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## Joint trajectories of spousal social support and depressive symptoms in older age

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Keywords:	intimate partner, personal relationships, latent growth curve
Abstract:	<p><b>Objectives:</b> We describe changes in depressive symptoms and positive and negative social support from the spouse/partner in a representative sample of older people in England.</p> <p><b>Methods:</b> Men and women aged 50+ (n = 7171) from the English Longitudinal Study of Ageing reported social support and depressive symptoms (Center for Epidemiologic Studies Depression scale) on up to 5 occasions between 2002-03 and 2010-11. Parallel process latent growth models estimated their bi-directional associations, adjusted for gender, wealth, education, and limiting illness.</p> <p><b>Results:</b> In age and gender-adjusted models, positive spousal support decreased and negative support increased over time, especially among women. Greater increases over time in depressive symptoms were seen in those with lower positive support or higher negative support at baseline. More baseline depressive symptoms predicted greater declines in positive support and greater increases in negative support from the spouse.</p> <p><b>Discussion:</b> Improving older couple's relationship quality may help reduce depressive symptoms.</p>

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7 **Abstract**  
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10 support from the spouse/partner in a representative sample of older people in England.  
11

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13 Methods: Men and women aged 50+ (n = 7171) from the English Longitudinal Study of  
14 Ageing reported social support and depressive symptoms (Center for Epidemiologic Studies  
15 Depression scale) on up to 5 occasions between 2002-03 and 2010-11. Parallel process latent  
16 growth models estimated their bi-directional associations, adjusted for gender, wealth,  
17 education, and limiting illness.  
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20 Results: In age and gender-adjusted models, positive spousal support decreased and negative  
21 support increased over time, especially among women. Greater increases over time in  
22 depressive symptoms were seen in those with lower positive support or higher negative  
23 support at baseline. More baseline depressive symptoms predicted greater declines in positive  
24 support and greater increases in negative support from the spouse.  
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27 Discussion: Improving older couple's relationship quality may help reduce depressive  
28 symptoms.  
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41 **Keywords**  
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44 intimate partner; personal relationships; latent growth curve  
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3 **Title:** Joint trajectories of spousal social support and depressive symptoms in older age  
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6  
7 **Introduction**  
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9 Many studies show an association between social support and lower risk of depressive  
10 symptoms (Schwarzbach, Luppa, Forstmeier, König, & Riedel-Heller, 2014). Social support  
11 may have a direct protective effect or may buffer the effect of stressors on depressive  
12 symptoms. In addition, this association may be bi-directional such that psychological disorder  
13 leads to poor quality social support (Monroe, 1983). Older adults have been the focus of  
14 much of the research in this field for at least two reasons. First, they are thought to be at  
15 greater risk of deficits in their social relationships and second, they may benefit more from  
16 the protective effects of social relationships since they are more exposed to or vulnerable to  
17 stressors such as health declines and other life events associated with ageing (Chan, Anstey,  
18 Windsor, & Luszcz, 2011). There is longitudinal evidence that social support is related to  
19 depressive symptoms among older people. In particular, received instrumental and emotional  
20 support and perceived social support (that is, positive evaluation of support) from family and  
21 friends have been associated with fewer depressive symptoms at follow-up in the general  
22 population of older adults (Russell & Cutrona, 1991; Sonnenberg, Deeg, van Tilburg, Vink,  
23 Stek, & Beekman, 2013). Although most evidence is from western cultures, there is some  
24 evidence for a protective effect of support in other cultures (Chao, 2011; Chao, 2014; Zimmer  
25 and Chen, 2012).  
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46 However, it is increasingly realised that negative aspects of social relationships should  
47 be considered alongside positive social support. Positive relationship quality is indicated by  
48 mutual understanding and openness. Negative aspects of the relationship include criticism  
49 and negative feelings, such as feeling let down or feeling that the other person is making too  
50 many demands. Conflict and criticism may co-exist with emotional and instrumental support  
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3 (Bradbury & Karney, 2004). There is evidence that negative aspects of social relationships  
4 are related to depressive symptoms in later life independently of positive support (Ingersoll-  
5 Dayton, Morgan, & Antonucci, 1997; Newsom, Nishishiba, Morgan, & Rook, 2003;  
6 Newsom, Rook, Nishishiba, Sorkin, & Mahan, 2005).

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11 As noted, the association between support and depressive symptoms may be bi-  
12 directional over time. Studies also show that depressive symptoms are prospectively  
13 associated with poorer perceived social support at follow-up (Gurung, Taylor, & Seeman,  
14 2003; Leskela, Melartin, Rytala, Sokero, Lestela-Mielonen, & Isometsa, 2008) and with  
15 greater negative interactions at follow-up (Krause & Rook, 2003). Recovery from depression  
16 leads to improved evaluation of one's social support, especially in older compared with  
17 younger adults (Patten, Williams, Lavorato, & Bulloch, 2010). Despite this suggestive  
18 evidence, there has so far been little empirical estimation of the bi-directional nature of the  
19 associations between trajectories of positive and negative social support and trajectories of  
20 depressive symptoms. The main aim of this study was to address this gap using longitudinal  
21 data from a nationally representative cohort study set in England.

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35 Social support may be derived from many different relationships including the spouse  
36 or partner (hereon referred to simply as spouse), other close family, friends and others (Fiori,  
37 Antonucci, & Cortina, 2006). The current study focuses on spousal social support for two  
38 main reasons. Spouses and children make up a greater portion of the social network of older  
39 compared with younger adults (Aartsen, van Tilburg, Smits, & Knipscheer, 2004) and the  
40 spouse is the most frequently nominated close person in older age (Antonucci, Akiyama, &  
41 Takahashi, 2004; Cornwell, Laumann, & Schumm, 2008; Cornwell, Schumm, Laumann, &  
42 Graber, 2009). There is evidence that a good relationship with the spouse is more strongly  
43 related to lower risk of depressive symptoms than other social relationships in later life (Teo,  
44 Choi, & Valenstein, 2013). The quality of the spousal relationship is therefore important in  
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3 older age. In line with the functional-specificity model (Weiss, 1974), the various forms of  
4 support provided within the spousal relationship may have a different impact when provided  
5 by another relationship. For example, the existence of a spousal relationship (and a  
6 relationship with children) has been related to sense of attachment among older people,  
7 whereas the existence of other types of relationship was not related to sense of attachment  
8 (Simons, 1984). On the other hand, reassurance of self-worth from those outside the family  
9 has been more strongly linked to positive affect than that derived from those within the  
10 family (Felton & Berry, 1992). Whereas low social support among unmarried people may  
11 indicate that they have few social connections, among married people it may indicate an  
12 unhappy marriage or difficulty in handling disagreements within the marriage, and it may in  
13 itself be a source of stress (Coyne & DeLongis, 1986). Therefore, rather than consider social  
14 support from multiple sources combined (Krause et al., 1998; Chou & Chi, 2003; Taylor &  
15 Lynch, 2004), we limit our investigation to change in support provided within the spousal  
16 relationship and its association with changes in depressive symptoms. This focus should be  
17 noted when interpreting the findings, however, since the magnitude of the association  
18 between spousal support and depressive symptoms may be modified by the presence of, and  
19 quality of, relationships with others who make up the closest part of the social convoy (Birditt  
20 & Antonucci, 2007).

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42 In addition, changes in spousal support in older age may show a different pattern than  
43 changes in social support across multiple sources. Generally studies indicate rising (Martire,  
44 Schultz, Mittlemark, & Newsom, 1999; Cornman, Lynch, Goldman, Weinstein, & Lin, 2004;  
45 Shaw, Krause, Liang, & Bennett, 2007; Cornwell et al., 2009) or stable (van Tilburg, 1998;  
46 Taylor & Lynch, 2004) levels of emotional support and declining negative interactions  
47 (Shaw, Krause, Liang, & Bennett, 2007; Fuller-Iglesias, Webster, & Antonucci, 2015) with  
48 age among all sources combined (in line with socioemotional selectivity theory (Carstensen,  
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3 Isaacowitz, & Charles, 1999)), but not with the spouse in particular. Mixed positive and  
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5 negative feelings are particularly high for the spousal relationship (Fingerman, Hay, &  
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7 Birditt, 2004) and longitudinal studies point to declining marital quality (Birditt, Jackey, &  
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9 Antonucci, 2009; Gurung et al., 2003; Umberson, Williams, Powers, Liu, & Needham, 2006)  
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11 and declining satisfaction with marital support (vanLaningham, Johnson, & Amato, 2001)  
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13 over time. This may be because the possibility to withdraw from an unsupportive relationship  
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15 is more difficult in the case of the relationship with the spouse compared with other  
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17 relationships. It is not yet clear whether positive and negative support change with age in the  
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19 same way for older men and women. Longitudinal studies are mixed in finding that changes  
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21 are not modified by gender (VanLaningham et al., 2001) but also that gender differences in  
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23 poor marital quality are most marked in older age (Umberson & Williams, 2005) and that  
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25 women experience greater increases in negative interactions with their spouses than men  
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27 (Gurung et al., 2003).  
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31 Previous longitudinal examinations of the association between spousal support and  
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33 depressive symptoms were based on two waves of data. One did not consider bi-directionality  
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35 (Stafford et al., 2012). One showed baseline marital discord predicted depressive symptoms  
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37 at two-year follow-up and baseline depression predicted subsequent marital discord among  
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39 middle aged and older adults (Whisman & Uebelacker, 2009). The only other study to  
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41 consider bi-directional associations between spousal support and depression was based on  
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43 younger twins (less than 58 years). That study showed that female twins with greater spousal  
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45 support had lower risk of major depression four years later and that baseline major depression  
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47 was associated with greater problems with spouse at follow-up. These longitudinal  
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49 associations were not fully explained by shared genetic factors (Wade & Kendler, 2000).  
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53 In longitudinal studies that captured social support from multiple close persons (not  
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55 only the spouse), one found a strong negative association between baseline satisfaction with  
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3 support and depressive symptoms at 18 month follow-up but no association between baseline  
4 depressive symptoms and later satisfaction with support (Krause et al., 1989). However,  
5 another found baseline depressive symptoms were positively associated with support from a  
6 household member three years later (Chou & Chi, 2003). We identified only one existing  
7 study that modelled depressive symptoms and social support trajectories. Based on multiple  
8 data points over a ten year period, increases in perceived social support summed across all  
9 sources were found to be correlated with decreases in depressive symptoms (Taylor & Lynch,  
10 2004).

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12 In summary, although there is some evidence for a bi-directional association,  
13 trajectories of spousal support and depressive symptoms in later life as related functions do  
14 not appear to have been described. We extend existing work to include multiple waves to  
15 better estimate cross-sectional and longitudinal bi-directional associations, considering  
16 changes in depressive symptoms and social support as processes that may be related to each  
17 other in older age using bivariate growth models. We also consider positive and negative  
18 aspects of the spousal relationship separately. Available data led us to focus on perceived  
19 support. Measures of perceived support have the advantage of allowing for the fact that not  
20 all partner's attempts at support are viewed as helpful, and they correlate well with reported  
21 marital quality. However, they do not necessarily capture the number and quality of  
22 supportive interactions or behaviours from the spouse (Dehle, Larson, & Landers 2001).

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24 The current study aimed to test associations between changes in positive and negative  
25 spousal support and changes in depressive symptoms captured on up to five occasions from  
26 eight years of follow-up in a nationally representative sample of older men and women living  
27 in England. We hypothesised a bi-directional association between depressive symptoms and  
28 support such that 1) baseline higher positive support would be associated with a stable or  
29 declining trajectory of depressive symptoms and baseline negative support with an increasing  
30 trajectory of depressive symptoms.

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3 trajectory of depressive symptoms; and that 2) a higher number of depressive symptoms at  
4 baseline would be associated with a decline in positive support (or an increase in negative  
5 support) over time. We also considered gender differences in trajectories, and in the  
6 association between spousal support and depressive symptoms, given previous evidence that  
7 women's mental health may be more negatively impacted by low support (Kendler, Myers, &  
8 Prescott, 2005).  
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### 18 **Data and Methods**

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20 The data for this study came from the English Longitudinal Study of Aging (ELSA).  
21 ELSA is a sample of people aged 50 and older living in England. It was drawn from  
22 households that responded to the Health Survey for England (HSE). Individuals were  
23 classified as core ELSA sample members at Wave 1 if they were included in the HSE and  
24 were aged 50 in 2002 when the first wave of ELSA took place. A total of 11,391, 67% of  
25 eligible sample members, took part in Wave 1 of ELSA. More detail on the sampling and  
26 response rates for ELSA is given elsewhere (Taylor et al., 2007). Every two years, data are  
27 collected by a trained interviewer in the participant's home and, after a computer assisted  
28 personal interview, respondents are also asked to fill in a self-completion questionnaire. Data  
29 from core members from the first five waves were used here and were accessed through the  
30 UK Data Service (UK Data Service, 2017). Ethical clearance for ELSA was obtained from  
31 the Multicentre Research and Ethics Committee.  
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### 48 *Measures*

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50 An eight-item version of the Center for Epidemiologic Studies Depression Scale  
51 (CES-D) was used to capture depressive symptoms by interview. This tool has been validated  
52 against the full CES-D (Turvey, Wallace, & Herzog, 1999) and predicts mortality in  
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3 community samples (Turvey, Schultz, Beglinger, & Klein, 2009). In the self-completion  
4 questionnaire, participants were asked whether they had experienced each symptom much of  
5 the time during the past week (possible responses “yes” or “no”). Positive support from the  
6 spouse or partner was captured in the self-completion questionnaire by three items covering  
7 empathy, dependability, and confiding. The item wordings were as follows: “How much do  
8 they really understand the way you feel about things?”, “How much can you rely on them if  
9 you have a serious problem?”, and “How much can you open up to them if you need to talk  
10 about your worries?” Possible responses ranged from “a lot” (coded 3) to “not at all” (coded  
11 0) and were summed to create a positive support from spouse scale (ranging from 0 to 9;  
12 Cronbach’s alpha = 0.79). Negative support was captured by three items covering criticism,  
13 being let down, and annoyance and was coded in the same way (with high scores indicating  
14 high negative support; Cronbach’s alpha = 0.62). The items were: “How much do they  
15 criticise you?”, “How much do they let you down when you are counting on them?”, and  
16 “How much do they get on your nerves?”  
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33 Age (from 50 to 99 years), gender (male, female), and educational attainment  
34 (secondary and above, primary and below) were identified as potentially important covariates  
35 and measured at baseline interview. At each wave, respondents were coded as having a  
36 limiting longstanding illness if they stated they had a long-standing illness, disability or  
37 infirmity *and* that this limited their activities in any way. Household wealth quintile  
38 (including housing and non-housing wealth minus debts but excluding pension wealth) was  
39 also captured at each wave.  
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### 50 *Statistical methods*

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52 Longitudinal changes in depressive symptoms and spousal support were first  
53 described separately. The number of depressive symptoms was analysed as a continuous  
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3 variable. Using up to five waves of data, baseline (intercept) and within-person linear change  
4 (slope, per two year increase in follow-up time) in depressive symptoms were estimated using  
5 a latent growth model. Latent intercept and slope were controlled for gender and age (centred  
6 at the mean of 63 years). Levels of positive and negative support were also analysed as  
7 continuous variables and baseline and within-person change in these variables were estimated  
8 in the same way in separate univariate models. We present aging-vector graphs of predicted  
9 scores (depressive symptoms, positive support and negative support) in order to show  
10 visually the level of each score at baseline, and the direction and amount of change  
11 throughout the age range of our sample. Each arrow represents the predicted origin and  
12 change in each score for an eight year birth cohort. The graphs reveal both trends by age of  
13 the sample at baseline *and* cohort-specific within-person changes over time in depressive  
14 symptoms, positive support and negative support.

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29 The associations between the latent intercepts and latent slopes of depressive  
30 symptoms and positive support were then estimated using a two-parallel process latent  
31 growth model (Figure 1; Muthen, 2007). Coefficient *a* represents the association between  
32 positive support at baseline (I +ve support) and change in depressive symptoms (S CESD).  
33 Coefficient *b* represents the association between baseline depressive symptoms (I CESD) and  
34 change in positive support (S +ve support). Coefficient *c* represents the correlation between  
35 slopes, with a negative and statistically significant correlation indicating that increases in  
36 positive support are associated with decreases in depressive symptoms. This approach was  
37 repeated to estimate associations between depressive symptoms and negative support.  
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Baseline age and education and time-varying wealth and limiting long-term illness were  
controlled and each of these variables was grand mean-centred. We show estimates for men  
and women combined (with adjustment for gender) and also based on multiple group analysis  
with gender as the grouping variable. In sensitivity analysis we tested whether associations

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3 between depressive symptoms and spousal support depended on age (i.e. we included age  
4 (coded as 50-64 and 65+ years) as a grouping variable). Coefficients a, b and c did not  
5 statistically significantly differ by age group (data available from authors). We note the  
6 limited age range in these data and do not interpret this finding as indicating that the  
7 association between spousal support and depressive symptoms would be constant across all  
8 age adults (see Patten et al., 2010).

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11 We evaluated several goodness-of-fit indices to determine the fit of the models. Chi-  
12 square is sensitive to sample size; in large samples it will tend to be statistically significant  
13 when there are only minor misspecifications of the model (Hu & Bentler, 1999). Therefore,  
14 we employed the Comparative Fit Index (CFI) and the Root-Mean-Square Error of  
15 Approximation (RMSEA). The CFI is based on the chi-square statistic; it ranges between 0  
16 and 1, with values close to 1 indicating a more acceptable fit to the data. The RMSEA  
17 represents closeness of fit, with values below 0.05 representing close fit of the model,  
18 although others suggest a value of 0.06 (Hu & Bentler, 1999). To handle missing covariate  
19 data, we used full information maximum likelihood estimation, which computes parameter  
20 estimates on the basis of all available data under the assumption that data are missing at  
21 random (Enders & Bandalos, 2001). Ethnicity (coded as white or non-white) and government  
22 office region were included as auxiliary variables since these, along with health and  
23 socioeconomic characteristics, are associated with missingness (Taylor et al., 2007).  
24 Analyses were run using MPlus version 7.11 software.

### 25 26 27 *Analytical sample*

28 Wave 1 sample members who had a spouse were included in the analysis. Of the 11,391 who  
29 took part in wave 1, 1,213 did not answer the self-completion questionnaire. Of the remaining  
30 10,178 participants, 2,893 did not have a spouse. After exclusion of those with missing

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3 depressive symptoms or spousal support data, the current study was based on 7,171  
4 participants. Of these, 3,639 provided data at all five waves (3,412 on depressive symptoms,  
5 2,497 on positive support and 2,487 on negative support), 1,058 at three or four waves, and  
6 1,934 at one or two waves.  
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## 11 12 13 14 15 **Results**

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18 Participants in the current study had a mean age of 62.9 years and just over 30% had a  
19 limiting long-term illness (Table 1). Sample members who were not included in the current  
20 study were older, less highly educated and less wealthy than those who were included. Those  
21 who provided data from fewer waves also had higher mean age, had lower levels of  
22 educational attainment, were less wealthy, had lower levels of positive support and higher  
23 levels of negative support, and had higher mean depressive symptoms than those with data at  
24 all five waves.  
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### 35 *Univariate trajectories*

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37 Univariate changes in depressive symptoms and in support over time controlling for  
38 gender and baseline age were examined (Table 2 and supplementary Figure 1). Compared  
39 with men, women had on average 0.39 more depressive symptoms at baseline. The mean  
40 number of symptoms increased over time at a rate of 0.019 symptoms per two years and there  
41 was no evidence that this increase differed for men and women. From age 63 onwards (the  
42 centring point for the age variable), higher age was positively related to baseline depressive  
43 symptoms and positively related to increasing depressive symptoms over time. These data  
44 indicate a decrease in depressive symptoms over eight years of follow-up in the youngest  
45 cohort and a nadir for depressive symptoms in the mid-sixties. The intercept and slope  
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3 variance estimates indicate significant variation between individuals in both the initial level  
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5 of depressive symptoms and change in symptoms over time.  
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7           Univariate changes in support from the spouse are also shown in Table 2. Positive  
8 support from the spouse was lower at baseline for women compared with men (by 0.52  
9 points, around one third of a standard deviation in positive support) (supplementary Figure  
10 2). On average, positive support decreased over time and decreased more for women than for  
11 men. Age was not related to positive support at baseline but was negatively associated with  
12 positive support slope indicating that older participants experienced greater declines over  
13 time compared with younger participants. Negative support from the spouse was slightly  
14 higher at baseline for women and for younger cohorts (Table 2 and supplementary Figure 3).  
15 There was an overall increase in negative support over time, particularly for women.  
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### 29 *Joint trajectories of positive support and depressive symptoms*

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31           Table 3 summarises the correlations between changes in positive support and  
32 depressive symptoms based on a two-parallel process model. In the model with men and  
33 women combined, adjusted for age, gender, wealth, education, limiting long-term illness and  
34 depressive symptoms, there was no significant change in positive support over time. This is  
35 in contrast to the age and gender-adjusted analysis presented in Table 2, in which positive  
36 support was found to decrease over time. Differences between these models indicate that  
37 time-varying socioeconomic circumstances and limiting long-term illness explained declines  
38 in positive support. The mean number of depressive symptoms, however, increased over time  
39 even after adjustment for these health and socioeconomic factors at a rate of 0.28 symptoms  
40 per two years. In line with the first hypothesis, those with higher baseline support had a  
41 smaller increase in number of depressive symptoms (standardised regression coefficient -  
42 0.26). Baseline depressive symptoms were negatively associated with change in positive  
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3 support (standardised regression coefficient -0.21). In other words, in line with the second  
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5 hypothesis, those with more baseline symptoms had a greater decrease in positive support.  
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7 The magnitude of these coefficients was very similar; there was no suggestion that one  
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9 direction dominated. Changes in the number of depressive symptoms and changes in positive  
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11 support were negatively correlated. In other words, those who experienced declining positive  
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13 support tended to experience an increase in number of depressive symptoms during the same  
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15 period. Estimates from the multiple group model show that the same associations were seen  
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17 when men and women were considered separately. That is, there was no evidence of gender  
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19 differences in the associations between trajectories of positive spousal support and depressive  
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21 symptoms.  
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#### 26 *Joint trajectories of negative support and depressive symptoms, and gender differences*

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28 Table 4 summarises changes in negative support and depressive symptoms and  
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30 associations between the growth factors. In the model for men and women combined, there  
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32 was no overall change in negative support in the fully adjusted model. More detailed analysis  
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34 revealed that this was due to the adjustment for depressive symptoms at baseline (data  
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36 available from the authors). There was an overall decline in number of depressive symptoms  
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38 over time (of 0.10 symptoms per two years) in the fully adjusted model. In other words,  
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40 adjustment for additional covariates explained the increases in depressive symptoms seen  
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42 between waves 1 and 5 in the age and gender-adjusted univariate model. There was a positive  
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44 association between baseline negative support and increasing depressive symptoms. There  
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46 was also a positive association between baseline number of depressive symptoms and change  
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48 in negative support; those with more symptoms at baseline experienced increasing negative  
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50 support over time. There was no evidence that changes in negative support were correlated  
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52 with changes in number of depressive symptoms. These associations provide support for the  
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3 first and second hypotheses, however there was evidence, albeit weak, of gender difference in  
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5 some of these associations. The multiple group analysis indicated that estimates representing  
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7 associations between the growth factors were similar for men and women, with the exception  
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9 that the positive association between baseline depressive symptoms and increase in negative  
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11 support was larger for men than women ( $p < 0.05$ ). Gender differences in other estimates did  
12  
13 not attain statistical significance though there was a suggestion that the positive association  
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15 between baseline negative support and depressive symptoms slope was a little larger among  
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17 women ( $\beta = 0.42$ ) than men ( $\beta = 0.28$ ) and that women ( $\beta = 0.05$ ), but not men ( $\beta = -0.02$ ),  
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19 experienced an increase in negative support through follow-up, conditional on all other  
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21 covariates.  
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## 26 **Discussion**

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28 Based on five waves of data spanning eight years of follow-up, we found an average  
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30 decrease in positive support and increase in negative support from spouses in age and gender  
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32 adjusted models. These slopes were explained by circumstances including illness and wealth  
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34 that also change in later life, and by levels of depressive symptoms at the start of follow-up,  
35  
36 discussed later. Changes were larger in magnitude for women compared with men. This  
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38 aligns with the small literature focused on marital quality which has found declining  
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40 satisfaction with support from the spouse and increasing negative spousal exchanges in later  
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42 life (Gurung et al., 2003; vanLaningham et al, 2001). Depressive symptoms also increased  
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44 through follow-up for those in their mid-sixties and over but declined or were stable for those  
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46 who were younger at baseline. Our findings concur with several longitudinal studies which  
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48 show increases in depressive symptoms with age from the mid-sixties onwards (Burns et al.,  
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50 2013; Davey, et al., 2004; Mirowsky & Kim, 2007; Taylor & Lynch 2004), partly due to  
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52 declines in physical health and proximity to death (Sutin et al., 2013) although others have  
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3 identified groups with differing trajectories (Melchior et al., 2013). Assessment of the age-  
4 related change in depressive symptoms was not the main aim of our study, but we note that  
5 the changes in depressive symptoms seen here were small in magnitude.  
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9 The main focus of our study was to examine the evidence for bi-directional  
10 associations of depressive symptoms and spousal support. We built on previous studies which  
11 have tended to focus on one as the exposure and the other as the outcome of interest. As  
12 hypothesised, higher baseline positive support was associated with greater decrease in  
13 depressive symptoms over time, controlling for age, gender, education, wealth and limiting  
14 long-term illness. Similarly, baseline depressive symptoms were negatively associated with  
15 trajectories of positive support. The associations between baseline positive support and  
16 changes in depressive symptoms were the same magnitude as those between baseline  
17 depressive symptoms and changes in positive support. We also found correlations between  
18 changes in positive support and changes in depressive symptoms. That is, given initial levels  
19 of positive support from the spouse, new information of relevance for understanding changes  
20 in depressive symptoms is gained by knowing about *changes* in that support.  
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35 The same conclusion cannot be drawn for the associations between trajectories of  
36 negative support and depressive symptoms however, since there was a suggestion that these  
37 may depend on gender. In particular, there was evidence that baseline depressive symptoms  
38 were more strongly associated with a subsequent increase in negative support among men  
39 than women. Based on the estimated coefficients, there was a tendency towards a steeper  
40 association between baseline negative support and increasing depressive symptoms over time  
41 among women compared with men though the gender difference did not attain statistical  
42 significance. Put together, these findings could suggest that the directionality of the  
43 association between depressive symptoms and negative support depends on gender. This  
44 warrants testing in other studies given that statistical evidence was not strong and that we did  
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3 not have a priori reasons to expect this result. Gender differences have been found in one  
4 previous study, in younger adults (aged 21-58 years; Kendler et al., 2005), which showed that  
5 positive support showed a stronger protective association for major depression among  
6 women. That study did not consider positive and negative aspects of support separately.  
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11 Bi-directional causal associations are conceptually plausible. Spousal support may  
12 reduce depressive symptoms by facilitating access to resources that buffer the potentially  
13 detrimental effects of stressors (Berkman, Glass, Brissette, & Seeman, 2000). Supportive  
14 spouses may also motivate self-care and promote a sense of belonging which reduces the  
15 likelihood of depressive symptoms (Krause, 2007). Spousal support may also lead to lower  
16 marital conflict, which is in turn associated with lower risk of depressive symptoms (Cramer  
17 & Jowett, 2010). Depressive symptoms and depressive cognition, on the other hand, can  
18 reduce a person's ability to recognise and use the positive support being offered as well as  
19 increasing the sensitivity to negative aspects of social relationships (Alloy et al., 1999;  
20 Maher, Mora, & Leventhal, 2006).  
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### 35 *Strengths and limitations*

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37 These findings are based on data from a large, representative sample of people aged  
38 50 and over living in England, though may not be generalizable to other cultures. The  
39 analytical method allowed for heterogeneity, that is, differences in spousal support and  
40 depressive symptom trajectories among older adults (Krause, 1999). Some limitations must  
41 be considered. The internal consistency of the negative support scale was rather low and this  
42 may result in some underestimation of the association between negative support and  
43 depressive symptoms. Furthermore, both positive and negative aspects of support were  
44 captured by only three items and did not represent the multiple dimensions of support that  
45 may be relevant for depressive symptomatology (Finch, Okun, Pool, & Ruehlman, 1999).  
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3 The study is based on self-reported data. These findings do provide stronger evidence than  
4 that provided by cross-sectional studies, however, since the associations between initial levels  
5 in one process and changes in the other process are not driven by cross-sectional correlations.  
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9 As with all longitudinal studies, loss to follow-up may have introduced bias.

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11 Depressive symptoms, poor own and spousal health and widowhood are associated with  
12 drop-out. This may result in an underestimation of the real increase in negative support and  
13 decrease in positive support in the general population since poor health may place a strain on  
14 the marital relationship. In addition, we expect that our analysis somewhat underestimated the  
15 true increases in depressive symptoms and the strength of the association between depressive  
16 symptoms and both negative and positive support. In order to minimize the potential bias  
17 derived from missing data due to loss to follow-up, we used full information maximum  
18 likelihood estimation. Thus the partial trajectories of those who did not provide data at later  
19 waves were able to be estimated.  
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31 There are a number of variables that we have not been able to consider in this  
32 analysis. The possibility of confounding by unmeasured factors (for example neuroticism or  
33 another element of personality disposition) cannot be ruled out (Lewis, Bates, Posthuma, &  
34 Polderman, 2014). Individuals, rather than dyads, were the unit of analysis. We measured  
35 perceived support from an individual's perspective but did not have any information  
36 capturing interactions within the partnership that may be most useful for developing  
37 interventions (Coyne & DeLongis 1986). Although we captured negative aspects of the  
38 spousal relationship, we did not explicitly capture spousal conflict. Previous studies show that  
39 couple's management of conflict is linked to depressive symptoms (Du Rocher Schudlich,  
40 Papp, & Cummings, 2011). Furthermore, we considered negative and positive aspects of the  
41 spousal relationship separately and did not explore their joint effects on depressive symptoms  
42 though previous evidence indicates that they influence each other over time (Bradbury &  
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3 Karney, 2004) and that they may modify each other's effects (DeLongis, Capreol, Holtzman,  
4 O'Brien, & Campbell 2004). Our study focused on the spousal relationship and we did not  
5 investigate changes in positive and negative support in other relationships, or possible  
6 modification of the link between spousal support and depressive symptoms according to  
7 support derived from other sources (Birditt & Antonucci, 2007). Cohabiting partnerships  
8 were also included in our analysis though we did not distinguish between married and  
9 cohabiting couples.  
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### 20 *Implications for research and practice*

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22 The finding of a bi-directional association between depressive symptoms and support  
23 from the spouse or partner has two key implications. First, initiatives to reduce depressive  
24 symptoms may have consequences for the spousal relationship. Second, the context of the  
25 spousal relationship is relevant to consider in treatment for depression among married and  
26 cohabiting older people. This observational, epidemiological study is one step in  
27 understanding these associations. Conceptually, spousal relationship quality might be  
28 expected to improve with age due to the increasing emotional control and emotional  
29 understanding, and greater familiarity that comes with experience (Carstensen, Gottman &  
30 Levenson, 1995; Charles & Piazza, 2007; Charles, 2010). On the other hand, chronic  
31 stressors and vulnerabilities that might negatively affect the quality of the spousal  
32 relationship tend to increase with age (Charles, 2010). A previous study showed negative  
33 interactions with the spouse or partner were highest among those aged 75+ compared with  
34 younger ages (Akiyama et al., 2003). We also found declines in spousal relationship quality  
35 with advancing age in models which were adjusted for age and gender, and our results shed  
36 some light on factors that might underlie this. In the fully-adjusted models, which were  
37 additionally controlled for baseline depressive symptoms and time-varying illness and  
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3 wealth, there was no evidence of significant change in positive or negative support from the  
4 spouse. The quality of support derived from the relationship with the spouse suffers in the  
5 presence of depressive symptoms, limiting illness and low wealth. This highlights a potential  
6 intervention point for the improvement of the quality of the spousal relationship in older age.  
7 In addition to the known societal and individual burden of depressive symptoms, this study  
8 emphasises the potential cost to a couple's relationship quality.  
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16 Previous studies note the concordance in depressive symptoms among spouses, due to  
17 assortative mating, social homogamy and shared environment (Pradeep & Sutin, 2015). Our  
18 study finds that the quality of spousal relationship is one element of the shared environment  
19 that is relevant for depressive symptoms. Indeed, other evidence suggests that the spousal  
20 relationship, to a greater extent than other relationships, is a key determinant of depressive  
21 symptoms (Teo et al., 2013). We did not have data reported by the spouse but future research  
22 might investigate the extent to which any correlation between trajectories of depressive  
23 symptoms of spouses is due to positive and negative support. The presence of depressive  
24 symptoms might limit the support that spouses can give each other. Initiatives to improve the  
25 quality of a couple's relationship, both by facilitating positive forms of support and reducing  
26 negative aspects, may be one approach to reducing depressive symptoms among older people.  
27 This may include interventions provided to couples as well as to individuals facing  
28 challenges associated with aging.  
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#### 46 **Conflict of interest**

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48 The authors declare that there is no conflict of interest/  
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Table 1. Baseline characteristics of n=7,171 study participants

	Mean (S.D)	Analytical sample n
Age	62.9 (8.9)	7,171
Positive support	7.9 (1.6)	7,171
Negative support	2.4 (1.8)	7,112
Number of depressive symptoms	1.3 (1.7)	7,078
	%	Analytical sample n
Female	48.6%	3,487
Household wealth quintiles		
Richest	25.8%	1,811
4th	23.4%	1,640
3rd	21.2%	1,491
2nd	18.5%	1,296
Poorest	11.2%	786
Low education	51.0%	3,656
White	97.7%	7,007
Limiting long-term illness	31.3%	2,246
Government Office Regions		
North East	6.3%	448
North West	12.7%	910
Yorkshire and The Humber	11.5%	826
East Midlands	9.9%	708
West Midlands	10.6%	763
East of England	12.3%	879
London	8.2%	585
South East	16.9%	1,209
South West	11.8%	843

S.D. Standard Deviation

Table 2. Univariate growth curve models for changes over time in mean i) number of depressive symptoms, ii) positive spousal support, and iii) negative spousal support.

	Depressive symptoms	Positive support	Negative support
	Estimate (se)	Estimate (se)	Estimate (se)
<b>Growth factors</b>			
Intercept	1.10 (0.03)	8.21 (0.03)	2.34 (0.03)
Intercept variance	1.57 (0.05)	1.74 (0.04)	1.90 (0.05)
Slope (per 2 years)	0.019 (0.009)	-0.036 (0.008)	0.050 (0.01)
Slope variance (per 2 years)	0.050 (0.005)	0.037 (0.004)	0.023 (0.005)
<b>Associations between growth factors and covariates</b>			
Intercept on female	0.39 (0.04)	-0.52 (0.04)	0.18 (0.04)
Intercept on age (centered at 63 years)	0.009 (0.002)	0.004 (0.002) <sup>NS</sup>	-0.006 (0.002)
Slope on female	0.015 (0.013) <sup>NS</sup>	-0.027 (0.012)	0.033 (0.012)
Slope on age (centered at 63 years)	0.006 (0.001)	-0.002 (0.001)	0.000 (0.001) <sup>NS</sup>
<b>Model fit</b>			
CFI	0.987	0.986	0.996
RMSEA	0.028	0.056	0.018
N	7,140	7171	7112

<sup>NS</sup> Non-significant

Table 3. Two-parallel process positive support and depression<sup>a</sup>

	All	Men	Women
	Estimate (se)	Estimate (se)	Estimate (se)
<b>Positive support growth factors</b>			
Intercept	7.96 (0.02)	8.21 (0.02)	7.68 (0.03)
Intercept variance	1.67 (0.04)	0.92 (0.04)	2.36 (0.07)
Slope (per 2 years)	-0.01 (0.01) <sup>NS</sup>	-0.00 (0.01) <sup>NS</sup>	-0.01 (0.02) <sup>NS</sup>
Slope variance (per 2 years)	0.03 (0.003)	0.03 (0.003)	0.04 (0.005)
<b>Depressive symptoms growth factors</b>			
Intercept	1.29 (0.02)	1.11 (0.02)	1.49 (0.03)
Intercept variance	1.06 (0.03)	0.92 (0.04)	1.19 (0.05)
Slope (per 2 years)	0.28 (0.04)	0.30 (0.07)	0.26 (0.05)
Slope variance (per 2 years)	0.03 (0.004)	0.03 (0.004)	0.02 (0.006)
	<b>Standardised</b>	<b>Standardised</b>	<b>Standardised</b>
	<b>estimate (se)</b>	<b>estimate (se)</b>	<b>estimate (se)</b>
<b>Associations between growth factors</b>			
Intercept depression on positive support slope	-0.21 (0.04)	-0.20 (0.06)	-0.21 (0.06)
Intercept positive support on depression slope	-0.26 (0.04)	-0.20 (0.05)	-0.31 (0.06)
Depression slope with positive support slope	-0.54 (0.08)	-0.62 (0.11)	-0.48 (0.14)
<b>Model fit</b>			
CFI	0.931	0.925	
RMSEA	0.038	0.039	
N	7,171	7,171	

<sup>a</sup> Adjusted for age, sex, education, ethnicity, government office region, wealth and limiting longstanding illness, all mean centred. <sup>NS</sup> Non-significant

Table 4. Two-parallel process negative support and depression<sup>a</sup>

	All	Men	Women
	Estimate (se)	Estimate (se)	Estimate (se)
<b>Negative support growth factors</b>			
Intercept	2.43 (0.08)	2.34 (0.03)	2.53 (0.03)
Intercept variance	1.17 (0.04)	1.38 (0.05)	2.14 (0.07)
Slope (per 2 years)	0.01 (0.01) <sup>NS</sup>	-0.02 (0.01)	0.05 (0.02)
Slope variance (per 2 years)	0.01 (0.004)	0.01 (0.004)	0.02 (0.006)
<b>Depressive symptoms growth factors</b>			
Intercept	1.29 (0.02)	1.11 (0.02)	1.49 (0.03)
Intercept variance	1.06 (0.03)	0.92 (0.04)	1.19 (0.05)
Slope (per 2 years)	-0.10 (0.01)	-0.09 (0.02)	-0.10 (0.02)
Slope variance (per 2 years)	0.02 (0.004)	0.03 (0.004)	0.02 (0.006)
	<b>Standardised</b>	<b>Standardised</b>	<b>Standardised</b>
	<b>estimate (se)</b>	<b>estimate (se)</b>	<b>estimate (se)</b>
<b>Associations between growth factors</b>			
Intercept depression on negative support slope	0.44 (0.04)	0.62 (0.13)	0.25 (0.11) <sup>b</sup>
Intercept negative support on depression slope	0.35 (0.04)	0.28 (0.13)	0.42 (0.08)
Depression slope with negative support slope	0.14 (0.17)	-0.01 (0.24)	0.34 (0.26)
<b>Model fit</b>			
CFI	0.934	0.931	
RMSEA	0.033	0.034	
N	7,171	7,171	

<sup>a</sup> Adjusted for age, sex, education, ethnicity, government office region, wealth and limiting

longstanding illness, <sup>NS</sup>Non-significant

<sup>b</sup> Intercept depression on negative support slope differed for men and women ( $p < 0.05$ )

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7 Figure 1. Simplified schematic of parallel process model describing associations of change in  
8 positive support with change in CESD depressive symptoms.  
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13 Supplementary Figure 1. Ageing vector graphs for changes over time in mean number of  
14 depressive symptoms by sex and birth cohort based on 7140 participants in the English  
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17 Longitudinal Study of Ageing  
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22 Supplementary Figure 2. Ageing vector graphs for changes over time in positive support from  
23 partner by sex and birth cohort based on 7171 participants in the English Longitudinal Study  
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31 Supplementary Figure 3. Ageing vector graphs for changes over time in negative support  
32 from partner by sex and birth cohort based on 7150 participants in the English Longitudinal  
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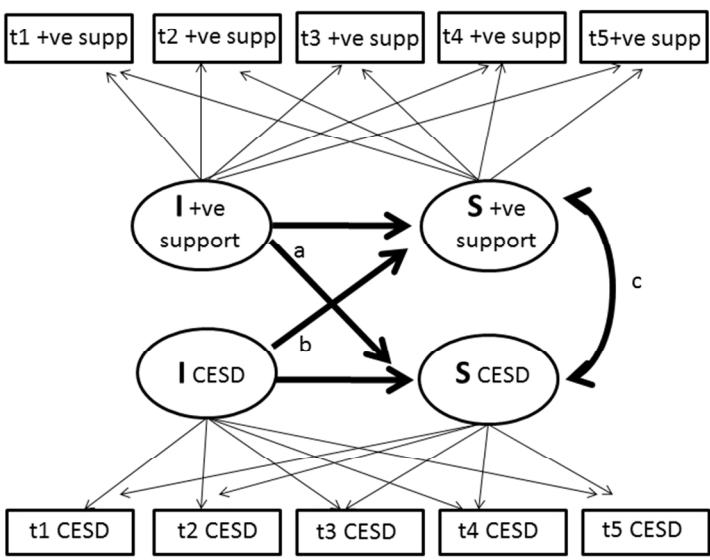
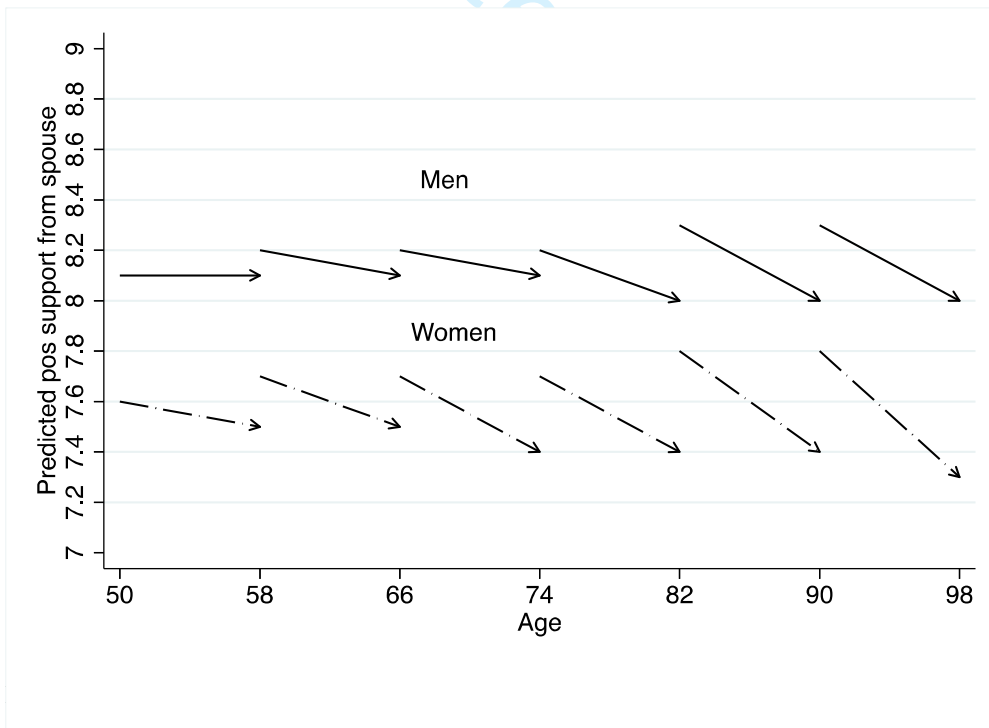
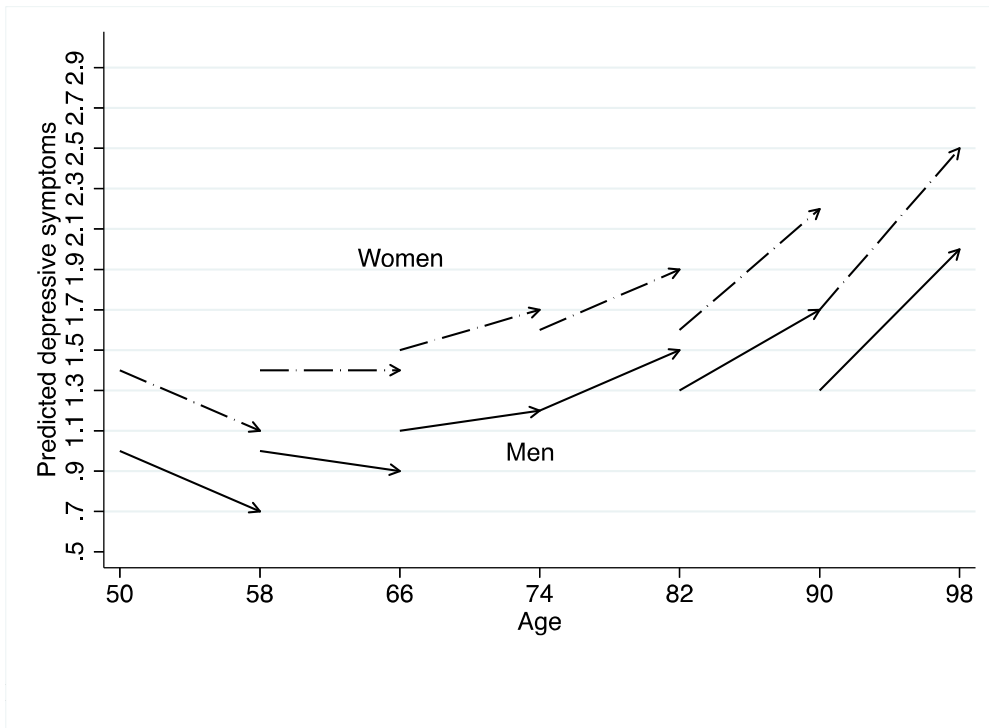
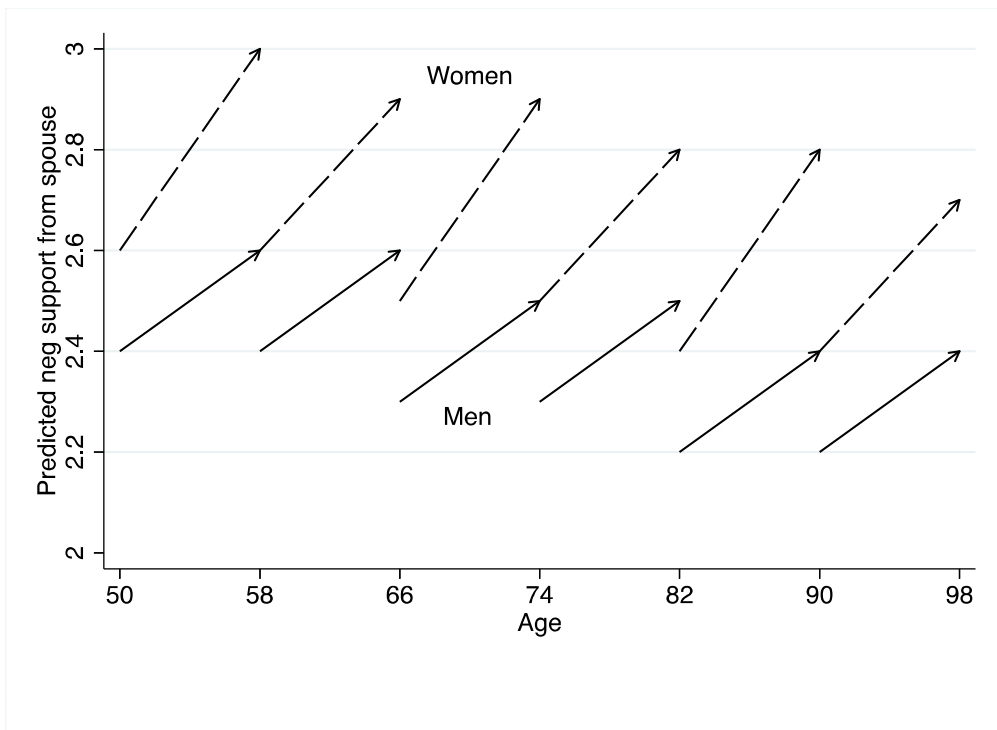


Figure 1

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