an individual's capacity to manage the routines of everyday life—a risk factor for lower psychological well-being.³¹

There are several strengths and weaknesses in this study. Strengths include the fact that we used a large sample of older couples over a span of approximately 7 years. African American participants were oversampled in the CHS, and their data were included in this study. We used the APIM²⁵ to account for nonindependent dyadic data, and we used the 3MS, which includes multiple cognition indicators and is more predictive of clinically diagnosed dementia than other global measures.

Limitations include the following: First, the CHS did not assess relationship information (e.g., relationship length), relationship quality, or caregiving burden. This would have shed light on interpersonal mechanisms. Second, psychiatric history was not included in the CHS. Third, we were not able to control for a comprehensive list of current or past medical conditions (e.g., cancer, heart disease) or other contextual influences (e.g., social support) due to the complexity of the APIM. Instead, we used physical disability as a proxy for medical illness burden. Although disability does not fully capture the demands of multimorbidity (e.g., pain expression), disability is likely a more proximal factor affecting caregiving burden and spouses' mental health and cognitive impairment.³² Indeed, Hoppmann et al.³³ have shown that couples' functional limitations and depressive symptoms are closely inter-related over time.

Fourth, even with oversampling, there were few African American couples. Ethnic minorities are under-represented in research on older adult romantic relationships; this will be important to address in future research. There were also no same-sex couples in the CHS. Future research is needed to examine whether partner influences in cognitive functioning and depressive symptoms are similar in nonheterosexual couples.

Also, most CHS participants were quite healthy, and their depressive symptoms and cognitive functioning stayed within normal range. As shown in our analysis of the missing data, couples included in our analysis were younger, more educated, less disabled, had better cognition, and were less depressed. We also examined differences in missing data due to death versus refusing to continue participating (data is available upon request). Generally,

we found that those who died had worse cognitive functioning at baseline than those who refused to continue. This should be considered when interpreting the present findings. However, there were participants who had depressive symptom and cognitive scores that exceeded the clinical cutoffs for the Center for Epidemiologic Studies Depression Scale and the 3MS. Furthermore, it is important to examine subclinical changes in these measures over time, as previous research has shown that increases in subthreshold symptoms of depression and cognitive impairment can have significant negative implications for older adults' health. For example, subclinical depression and cognitive impairment predict disability in older adults in home care settings.³⁴ Finally, although previous research has examined dynamic time-lagged spousal associations in memory and depressive symptoms every 2 years over 10 years,⁶ future dynamic models should use clinical measures of cognitive impairment.

CONCLUSION

Among married older adults, spouses' depressive symptoms and cognitive functioning are inter-related. There is a need for clinicians to account for older adults' marital environments when diagnosing patients and when designing interventions to prevent and treat depression and cognitive decline. Our research supports efforts to target older couples to collaborate in cognitive training and therapy to enhance well-being.³⁵ Although studies examining the efficacy of couples treatment of depression³⁶ and cognitive decline³⁷ are limited, there is growing interest in dyadic interventions for persons with dementia and mild cognitive impairment and their spousal caregivers.³⁸ For example, Stahl et al.³⁹ demonstrated in a recent case study that training a spouse to be a problem-solving therapy coach can have psychological benefits not only for the person with mild cognitive impairment but also for the spouse.

Randomized clinical trials examining the effects of dyadic interventions are needed to prevent depression and cognitive decline in older couples. In designing these studies, it will be important to measure the mechanisms through which partners influence each other's health over time with shorter measurement intervals. It may be that encouraging specific health behaviors (e.g., physical activity, eating, mindfulness), social activities (e.g., interaction with the community), or interpersonal communication (e.g., reducing conflict, creating shared goals) is what is needed to protect older married adults' well-being and cognitive functioning.

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Queries and Answers

Query: Please confirm that givennames and surnames have been identified correctly.

Answer: Yes

Query: The author names have been tagged as given names and surnames (surnames are highlighted in teal color). Please confirm if they have been identified correctly.

Answer: Yes

Query: Please verify affiliations; okay as edited?

Answer: What is the (BCF) next to the g affiliation? Is that Brooke's initials? I don't think that should be there.

Query: Please verify in-text citation for Gerstorf et al.

Answer: This is correct.

Query: Citation #24 removed from reference list and included in text per journal style and remaining citations renumbered; okay as edited?

Answer: This is fine with me.

Query: Same citation number (i.e., #27 after renumbering) used for both TLI and RMSEA; please verify

Answer: This is correct, but I see one of the 27 superscripts is not in blue.

Query: Please verify "had more ADLs ... and IADLs"; as included, statement appears to contradict other findings; occurred throughout article; would "needed more help with ADLs ... IADLs" work

better here?

Answer: "needed more help with ADLs...IADLs" is more accurate

Query: See previous comment regarding ADLs; would "issues with ADLs" or similar work better in the sentence beginning "Participants with more ADLs..."?

Answer: "needing more help with ADLs" is more accurate.

Query: See previous comment regarding IADLs; would "issues with IADLs" or similar work better in the sentence beginning "Participants with more IADLs..."?

Answer: You can change to "Participants needing more help with IADLs..."

Query: Please provide page numbers for noted chapter in citation #3

Answer: pp. 239–257

Query: Please verify citation #14; apparent page number listed but no chapter title given

Answer: Ofstedal MB, Fisher G, Herzog AR: Documentation of cognitive functioning measures in the Health and Retirement Study. <http://hrsonline.isr.umich.edu/docs/userg/dr-006.pdf> (accessed March 16, 2018).

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FIGURE 1.

Actor-partner interdependence model with cognitive functioning predicting depressive symptoms (model 1).

Notes, Cog= cognitiv fnctioning. V5=visit 5, V8=visit 8, V11=visit 11. Bold lines are significant $p < .05$. Superscript indicate constrained paths.

FIGURE 2.

Actor-partner interdependence model with depressive symptoms predicting cognitive functioning (model 2).

Notes, Cog= cognitiv fnctioning. V5=visit 5, V8=visit 8, V11=visit 11. Bold lines are significant $p < .05$. Superscript indicate constrained paths.

TABLE 1

Participant Characteristics at CHS Enrollment

	Husbands	Wives
Age in years-mean (SD)	75.89 (5.06)	73.47 (4.47)
Race or ethnic group-no. (%)		
White	932 (90.7)	933 (90.8)
Black	92 (8.9)	91 (8.9)
American Indian/Alaska Native	1 (0.1)	1 (0.1)
Asian	0	2 (0.2)
Other	3 (0.3)	1 (0.1)
Hispanic-no. (%)	11 (1)	10(1)
Education		
Less than high school	263 (25.6)	202 (19.7)
Completed high school/GED	246 (23.9)	355 (34.5)
Attended vocational school/college	369 (35.9)	385 (37.5)
Attended graduate school	154(15.0)	83 (8.1)
Employment		
Currently employed	90 (8.9)	73 (7.3)
Retired	901 (89.6)	451 (44.8)
Not employed	13 (1.3)	12 (1.2)
Homemaker	2 (0.2)	470 (46.7)
IADLs-mean (SD)	0.14(0.53)	0.16 (0.55)
ADLs-mean (SD)	0.31 (0.75)	0.40 (0.75)

Notes: n = 1,028 couples. GED: general equivalency diploma.

TABLE 2

Pearson Correlations Between Husbands' and Wives' Baseline Cognitive Functioning and Depressive Symptoms and Baseline Age, ADLs, and IADLs

	Husbands		Wives	
	Cognitive functioning	Depressive symptoms	Cognitive functioning	Depressive symptoms
Husbands				
Age	−0.32 ^b	0.13 ^a		
ADLs	−0.20 ^b	0.23 ^b		
IADLs	−0.27 ^b	0.27 ^b		
Wives				
Age			−0.24 ^b	0.09 ^a
ADLs			−0.11 ^b	0.25 ^b
IADLs			−0.17 ^b	0.28 ^b

^a p = 0.004.

^b p < 0.001.

TABLE 3
Husbands' and Wives' Mean Cognitive Functioning and Depressive Symptoms Over Time

	Husbands'			Wives'		
	Means (SD)			Means (SD)		
	n			n		
	Visit 5	Visit 8	Visit 11	Visit 5	Visit 8	Visit 11
Cognitive functioning	89.65 (10.18) n = 1,028	89.81 (11.16) n = 756	89.79 (12.61) n = 585	92.25 (8.04) n = 1,028	92.21 (10.07) n = 823	91.79 (12.51) n = 707
Depressive symptoms	4.20(4.01) n = 1,028	4.86 (4.59) n = 800	4.75 (4.63) n = 617	5.29 (4.76) n = 1,028	6.10 (5.04) n = 885	5.74 (4.71) n = 763

Notes: Pairwise comparisons showed that husbands' cognitive functioning significantly decreased from visit 5 to 8 (mean difference = -1.38, SE = 0.25, df = 1065.23, $p < 0.001$) and from visit 8 to 11 (mean difference = -1.83, SE = 0.36, df = 730.87, $p < 0.001$). Wives' cognitive functioning significantly decreased from visit 5 to 8 (mean difference = -0.70, SE = 0.30, df = 1556.48, $p = 0.02$) and from visit 8 to 11 (mean difference = -0.98, SE = 0.33, df = 1515.84, $p < 0.01$). Husbands' depressive symptoms significantly increased from visit 5 to 8 (mean difference = 0.89, SE = 0.14, df = 1211.15, $p < 0.001$) but did not significantly change from visit 8 to 11 (mean difference = 0.02, SE = 0.17, df = 1023.77, $p = 0.91$). Wives' depressive symptoms significantly increased from visit 5 to 8 (mean difference = 0.96, SE = 0.15, df = 1688.97, $p < 0.001$) but did not significantly change from visit 8 to 11 (mean difference = 0.18, SE = 0.16, df = 1665.88, $p = 0.28$).

TABLE 4

Estimates for Structural Equation Models: Hypothesized Actor and Partner Effects

Structural equation model 1, in which paths from cognitive functioning to depression are included					Structural equation model 2, in which paths from depression to cognitive function are included				
	Path Coefficient	SE	Path Coefficient/SE	p		Path Coefficient	SE	Path Coefficient/SE	p
Hypothesis 1a (actor):									
Cog → Cog	1.11	0.02	61.12	p < 0.001	Cog → Cog	1.10	0.02	60.19	p < 0.001
Hypothesis 2a (partner):									
Cog → Partner Cog	-0.01	0.01	-0.54	p = 0.59	Cog → Partner Cog	-0.01	0.01	-1.00	p = 0.32
Hypothesis 1b (actor):									
Depress → Depress	0.60	0.02	36.33	p < 0.001	Depress → Depress	0.61	0.02	37.28	p < 0.001
Hypothesis 2b (partner):									
Depress → Partner Depress	0.05	0.02	2.90	p < 0.01	Depress → Partner Depress	0.06	0.02	3.60	p < 0.001
Hypothesis 3 (actor):									
Cog → Depress	-0.04	0.01	-3.68	p < 0.001	Depress → Cog	-0.06	0.03	-1.75	p = 0.08
Hypothesis 4 (partner):									
Cog → Partner Depress	-0.01	0.01	-1.64	p = 0.10	Depress → Partner Cog	-0.07	0.03	-2.03	p = 0.04

Notes: All like effects (e.g., visit 5 to visit 8, visit 8 to visit 11) were set to be equal, giving us an overall test of whether previous scores influenced subsequent scores. The fit indexes for model 1 were as follows: CFI = 0.95, TLI = 0.93, RMSEA = 0.05. For model 2, they were as follows: CFI = 0.95, TLI = 0.94, RMSEA = 0.05. All variables are continuous. Covariates in each model include both partners' age, education, ADLs, IADLs, and race (white = 1, nonwhite = 2). CFI: confirmatory fit index; Cog: cognitive functioning; RMSEA: root mean square error of approximation; TLI: Tucker-Lewis index.