Psychology and Aging

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Online First Publication, May 4, 2015. http://dx.doi.org/10.1037/pag0000025

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0882-7974/15/$12.00 http://dx.doi.org/10.1037/pag0000025

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Married couples evidence interdependence in their psychological and physical wellbeing across the life span. This is particularly true in aging populations that experience declines in physical health and cognitive ability. This study investigated the effects of partners' physical health and cognition on quality of life (QoL) in a series of bivariate latent curve growth models. The sample included aging married couples (N = 8,187) who participated in the Survey of Health, Ageing, and Retirement in Europe (SHARE) study and provided data across 6 years. Results indicated that husbands' and wives' baseline levels and rates of change in QoL covaried significantly over time. In addition, husbands' and wives' physical health and cognition predicted their partners' baseline level of QoL above and beyond their own health and cognition, and these effects were of equivalent size for both men and women. The findings suggest that as couples age, husbands' and wives' QoL, cognition, and health are predictive of their partners' QoL.

Keywords: marriage, aging, cognition, health, quality of life

Close relationships provide a vital context for human wellbeing (Reis, Collins, & Berscheid, 2000). As married or partnered couples age together, changes in one person's functioning can affect their partner's wellbeing. Physical health and cognitive ability are two important areas of functioning for aging adults, and both have important impacts on elements of wellbeing (Hillerås, Jorm, Herlitz, & Winblad, 1999; Okun & Stock, 1987), including quality of life (QoL; Netuveli, Wiggins, Hildon, Montomery, & Blane, 2006; Wiggins, Higgs, Hyde, & Blane, 2004). Although the predictive power of health and cognitive ability on individuals' QoL is firmly established, fewer studies have explored the association of physical health and cognitive abilities with later QoL within a dyadic context. Furthermore, those studies that have examined dyadic effects focus primarily on clinical conditions, such as cancer or dementia, rather than on how normative variations in physical health and cognition are associated with older adults' QoL. As levels of partner functioning have important impacts on both members of a marriage (Walker & Luszcz, 2009), aging adults' physical health and cognition may have unique effects on their partners' QoL. The current study seeks to identify if aging husbands' and wives' health and cognitive ability are predictive of their partners' later wellbeing, as indexed by QoL, in a large multinational sample of married adults.

QoL in Aging Populations

People are increasingly living longer, and aging adults are a growing proportion of developed countries' populations (Restrepo & Rozental, 1994). As the population of aging adults grows, so too does the need to understand successful aging, a term encompassing low levels of disability, high cognitive and physical functioning, and "active engagement with life" (Depp & Jeste, 2006; Rowe & Kahn, 1997). Increasing attention has been focused on successful aging, including a recent special issue devoted to its implications and concerns (cf. Pruchno, 2015), suggesting a continuing interest in understanding successful aging. QoL is a broad but important aspect of successful aging, typically describing a positive subjective perception of the aging process (Bowling, 2007; Strawbridge, Wallhagen, & Cohen, 2002) in aging populations. For example, higher QoL scores correspond with lower levels of plasma triglycerides and is linked to better cardiovascular health, and lung function (Steptoe, Demakakos, De Oliveira, & Wardle, 2012), better sleep (Steptoe, O'Donnell, Marmot, & Wardle, 2008), and a reduction in all-cause mortality (Netuveli, Pikhart, Bobak, & Blane, 2012; Steptoe & Wardle, 2012). Although several studies have identified the importance of physical health and cognition on

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This article uses data from SHARE Wave 4 release 1.1.1, as of March 28, 2013, and SHARE Wave 1 and 2 release 2.6.0 as of November 29, 2013. The SHARE data collection has been primarily funded by the European Commission through the 5th Framework Programme (project QLK6-CT-2001-00360 in the thematic programme Quality of Life), through the 6th Framework Programme (projects SHARE-I3, RII-CT-2006-062193, COMPARE, CIT5-CT-2005-028857, and SHARELIFE CIT4-CT-2006-028812), and through the 7th Framework Programme (SHARE-PREP, No 211909; SHARE-LEAP, No 227822; and SHARE M4, No 261982). SHARE data collection was also provided additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, R21 AG025169, Y1-AG-4553-01, IAG BSR06-11, and OGHA 04-064) and the German Ministry of Education and Research, as well as from various national resources whose support is gratefully acknowledged (see www.share-project.org for a full list of funding institutions). The authors did not directly receive support from any agencies for this article.

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individual QoL in older adults, fewer studies have examined these topics from a dyadic perspective. Variations in the physical health or cognition of a partner could interfere with the shared emotion long-term romantic partners may enjoy or rely on for their QoL.

Physical Health and Cognition Predicting Individual QoL

Health and cognition play an understandably central role in successful aging. In terms of physical health, people face increased risk for a variety of impairments in health as they age, including chronic diseases, decreased mobility, and immune function for example, and these difficulties are associated with decreases in aging adults' QoL. Life satisfaction is associated with elevated risk for early mortality (Gerstorf, Ram, Röcke, Lindenberger, & Smith, 2008). In contrast, better physical health is linked to improved QoL (Netuveli et al., 2006; Wiggins et al., 2004)

Cognition is a second, but equally important factor that contributes to successful aging. Aging is associated with an overall cognitive decline (Park, O'Connell, & Thomson, 2003), which can range from a normative, gradual change in cognitive ability to the onset of clinical conditions. Debilitating disorders, such as Alzheimer's disease (AD), dementia (Bäckman, Jones, Berger, Laukka, & Small, 2005), and mild cognitive impairment (MCI; Gauthier et al., 2006) have large effects on aging adults' QoL, increasing health care needs (Gaugler, Kane, Kane, & Newcomer, 2005) and mortality (Mölsä, Marttila, & Rinne, 1995). Normative changes in cognitive ability also have important effects on aging adults. Lower levels of cognitive functioning increase the likelihood of later disability and death (McGuire, Ford, & Ajani, 2006). In addition, cognitive decline predicts later wellbeing, disability, and use of health care (Comijs, Dik, Aartsen, Deeg, & Jonker, 2005), and correlates with psychological wellbeing (Okun & Stock, 1987; Wiggins et al., 2004) and life satisfaction (Jones, Rapport, Hanks, Lichtenberg, & Telmet, 2003).

Interpersonal Effects of Health, Cognition, and QoL

Individual levels of physical health and cognition are embedded in a social context. Relationships with friends and family can be either salubrious or harmful for older adults' physical health (Ashida & Heaney, 2008), cognition (Dixon, 2011; Seeman, Lusignolo, Albert, & Berkman, 2001), and wellbeing (Berg, Wiebe, & Butner, 2011). Personal relationships become especially important to aging adults as they begin to appraise that the time in their life is more limited and assume a more present-focused orientation that maximizes subjective emotional states (Carstensen, Isaacowitz, & Charles, 1999; Carstensen & Mikels, 2005). In this orientation, aging adults are more selective and put more effort into emotionally meaningful relationships and activities compared with those in earlier life stages (Carstensen, Fung, & Charles, 2003). By the same token, a smaller social network may also mean members have a more meaningful impact on aging adults' wellbeing. As such, it is important to explore the impact of close partners on aging adults' QoL

Marriage plays a central role in affecting the course of successful aging (Hoppmann, Gerstorf, & Luszcz, 2011). Interdependence theory posits that married people's patterns of behavior—whether positive or negative—can affect their partners because of nonindependent nature of their relationship (Cook & Kenny, 2005; Kelley & Thibault, 1978). These dyadic effects are conceptualized in several ways. *Crossover* or *spillover effects* occur when aspects of individuals negative experiences affect their partner via activation of both partners stress management and coping resources, particularly when one partner faces health issues (Berg & Upchurch, 2007; Westman, Keinan, Roziner, & Benyamini, 2008; Yorgason, Roper, Sandberg, & Berg, 2012). For example, older adults become physiologically aroused when thinking about or viewing their partner's simulated suffering (Monin, Schulz, Fenney, & Cook, 2010). In addition, *emotional transmission* occurs when individual's nonshared experiences affect their emotions and behaviors, which in turn affect their partners' future emotions and behaviors through interpersonal interactions (Larson & Almeida, 1999).

There is some broad support in the literature for dyadic effects of physical health, cognition and QoL specifically. For instance, husbands' and wives' wellbeing predicts their partner's wellbeing (Bookwala & Schulz, 1996), though subsequent research found only husbands' subjective wellbeing (SWB) predicts wives' SWB over time (Walker, Luszcz, Gerstorf, & Hoppmann, 2010).

In the case of physical health, dyadic effects can be both positive and negative. For example, there is a direct crossover effect of husbands' and wives' perceived health (Westman et al., 2008), and observing a partner suffering from pain can result in heightened individual distress, particularly among people who perceive their partner to be in greater pain (Monin, Schulz, Martire, et al., 2010). Couples coping with chronic illness also covary in their daily affect, suggesting that the negative effect of illnesses in later life are shared among marital partners (Berg, Wiebe, & Butner, 2011). In addition, among the oldest-old, individuals with chronic illnesses report more negative experiences when they are with their spouses, suggesting that health has contextual impacts on interpersonal experiences (Chui, Hoppmann, Gerstorf, Walker, & Luszcz, 2014). Couple dynamics can also positively influence health habits that reduce risk as a result of a shift from self-focused to relationship-centered thinking (Lewis et al., 2006). Communal coping, in which both members of a couple view one partner's health problems as a shared issue (Lyons, Mickelson, Sullivan, & Coyne, 1998), is associated with lowered mortality from heart failure (Rohrbaugh, Mehl, Shoham, Reilly, & Ewy, 2008).

Similar to physical health, cognition shows important dyadic associations in couples. For example, marital partners are generally concordant in cognitive measures (Dufouil & Alpérovitch, 2000). Much dyadic research focuses on the effect of acting as a caregiver to a romantic partner or family member. Caregivers generally report qualitative increases in frustration, resentment, and grief when beginning to care for those with clinical cognitive conditions, such as early dementia or MCI (Adams, 2006). More normative cognitive declines also are associated with dyadic quality. For example, husbands' earlier cognition predicts wives' later cognitive functioning among couples with marital problems (Strawbridge, Wallhagen, & Shema, 2011). In addition, husbands' perceptual speed predicts their wives' lagged scores on the same measure a year later, though this effect does not hold for wives' scores (Gerstorf, Hoppmann, Anstey, & Luszcz, 2009).

Gender Differences in Partner Effects

The broad dyadic effects of partners' physical health and cognition show meaningful gender differences. In general, wives' outcomes are more highly associated with their husbands' functioning than vice versa. For example, husbands' experience of stroke and high blood pressure is associated with wives' depression, but there is no association in the opposite direction (Ayotte, Yang, & Jones, 2010). This same effect occurred in the aforementioned work by Gerstorf et al. (2009) and Strawbridge et al. (2011), in which wives had greater sensitivity to their husbands' cognition, as well as work by Walker et al. (2010) examining wellbeing. In addition, among couples dealing with a chronic illness, women's wellbeing is generally more affected than men's (Northouse, Mood, Templin, Mellon, & George, 2000). These findings may reflect differences in how men and women experience variability in their partners' physical health and cognition because of a general pattern of gender expectations for caregiving relationships in old age, where women are more often expected to act as caregivers. For instance, wives with husbands with an illness report providing more support to their husbands than husbands with ill wives (Revenson, Abraido-Lanza, Majerovitz, & Jordan, 2005). Alternatively, different cultural expectations for men and women results in more women assuming interdependent self-construals (Cross & Madson, 1997; Impett & Peplau, 2006) than men. These construals could result in greater sensitivity for wives to their husbands' health and cognition, particularly in situations where a partner is experiencing age-related decline. Testing potential gender differences is essential to explore possible differences in how men and women experience their partners' health and cognition levels.

The Present Study

QoL is a central outcome for aging adults. Although research points to important interpersonal effects on QoL from partners' QoL, physical health and cognitive ability among older married couples, few studies address these topics in an integrated, longitudinal, dyadic model. There are a number of reasons why such an approach would be useful. First, physical health and cognition are correlated, both within and over time, resulting in shared variance that separate models cannot account for. An integrated model allows for an analysis of unique variance for both predictors of interest. Second, dyadic functioning may have important effects on a couple above and beyond individual QoL, health, and cognition alone. A dyadic model would allow for a better estimation of these interpersonal effects. Finally, using longitudinal data also allows for an examination of longitudinal partner effects of a couples' QoL over time.

To address these gaps in the literature, we examined the possible effects of partner's QoL, physical health and cognitive ability on QoL within a marital dyad using data from the Survey of Health, Ageing, and Retirement in Europe (SHARE) study. The large sample of married couples (n = 8,187) with full data collected over 6 years of data collection (with four waves of data collected every 2 years), including aspects of cognition, physical health, and QoL, presents a unique and rich opportunity to explore these associations over time in a dyadic model. Based on prior work by Bookwala and Schulz (1996) and Walker et al. (2011), we predict strong positive associations between husbands' and wives' baseline levels and rates of change in QoL. Further, we predict that husbands' and wives' health and cognition levels will predict their partner's QoL above and beyond their own health and cognition. Finally, we predict that these associations will be stronger for women than for men.

Method

Participants

As described in more detail by Börsch-Supan et al. (2013), the SHARE dataset currently has four waves of data collection (2004–2005; 2006–2007; 2008–2009; and 2011–2012); three panel waves (2004, 2006, and 2010) and one dealing with retrospective life histories (2008), with six planned additional waves of data. Participants were interviewed and were selected from 19 European Union countries (Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Sweden, Slovenia, Spain, and Switzerland) and Israel, with over 150,000 completed interviews with about 86,000 unique participants ages 50 or older, including a subset of interviews with both partners of romantic couples (of which, some were younger than 50). Participants from earlier waves were contacted for participation in subsequent waves and the average retention rate of the study for the first four waves was 81%. All nonincarcerated, nonhospitalized individuals in the countries being surveyed were eligible, and population registries were used for those countries in which such use was allowed. Interviewers made use of computer-assisted personal interviewing (CAPI) for the data collection, along with self-administered questionnaires that were dropped off to participants. The data collection incorporated a variety of variables capturing psychological, physical health, and cognitive aspects of participants. Six countries, however, (Ireland, Israel, Hungary, Portugal, Slovenia, and Estonia) did not participate in more than a single wave and are not included in the study sample.

Figure 1 outlines the inclusion and exclusion criteria that resulted in the final sample for the study. The original SHARE data contains 86,290 people (44% male), of whom 29,555 participated during at least two assessments among Waves 1, 2, and 4.[1] Of these 29,555 participants, 21,194 reported being continuously married across all completed waves of data. Participants with same-sex partners (n = 50) were excluded to maintain dyads distinguishable by gender. Of the remaining 29,555 people, 16,374 had data from the same partner available; resulting in 8,187 married couples. The selected participants were as a whole significantly younger (Cohen's d = −0.31), had more education (d = 0.07), higher income (d = 0.37), worse T0 physical health (d = −0.17), better T0 cognitive functioning (d = 0.23), higher T0 (d = 0.10), T1 (d = 0.19), and T3 QoL (d = 0.18), and fewer T0 depressive symptoms (d = −0.19), though in all cases besides age and income, the effect size of the differences in samples were small. Table 1 displays the

[1] The large number of participants who did not complete the necessary waves is because of the large additions to the dataset to include new participation from countries not originally involved in SHARE. These countries will have multiple assessments once additional waves are collected.

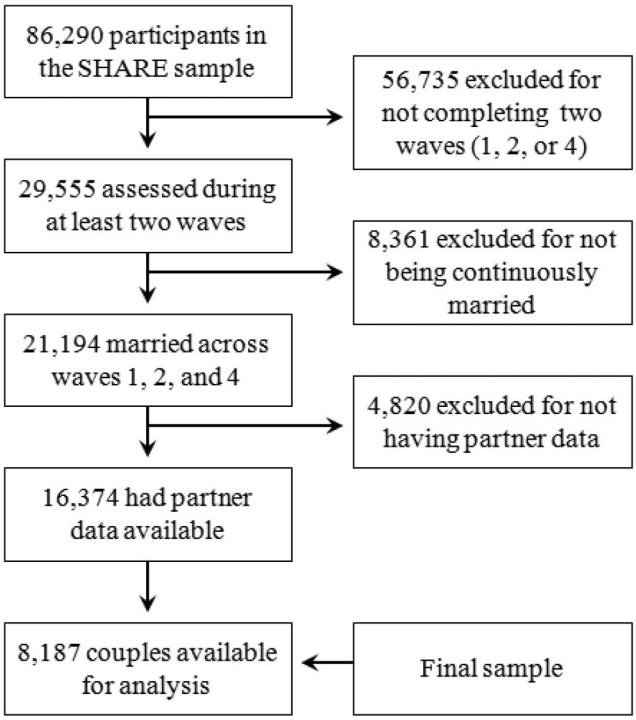

Figure 1. Selection and exclusion criteria for the final sample used in the present study.

descriptive statistics for the men and women who met the inclusion criteria on all variables used in the current study (N = 16,374).

Measures

Demographic variables. The SHARE study assessed a variety of demographic variables, including age, gender, household income percentile (out of 10), education, and year in which a marriage began. Household income percentile and marriage length differed for respondents, but were held constant across married partners in the analyses. A dichotomous measure of caregiver status, which asked participants whether they cared for a sick or disabled adult, was also included.

Physical health. Physical health was measured using participants' response to a 5-point Likert scale read out to them asking "Would you say your health is . . ." with responses ranging from *very poor* to *excellent*. Participants were randomized to receive the question either at the beginning or end of the broader physical health questionnaire to account for response biasing. Scores were reverse coded so that higher scores denoted higher self-perceived physical health. In general, self-perceived health is considered a valid measure of physical health among aged adults, showing convergent validity (Liang, 1986), and is predictive of future health problems and mortality (Idler & Benyamini, 1997). Some caution, however, must accompany judgments of self-rated health, as it is relative and is affected by the culture and country of the respondents (Jürges, 2007).

Cognitive ability. Cognitive ability was measured using an arithmetic mean of the scores of participants on three cognitive tasks: verbal fluency, immediate word recall, and delayed word recall. Score were standardized against the larger sample with data at all four waves (n = 9,773, 43.5% male) to account for differences in scaling of the measures. Verbal fluency was assessed using a task where participants were asked to name as many animals correctly as possible during a 1-min period. The measure is designed as an assessment of semantic fluency and is sensitive to alterations in brain function and has been used widely as a component of neuropsychological batteries to differentiate between healthy age-related memory change and clinically significant impairments (Haugrud, Crossley, & Vrbancic, 2011). Immediate and delayed word recall was measured using the Ten-Word Delayed Recall Test. Ten common words were presented and participants were asked to recall the words immediately and then again 5 min later. This assessment was constructed based on similar computerized word recall tasks that have been used extensively to assess immediate and delayed memory performance (Green, Montijo, & Brockhaus, 2011; Hoskins, Binder, Chaytor, Williamson, & Drane, 2010). The three-item scale showed adequate internal reliability in the current sample (α = .79).

Quality of life. QoL was measured using 12 items of the CASP-19 (Hyde et al., 2003), a scale developed specifically for use in assessing QoL, life satisfaction, and wellbeing in aging populations, which shows concurrent validity with similar measures. The scale seeks to assess the domains of "control," "autonomy," "self-realization," and "pleasure," with four to five Likert-scale agreement items across the four domains for a total of 19 items (e.g., "I look forward to each day"). These items' scores, ranging from 0 to 3, are then summed for a final score that can range from 0 to 57, with higher scores representing higher QoL. The CASP-19 shows predictive power based on contextual factors that impact wellbeing, such as health and marital problems (Blane, Higgs, Hyde, & Wiggins, 2004), has shown adequate internal reliability, and all four subdomains load on a single latent factor of QoL (Wiggins, Higgs, Hyde, & Blane, 2004). The SHARE dataset uses a subset of 12 of these items that show more robust statistical

Table 1
Demographic Characteristics Across Relevant Variables for Husbands and Wives

N = 16,374	Husbands	Wives	Effect size (d)
Physical health	3.18 ± 1.05	3.15 ± 1.04	0.03
Cognition	0.03 ± 0.78	0.21 ± 0.81	−0.23**
QoL	37.36 ± 5.73	37.09 ± 6.15	0.05*
QoL at T1	37.72 ± 5.94	37.44 ± 6.03	0.05*
QoL at T3	37.69 ± 6.04	37.40 ± 6.18	0.05*
Depressive symptoms	1.70 ± 1.86	2.49 ± 2.22	−0.39**
Age	63.77 ± 8.89	60.48 ± 9.01	0.37**
Education	10.88 ± 4.46	10.35 ± 4.20	0.12**
Caregiving status	0.05 ± 0.22	0.09 ± 0.88	−0.06**
Years married	35.57 ± 11.33		
Income percentile	6.19 ± 2.64		

Note. Data are means ± *SD*s. The effect size (d) represents the effect size of significant differences between husbands and wives. All variables are measured at T0 unless otherwise noted. QoL = quality of life, education is defined by self-reported years of education, income percentile ranges from 1 to 10. Income percentile and years married were equal for each dyad. Significant differences between husbands' and wives' are indicated with a * $p < .05$ or ** $p < .001$. All means and *SD*s were calculated using full information maximum likelihood estimation.

measurement properties as determined through exploratory and confirmatory factor analyses (Wiggins, Netuveli, Hyde, Higgs, & Blane, 2008). Response choices were coded from one to four and resulted in a final shorted scale with a range from 12 to 48, with higher scores representing higher QoL. The measure shows adequate internal reliability in the current sample in the fourth wave of SHARE data collection ($\alpha = .76$).

Depressive symptoms. Depressive symptoms were measured using the EURO-D, a measure designed to assess the self-reported presence of depressive symptoms within the European Union (Castro-Costa et al., 2007; Prince, Beekman, et al., 1999). The scale uses 12 binary yes or no items (1, 0; e.g., "Have you been sad recently?" and "Have you cried recently?") from the Geriatric Mental State, a scale designed for assessing depression in the elderly (Gurland et al., 1976). The EURO-D shows associations with age, gender, and marital status typical of other such scales, as well as concurrent validity with those same scales (Prince, Reischies, et al., 1999). The EURO-D showed adequate internal reliability in the current sample in both the first and fourth wave of data collection ($\alpha = .69$).

Data Analysis

In the current study, we specified a series of bivariate latent curve growth models (LCGM; McArdle & Anderson, 1990) that assess changes in QoL over the three study assessments, while accounting for unique actor and partner effects on the outcomes of interest. To test the primary hypotheses of interest, we first specified separate latent curve models for husbands and wives. Once the basic change models were created, we specified a bivariate LCGM (Model 1) to examine the intercept-intercept and slope-slope covariation of QoL among husbands and wives, including within occasion covariation (between the partners) of the manifest variables of QoL at T0, T1, and T4. We then specified a second model (Model 2) where we added the focal predictors of husbands' and wives' health and cognition at T0 to examine their associations with the latent curve parameters for QoL. Finally, we specified a third model (Model 3) where we added covariates to account for possible alternative predictors, including participant's age, depressive symptoms, caregiving status, and education, as well as couples' income percentile, and years married. The final conceptual model is presented in Figure 2.

In specifying the models, we identified the best-fitting LGCMs by comparing nested model specifications using a χ^2 difference tests [$\chi^2_{\text{Model 2}} - \chi^2_{\text{Model 1}}$ ($df_{\text{Model 2}} - df_{\text{Model 1}}$)]. Elements of the original model were constrained and estimated a second time in the nested model; if constraining different change parameters did not adversely affect model fit, we retained the more parsimonious model. Three main indexes of model fit are the standardized root-mean-squared residual (SRMR), root-mean-squared error of approximation (RMSEA), and comparative fit

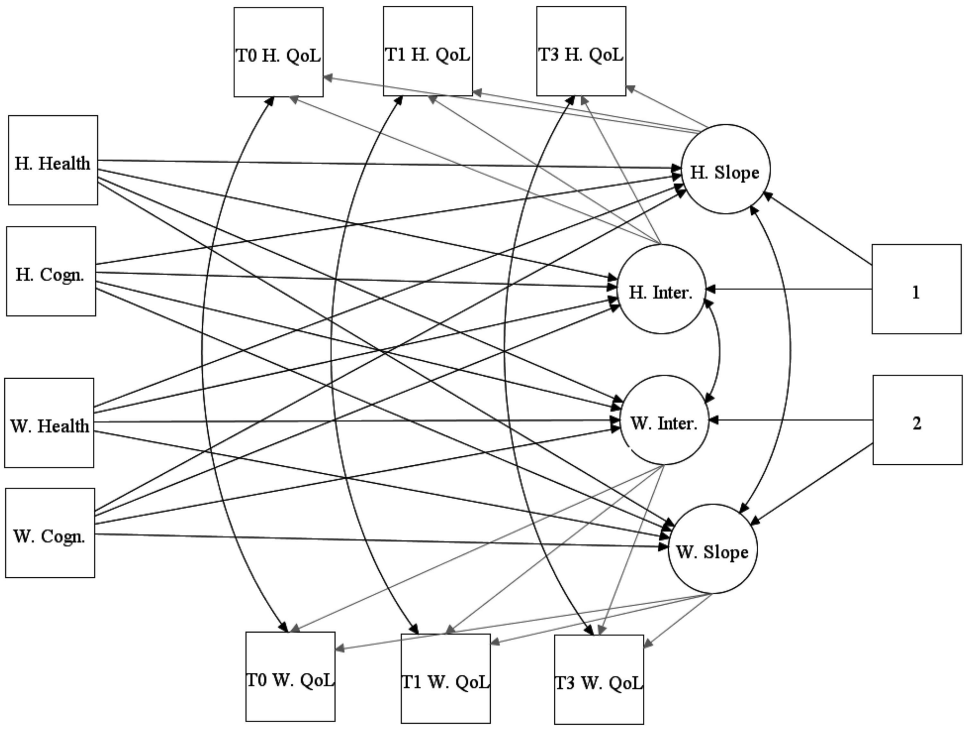

Figure 2. The final conceptual model for the current study, including the bivariate latent curve growth model and all relevant predictors for the latent curve parameters for QoL for husbands and wives, is presented above. The variables numbered 1 and 2 represent the relevant covariates included for (1) husbands and (2) wives (years married, income, education level, age, and depressive symptoms at T0). Health and cognition for husbands and wives were assessed at T0. H. = husbands, W. = wives, inter. = intercept, cogn. = cognition, QoL = quality of life. The estimates for all pathways in the model are included Table 2, Model 3.

index (CFI). Hu and Bentler (1999) suggested that a combination of examining SRMR, supplemented with RMSEA and CFI, is a robust method to assess model fit. Models were considered to have relatively good fit if SRMR values $<.08$, RMSEA values $<.06$, and CFI values $>.95$.

Finally, we conducted additional post hoc comparisons within Model 3 to test the difference in the strength of association between husbands' and wives' partner effects. In each case where a significant partner effects on QoL existed, we constrained husbands' parameter estimates within the model to equal their wives' estimate and calculated the χ^2 difference in model fit. Significant differences indicated a sex difference between men and women in the strength of partner effects of cognitive ability and physical health predicting QoL.

We conducted all analyses in Mplus version 7.2 (Muthén & Muthén, 2011) using full information maximum likelihood (FIML) estimation and simultaneous regression for all path models. Estimates included standardized regression weights to allow for comparison between differently scaled predictors. The values represent the amount of a *SD* change in the outcome variable predicted by a 1 *SD* change in the predictor. The standardized values are calculated using the formula $\beta = b^{*}SD(x)/SD(y)$ for continuous predictors, and $\beta = b/SD(y)$ for dichotomous variables, which is described in further detail in Muthén & Muthén (2011).

Missing data. Our treatment of missing data reflected a balance between inclusion and exclusion of participants to best approach the assumptions of FIML estimation for missing data, namely data that is missing at random (MAR; Graham, 2009), while also including as many participants in the sample as possible. Both concerns can produce results that do not reflect the associations in the population a sample is collected from. In the case of the former, if a sample contains data that is not missing at random (NMAR), it can produce biased parameter estimates for structural equation models (Graham, 2009; Schafer & Graham, 2002). In the case of the latter, excluding participants from representative samples can act to create samples that are no longer representative, but are biased because of the nature of exclusionary criteria. For these reasons, we elected to include all continuously married couples with partner data who completed at least two of the three time points in our models. This approach balances the importance of including as many participants as possible while also maintaining the likelihood that the sample data is MAR. Despite this balanced approach, concerns may remain that the data may still be NMAR; therefore, we specified our final model using a smaller subsample of couples ($n = 2{,}566$) with data at all time points (T0, T1, and T3) to confirm results found in the larger sample.

Results

Table 1 displays the descriptive statistics of the variables used in the models. In comparison to the women in the sample, men reported significantly higher QoL at T0 ($d = 0.05$), T1 ($d = 0.05$), and T3 ($d = 0.05$), age ($d = 0.37$), and education in years ($d = 0.12$). They also reported significantly lower levels of T1 cognitive ability ($d = -0.23$), caregiver status ($d = -0.06$), and depressive symptoms at T0 ($d = -0.39$). All significant differences were in the small to moderate range for effect size. In addition, men and women's reports of physical health and cognition at T0 were significantly correlated in the sample, at the level $r = .37$, $p < .001$, and $r = .48$, $p < .001$, respectively.

Model 1: Bivariate LCGM

Before examining the bivariate specification, we first tested the basic LCGMs for husbands and wives separately to identify the best fitting univariate models. These models suggested that a simple linear change model fit the data well for both husbands and wives. Allowing the final time point to vary freely (while also setting the covariation between the slope and intercept of QoL to zero to maintain one model *df*) improved model fit for both husbands, χ^2 (1, $n = 8{,}187$) = 10.69, $p < .001$, and wives, χ^2 (1, $n = 8{,}187$) = 9.16, $p < .001$. The model for husbands, χ^2 (1, $n = 8{,}187$) = 1.18, $p = .227$, SRMR = .010, CFI = 1.00, RMSEA = .005, and wives, χ^2 (1, $n = 8{,}187$) = 0.35, $p = .554$, SRMR = .005, CFI = 1.00, and RMSEA = .000, both had good fit.

Model 1 integrated these two LCGMs into a single bivariate specification that included covariation among the latent curve parameters for husbands and wives, while also allowing the manifest variables of QoL to covary over time. (Constraining the intercept-slope partner effects—i.e., husbands' slope covarying with wives' intercept—to zero was necessary to produce a positive definite PSI matrix.) Once constrained, the final model fit the data adequately, χ^2 (6, $n = 8{,}187$) = 20.61, $p = .002$, SRMR = .017, CFI = 1.00, and RMSEA = .017. The results evidenced a significant positive covariation between husbands' and wives' intercepts (i.e., their initial QoL levels at the start of the study), $\beta = 0.74$, $p < .001$, and slopes, $\beta = 0.85$, $p < .001$, for QoL.[2] The final results for the model are presented in Table 2.

Model 2: Bivariate LCGM Including Focal Predictors

In Model 2, we then added husbands' and wives' physical health and cognition at T0 as predictors of the slope and intercept of QoL. The model, including physical health and cognition as predictors, fit the data well, χ^2 (14, $n = 8{,}187$) = 21.26, $p = .095$, SRMR = .009, CFI = 1.00, and RMSEA = .008. Husbands' intercept of QoL was significantly predicted by their partner's physical health, $\beta = 0.06$, $p = .003$, at T0, and cognition, $\beta = 0.15$, $p < .001$. Wives' intercept of QoL was also predicted by their husbands' physical health, $\beta = 0.09$, $p < .001$ at T0, and cognition, $\beta = 0.13$, $p < .001$. In addition, husbands' slope of QoL was significantly predicted by wives' physical health, $\beta = 0.13$, $p = .005$; however, there were no other significant partner effects on the slope of QoL for men or women. The covariation between the intercepts, $\beta = 0.69$, $p < .001$, and slopes, $\beta = 0.72$, $p < .001$, of QoL remained significant with the addition of these predictors. The final results for Model 2 are presented in Tables 2 and 3.

Model 3: Bivariate LCGM Including Focal Predictors and Covariates

Model 3 included the addition of competing predictors (age, education level, income, years married, caregiving status, and depressive symptoms) to the bivariate specification examined in

[2] In the case of covariations, standardized effect sizes (β) represent the correlation coefficient between the two latent curve parameters (*r*).

Table 2
Husbands' and Wives' QoL LCGM Parameters and Covariations

	Model 1		Model 2		Model 3	
Parameter	Mean	Variance	Mean	Variance	Mean	Variance
Husbands' intercept	37.41**	4.24**	37.36**	4.22**	37.43**	4.29**
Husbands' slope	0.36**	1.93**	0.38**	2.05**	0.20**	1.64**
Wives' intercept	37.15**	4.58**	37.07**	4.66**	37.12**	4.69**
Wives' slope	0.30**	1.73**	0.37**	1.91**	0.27**	1.75**
Fit statistics						
H1 log-likelihood	−99473.53		−128422.91		−285613.11	
No. of parameters	21		51		180	
Model *df*	6		14		50	
χ^2	20.61		21.26		281.57	
SRMR	0.017		0.009		0.016	
RMSEA	0.017		0.008		0.024	
CFI	1.000		1.000		0.990	
Covariations	β	95% CI	β	95% CI	β	95% CI
Intercept–intercept	0.74**	[0.72, 0.76]	0.69**	[0.65, 0.72]	0.67**	[0.63, 0.71]
Slope–slope	0.85**	[0.68, 1.02]	0.72**	[0.57, 0.87]	0.72**	[0.58, 0.85]
T0 QoL–T0 QoL	0.34**	[0.29, 0.39]	0.37**	[0.32, 0.41]	0.35**	[0.31, 0.40]
T1 QoL–T1 QoL	0.29**	[0.22, 0.36]	0.29**	[0.23, 0.34]	0.34**	[0.30, 0.37]
T3 QoL–T3 QoL	0.37**	[0.32, 0.42]	0.37**	[0.33, 0.41]	0.31**	[0.25, 0.38]

Note. Model 1 is the bivariate latent curve growth model (LCGM), Model 2 is the bivariate LCGM including the focal predictors, and Model 3 includes relevant covariates. QoL = quality of life; SRMR = standardized root-mean-squared residual; RMSEA = root-mean-squared error of approximation; CFI = comparative fit index.
* $p < .05$. ** $p < .001$.

Model 2. In this final model, the slopes and intercepts of QoL for men and women were regressed on all couple level covariates (years married, income level), whereas individual level covariates (age, caregiving status, education level, and depressive symptoms) were only included for each individual. The resulting model fit the data adequately, χ^2 (14, n = 8,187) = 281.57, $p < .001$, SRMR = .016, CFI = 0.99, and RMSEA = .024. The model results are presented in Table 2. The partner effects of wives' health, β = 0.07, $p < .001$, and cognition β = 0.14, $p < .001$ on husband's QoL intercept, and the partner effects of husbands' health, β = 0.10, $p = .005$ cognition, β = 0.07, $p = .005$, and, on wives' QoL intercept remained significant. These results are displayed in Figure 3. With the addition of the covariates, there were no significant partner effects on the slope of QoL, suggesting the association of wives' physical health predicting husbands' slope in QoL is better explained by husbands' covariates included in Model 3. The results for all predictors are presented in Table 3. In addition, the covariation between the intercepts, β = 0.67, $p < .001$, and slopes, β = 0.72, $p < .001$, for QoL remained significant with the addition of these covariates.

Partner Effects by Gender

We next compared partner effects of health and cognition on the intercepts of QoL for men and women using a single degree of freedom χ^2 difference test to test our hypothesis that men's health and cognition would be more predictive of wives' QoL than vice versa in Model 3. Men and women did not significantly differ on the strength of partner effects for physical health, χ^2 (1, N = 8,187) = 0.10, $p = .752$, or cognition, χ^2 (1, N = 8,187) = 2.02, $p = .155$. The results suggest there are not significant gender differences in the observed partner effects on QoL.

Additional Effects of Interest

Beyond the hypothesized effects of interest, the results of the LCGM also presented additional findings of interest. First, both husbands' and wives' had a positive slope of QoL (0.20, $p = .002$ and 0.27, $p < .001$, respectively), suggesting that QoL increased over the course of the study for both spouses, even when accounting for relevant covariates. Wives' slope of QoL was significantly higher than husbands' slope ($p = .009$) suggesting that aging wives gain more QoL over time, though the size of this effect was very small (d = 0.04) and significant primarily because of the large size of the sample.

In addition, the covariates included in Model 3 evidenced actor effects on baseline levels of QoL for husbands and wives. In particular, husbands and wives who reported higher age, education, and income, and lower depressive symptoms, predicted higher baseline levels of QoL. Model 3 also revealed effects on QoLs slope from husbands' and wives' depressive levels and age, such that people who were older and those with lower levels of depressive symptoms evidenced lower slopes, and lower levels of QoL over time compared with those with higher levels of depressive symptoms or age at T0.

Confirmatory Analyses

Finally, as a confirmation that the use of couples with two assessments and FIML was not biasing our parameter estimates, we specified the models described including only participants with all three assessments available (n = 2,566). The final model, including the focal predictors and covariates, fit the data adequately, χ^2 (14, n = 2,566) = 138.48, $p < .001$, SRMR = .020, CFI = 0.99, RMSEA = .026, and replicated the significant pos-

itive covariation between husbands' and wives' QoL intercept, $\beta = 0.60$, $p < .001$, and slope, $\beta = 0.79$, $p < .001$. In addition, the result replicated partner effects on both husband's QoL intercept from wives' health, $\beta = 0.14$, $p < .001$, and cognition, $\beta = 0.10$, $p < .001$, and wives' QoL intercept from husbands' health, $\beta = 0.07$, $p = .003$, and cognition, $\beta = 0.14$, $p < .001$. Finally, in this smaller sample, partner effects for physical health were significantly stronger for men, χ^2 (1, n = 2,566) = 23.39, $p < .001$, whereas the partner effects for cognition were significantly stronger for women, χ^2 (1, n = 2,566) = 4.79, $p = .029$.[3]

Discussion

Using a representative multinational sample of European couples in later life, we explored dyadic associations, including the partner effect of physical health and cognition, on QoL. Spouse's QoL covaried, both at baseline and over time, and husbands' and wives' variations in cognition and health predicted their partners' QoL at baseline, but not over time. Finally, the strength of these partner effects did not differ for men compared with women.

Partner Concordance in QoL

In the current study, husbands' and wives' baseline QoL were positively correlated, suggesting that husbands and wives entered the study with similar QoL scores. Further, their QoL slopes also were positively correlated, suggesting that as wives' QoL increased or decreased so did their husbands' QoL (and vice versa). These findings replicate previous research that has found similarities among husbands' and wives' wellbeing (Bookwala & Schulz, 1996; Walker et al., 2011). The present study also extended these findings to LCGM parameters (namely intercept–intercept and slope–slope covariation) and presents a compelling case for interdependence of QoL among older couples, though in the current model specification, directionality of these associations could not be determined. Further, the sizes of the effects are large, accounting for 45.4% and 51.2% of the variance in baseline and change in QoL, respectively.

Partner Effects of Physical Health and Cognition on QoL

We also found that husbands' and wives' levels of physical health and cognition were predictive of their partners' baseline levels of QoL, but not their slope. A 1 *SD* change in a husbands' physical health corresponded to a 0.07 *SD* change in wives' QoL, and a 1 *SD* change in husbands' cognition corresponded to a 0.11 *SD* change in wives' QoL, representing a change of ~0.30 and 0.47 points in husbands' baseline CASP-12 subscale. Similarly, a 1 *SD* change in a wives' physical health corresponded to a 0.07 *SD* change in husbands' QoL, and a 1 *SD* wives' cognition corresponded to a 0.10 *SD* change in husbands' QoL, representing a change of ~0.33 and 0.47 points in wives' baseline CASP-12 subscale, respectively. As shown in Figure 3, partner effects of both physical health and cognition are smaller than actor effects of physical health, but are more similar to actor effects of cognition. These findings extend prior literature regarding the interdependent effects of physical health (Berg et al., 2011; Rohrbaugh et al., 2004; 2008; Westman et al., 2008) and cognition (Gerstorf et al., 2009; Strawbridge et al., 2011) among couples to the prediction of QoL, an important outcome for aging adults. The results suggest that variations in physical health and cognition may affect partners' QoL, possibly by activating partner's stress management and coping resources, or by affecting individual's emotions and behaviors, which then affects their partner's QoL.

Spouse's physical health and cognition levels did not predict *change in* their partner's QoL over time. This null finding should be understood in the context of the actor effects of both physical health and cognition. Only wives' own physical health level predicted lower QoL overtime, whereas cognition did not. Neither husbands' own physical health nor cognition predicted their change in QoL over time. The lack of actor effects (the effect of people's own health and cognition predicting their change in QoL) suggests that variation in levels of physical health and cognition are not predictive of change over time for individuals or their partners. Future research should test the possibility that change may better predict change over time, as *changes in* physical health and cognition may predict *changes in* QoL over time.

Gender Differences in Partner Effects on QoL

There were no significant gender differences between husbands' and wives' effects on their partners' QoL. These results contrast with prior research that found stronger effects of husbands' variables on wives' outcomes (Gerstorf et al., 2009; Northouse et al., 2000; Strawbridge et al., 2011; Walker et al., 2011). This similarity (of effects for husbands and wives) for physical health is more surprising given the literature that find women are more affected by their partners' physical illnesses or clinical cognitive disorders than men (Ayotte et al., 2010; Northouse et al., 2000). The current study examined self-reported physical health and cognition across the full normative spectrum, rather than in the presence of a clinical cognitive disorder or chronic illness, as was typically the case in prior research. It is possible that gender differences exist in more severe caregiving scenarios involving clinical illness, but not across normative levels of physical health and cognition. Future research is necessary to replicate this before firm conclusions can be drawn regarding gender differences in partner effects for physical health and cognition on QoL.

Additional Effects of Interest

Beyond our hypothesized dyadic effects, our models revealed additional associations of interest more broadly. First, the mean QoL slope for the study was positive, indicating that people's QoL increased over time in this sample. In addition, wives'

[3] The models described here were also run with depressive symptoms as the outcome of interest in a LCGM with covariates. Although the model fit the data adequately, χ^2 (46, n = 2,566) = 104.13, $p < .000$, SRMR = .010, CFI = 0.99, and RMSEA = .022, there were no significant partner effects of physical health or cognition levels predicting depressive symptoms at baseline (the intercept) or change in depressive symptoms over time (slope). Participant's own physical health and cognition predicted baseline QoL, but not the slope of QoL, except in the case of women's cognition predicting their own depression at baseline (that was nonsignificant).

Table 3
Standardized Regression Coefficients Predicting Husbands' and Wives' QoL Slopes and Intercepts

	Model 2		Model 3	
	β	95% CI	β	95% CI
Husbands' QoL intercept				
Husbands' health	0.41**	[0.37, 0.45]	0.28**	[0.23, 0.31]
Husbands' cognition	0.19**	[0.15, 0.23]	0.11**	[0.07, 0.16]
Wives' health	0.06*	[0.02, 0.10]	0.07**	[0.03, 0.11]
Wives' cognition	0.15**	[0.11, 0.19]	0.14**	[0.10, 0.18]
Husbands' age			0.08**	[0.04, 0.13]
Husbands' education			0.12**	[0.09, 0.15]
Husbands' depression			−0.35**	[−0.38, −0.32]
Husbands' caregiving			0.04*	[0.01, 0.07]
Years of marriage			0.05*	[0.00, 0.10]
Income percentile			0.11**	[0.07, 0.15]
Husbands' QoL slope				
Husbands' health	−0.10*	[−0.20, −0.01]	−0.03	[−0.12, 0.05]
Husbands' cognition	0.02	[−0.09, 0.12]	0.04	[−0.06, 0.13]
Wives' health	0.13**	[0.04, 0.22]	0.03	[−0.04, 0.13]
Wives' cognition	0.09	[−0.01, 0.19]	0.05	[−0.04, 0.14]
Husbands' age			−0.34**	[−0.43, −0.24]
Husbands' education			−0.08*	[−0.15, −0.01]
Husbands' depression			0.19**	[0.11, 0.27]
Husbands' caregiving			−0.03	[−0.09, 0.04]
Years of marriage			0.08	[−0.01, 0.17]
Income percentile			−0.05	[−0.13, 0.03]
Wives' QoL intercept				
Husbands' health	0.09**	[0.05, 0.13]	0.07**	[0.03, 0.11]
Husbands' cognition	0.13**	[0.09, 0.18]	0.10**	[0.06, 0.14]
Wives' health	0.40**	[0.37, 0.44]	0.28**	[0.25, 0.32]
Wives' cognition	0.25**	[0.21, 0.29]	0.19**	[0.15, 0.23]
Wives' age			0.10**	[0.05, 0.15]
Wives' education			0.13**	[0.10, 0.17]
Wives' depression			−0.35**	[−0.38, −0.31]
Wives' caregiving			0.01	[−0.02, 0.04]
Years of marriage			0.02	[−0.03, 0.04]
Income percentile			0.08**	[0.05, 0.12]
Wives' QoL slope				
Husbands' health	0.06	[−0.04, 0.16]	0.06	[−0.03, 0.15]
Husbands' cognition	0.01	[−0.10, 0.12]	0.04	[−0.07, 0.14]
Wives' health	−0.16*	[−0.26, −0.06]	−0.12*	[−0.22, −0.02]
Wives' cognition	0.00	[−0.11, 0.11]	−0.02	[−0.12, 0.08]
Wives' age			−0.30**	[−0.42, −0.17]
Wives' education			−0.03	[−0.12, 0.07]
Wives' depression			0.18**	[0.09, 0.27]
Wives' caregiving			0.03	[−0.05, 0.10]
Years of marriage			0.12	[−0.01, 0.25]
Income percentile			−0.06	[−0.16, 0.04]

Note. Model 2 is the bivariate latent curve growth model (LCGM) including the focal predictors (health and cognition), whereas Model 3 includes covariates (age, education, depressive symptoms, caregiving status, years of marriage, and income). QoL = quality of life; education is defined by self-reported years of education; income percentile ranges from 1 to 10.
* $p < .05$. ** $p < .001$.

slope was significantly higher than husbands', though the size of this effect was very small ($d = 0.04$). The finding that husbands' and wives' mean slopes are positive may provide support for the idea that people are aging successfully over time in the domain of subjective wellbeing. This result matches well with prior findings regarding the positivity effect of aging (Carstensen, 2006), which suggests that as people age and approach the end of life, they generally view prior events more positively, which could affect QoL. Alternatively, it is possible that increased attention to successful aging and improving standards of medical care could result in increased QoL. These possibilities are not mutually exclusive, however, and further research should attempt to identify and test additional mechanisms of action that result in increasing QoL among aging adults.

Also of interest is the finding that people who are older have higher QoL at the start of the study, but their QoL is more likely to decrease over time. It is possible that those who are older may

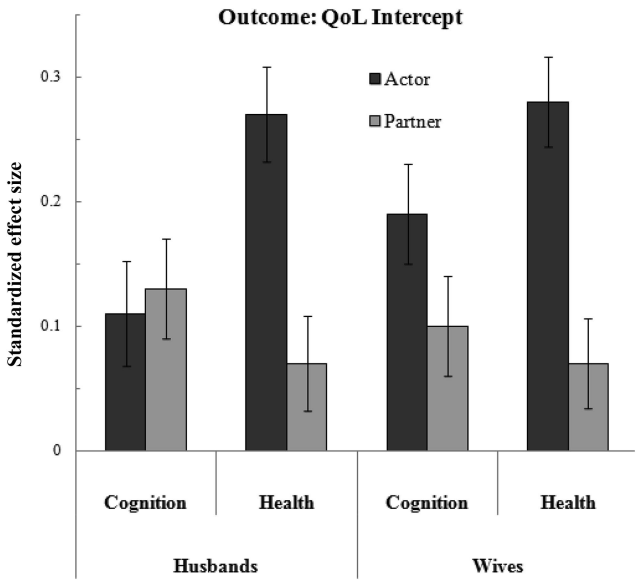

Figure 3. The standardized actor and partner effects of health and cognition predicting the intercept of husband and wives' QoL from the full model, including all covariates (years married, income, education level, age, and depressive symptoms at T0). All actor and partner effects displayed were significant at the $p < .001$ level. There were no significant differences in partner effects between men and women for cognition or physical health's prediction of husbands' or wives' QoL intercept. Error bars represent 95% confidence intervals.

have experienced the aforementioned benefits of the positivity effect on QoL already, but also may be more likely to face age-related issues that reduce QoL, such as decreased physical health or cognition. In comparison, people with higher depressive symptoms had lower QoL initially, but higher depressive symptoms also predicted improvement in QoL over time. It is possible that people would likely experience gains in QoL if their depressive symptoms are treated or spontaneously remit. Finally, higher levels of education and income were associated with higher baseline levels of QoL. It is likely that having more education and wealth allows aging adults to have more control over their living situations and job prospects as they age, which could lead to higher levels of QoL. Alternatively, it is possible those with higher incomes are still working, which may affect subjective QoL.

The results of this study have implications for both treatment and research that involves aging couples. QoL is an important predictor of long-term health outcomes (Netuveli et al., 2012; Steptoe et al., 2012). The results of this study suggest that treatments focused solely on *the aging individual*, rather than both members of a couple, can miss an important avenue for improving these outcomes. This is consistent with prior work that has found dyadic interventions to be more effective than patient-only treatments in cases when one member of the couple faces a chronic illness (Martire, Schulz, Helgeson, Small, & Saghafi, 2010). These results suggest that partner differences in more normative levels of physical health may affect QoL, and future interventions could provide resources to couples to address possible decreases in QoL when one partner has lower levels of self-reported physical health. Fewer studies have examined the impact of interventions that improve retention of cognition, such as those focused on social engagement (Fried et al., 2004; Hertzog, Kramer, Wilson, & Lindenberger, 2008). It is possible that the same benefits that have been shown in using dyadic interventions in the case of physical health problems may extend to QoL outcomes as a result of partner effects of cognition.

These results also suggest that examining partners' health and cognition in the context of QoL is an important consideration. Further research can shed light on the pathways responsible for partner effects of physical health and cognition on QoL. Although much work has examined the effect associated with neurological disorders such as Alzheimer's disease or dementia that result in a partner needing to serve as a primary caregiver, fewer have explored how more age-typical cognitive levels may impact QoL. It is possible that lower levels of cognition could interfere with husbands' and wives' pattern of emotional and practical support to their partner, leading to losses in QoL. Alternatively, lower levels of cognition, particularly if lower levels of cognition are because of age-related decline, could result in emotions or behaviors that affect interpersonal interactions within couples (via emotional transmission). Aging adults generally invest more resources into emotionally meaningful relationships and activities, interacting with close social partners rather than broader social networks (Carstensen, Fung, & Charles, 2003; Carstensen, Isaacowitz, & Charles, 1999). For those people whose partners have experienced lower levels of cognition or health, interactions with a spouse may not meet their expectations, resulting in lower satisfaction.

The results of this study should be understood in light of its limitations. First, the neurocognitive measures used to assess cognition in the present study are not ideal for analyzing specific elements of cognition. Although prior studies have used this group of measures as an index of cognition and each measure has been independently validated (Green et al., 2011; Haugrud et al., 2011; Hoskins et al., 2010), it is possible more refined measures of cognition may result in different findings or more reliable measurement. Second, it is unclear from the current study if the pattern of covariation among husbands' and wives' baseline levels and change over time in QoL is bidirectional or unidirectional. Future research could incorporate specific directional associations to test the nature of this relationship. Third, the models used in the current study imply some type of partner effect, but do not explicitly test different types of proposed mechanisms. Additional models are necessary before firm conclusions can be drawn about *how* people's physical health and cognition affect their partner's QoL. Fourth, although the results evidenced partner effects for physical health and cognition predicting baseline QoL, these effects are time-ordered and directionality cannot be determined by the current model. Future research should use models with lagged associations or change in physical health and cognition to explicitly test the directionality of these effects. Finally, same-sex couples were excluded from this study to maintain distinguishable dyads to test the presence of gender differences in partner effects. The existence of partner effects among same-sex couples is an important scientific question, however, and future research could use indistinguishable dyadic designs and explicitly test partner effects of physical health and cognition on QoL in same sex-couples.

Conclusion

By examining the association of physical health and cognition with QoL in a dyadic model, the current study replicates and extends prior findings regarding the interdependence of aging married couples. Husbands' and wives' baselines and slopes for QoL significantly covaried, further supporting prior research that husbands' and wives' QoL are interdependent. In addition higher levels of husbands' and wives' physical health and cognition predicted higher levels of baseline QoL for their partners, and these associations were similar in size for husbands and wives. As couples age, they face a variety of challenges, including age-related cognitive decline and physical health concerns. The current findings suggest that variations in physical health and cognition have meaningful effects on not only individual's own QoL, but their partner's QoL as well. As a result, future treatment and research on aging couples should address the possible interdependent effect of physical health and cognition on QoL outcomes.

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Received September 12, 2014
Revision received March 4, 2015
Accepted March 10, 2015 ■