Partnership trajectories and biomarkers in later life: A life course approach

Abstract

This study investigates how partnership histories of older men and women are associated with later life health using biomarkerks as objective health measures (C-reactive protein (CRP), HbA1c (blood sugar level), systolic and diastolic blood pressure. Partnership histories derived via sequence analyses, optimal matching and clyster analysis that span over 35 years are described using the third and the fourth wave of the German Survey of Health and Retirement Europe (SHARE). Next to selection mechanisms (early life conditions, smoking and physical exercise) the mentioned longitudinal partnership patterns are used to investigate accumulative partnership effects on health. Results reveal that men in a cohabiting trajectory have a higher score on the CRP marker (related to heart disease) and a higher diastolic pressure compared to continuously married men. For women, there is notable absence of such effects on biomarkers.

Introduction

Many studies have found that married people are healthier, happier, and less likely to engage in health threatening behaviors (see e.g. Koball et al., 2010; Mirowsky, 2005; Schoenborn, 2004; Umberson et al., 2006; Wood et al., 2007). Further research using a life-course perspective that examined the incidence of chronic diseases and marital histories discovered that age-associations in disease are slowed down by longer duration in marriage, thus they have emphasized the importance of time spent in marriage (Dupre and Meadows, 2007). Research on mental health has also demonstrated the effects of marital history (Horwitz and White, 1998; Lamb et al., 2003; Meadows, 2009; Soons and Kalmijn, 2009). For example, individuals who are currently divorced or widowed for the first time report better mental health than those with more marital disruptions (Barrett, 2000). The vast majority of these studies considered only current marital status or transitions over relatively short periods. In addition, most studies focused on young or mid-life adults (REFS). There is a possibility, as noted by previous research (Ploubidis, Silverwood & Grundy, 2014) that accumulated benefits or risks of marital status over the life-course affect health in different ways when objective measure of health are used. Much less is known about the longitudinal accumulated effects of partnership on health, especially as previous studies mostly relied on self-reported health outcomes (Loucks et al, 2005; Holt-Lunstad, Birmingham & Jones, 2008).

Next to measures of general self-reported health and measures of incidence of chronic diseases, the use of biomarkers has become prominent for investigating the social aspects of health. There are several benefits of using biomarkers as objective health measures. Biomarkers could help in the identification of pre-disease pathways, since physiological processes are often below the individual's threshold of perception. In addition, biomarkers also could also enable researchers to validate respondents' self-reports and therefore to study the amount and determinants of under-, over-, and misreporting in large-scale population surveys. Recent research reveals that longitudinal partnership status is associated with biomarkers in mid-life. Ploubiodis and colleagues (Ploubidis et al, 2014) show the effects that 21 year of partnership status trajectories have on a wide range of biomarkers in mid-life using the British National Child Development Study (NCDS). Using a Latent Class Analysis (LCA) to derive a longitudinal typology of partnership they concluded that different typologies are associated with a variety of homeostatic and inflammatory markers. They find gender differences, but refrain from exploring more the possible mechanisms how partnership trajectories relate to specific biomarkers.

This study aims to investigate how individual's partnership trajectory influences health using biomarkers in later life. Building on previous research on social stressors and biomarkers, first partnership trajectories of older men and women are described using sequence analyses, optimal matching and cluster analyses. Data from a nationally representative sample (not clinical data) is used to describe longitudinal patterns of partnership status, distinguishing marriage and non-

marital cohabitation. Exploring the heterogeneity of partnership histories of older adults provides an insight of the life-course partnership dynamics. This strategy enables researchers to understand partnership histories from a "holistic" perspective (Mills, 2011), providing simultaneous information about the incidence, timing and order across time (Barban, 2013; Barban and Billari, 2011). Second, the study focus is on older individuals' longitudinal patterns of partnership spanning at least 35 years. In this way possible accumulation of partnership effects on health can be captured as the study moves beyond the examination of young and mid-life adults. Last, possible selection mechanisms are taken into account when we investigate particular effects of partnership on health, therefore controls for early life conditions, lifestyle behaviors like smoking and physical exercise are also included.

Background

From a life course perspective, health outcomes are the result of the cumulative influence of multiple risks and protective factors experienced during the life course (Halfon and Hochstein 2002; Ben-Shlomo and Kuh, 2002; Oxford et al. 2006; Harris and Eileen, 2010). Thus, in order to explain the mechanisms that produce health it is necessary to take into account the whole life course development. Using whole trajectories (traits that capture longitudinal aspects) to see how they influencing health is not straightforward, both from theoretical and methodological perspective (Barban, 2013; George, 2009; Amato and Kane 2011). With regards to partnership, it is not clear if instability per se increases the risk of having worse health outcomes. Does stability in family trajectories affect health outcomes? Does the number of transitions matter? Trajectories can vary greatly in terms of complexity, with some individuals experiencing a large number of transitions. It may be possible that certain typologies of family formation are associated with worse health outcomes, which can have profound relevance, especially for family and caregiving policies and practices.

The benefits associated with marriage are generally called the ‘‘protection effects’’ of marriage (Waldron et al. 1996). Musick and Bumpass (2006) suggest four possible explanations for the beneficial effects of marriage: institutionalization, social roles, social support, and commitment. Marriage is a social institution where spouses have defined social roles (Ferree, 1990). Most important, marriage is a source of social support, as on one hand spouses provide intimacy and companionship, and on the other hand married people are connected to a larger network of friends and kin. Last, marriage is of public nature and therefore it strengthens commitment and facilitates joint long-term investments, including financial commitment, role specialization, and time devoted to childrearing. However, there is debate if the marriage benefits hold true for non-marital cohabitation. Previous research shows mixed evidence. Musick and Bumpass (2006) examine several dimensions of wellbeing including psychological health, social ties, and relationship quality and they do not find significant differences between married and cohabiters. Horwitz and White (1998) find differences in happiness, but no disadvantages in terms of mental health. In comparative research using data from 30 European countries, Soons and Kalmijn

(2009) find that the cohabitation gap (with respect to marriage) in wellbeing is associated with the degree of acceptance of non-marital unions in the society. Barban (2013) finds that for women early transitions to marriage have negative repercussions on self-reported health and smoking behaviour, but moving away from normative family patterns (in terms of age roles and order of events) is associated with a decrease in wellbeing.

C-reactive protein

Research using biomarkers as health outcomes has commonly found differences between married and non-married respondents, usually not making a distinction between the non-married groups (Kohler et al, 2013; Calle-Pascual et al, 2013). Various biomarkers have been related to marital status measured contemporaneously with biomarkers. For example, Kohler and colleagues (2013) found that being married is weakly associated with lower risk of having an elevated CRP level in a Malawi sample; and Calle-Pascual and colleagues (2013) found no differences in CRP levels for marital status in a Spanish sample. Johnson and Master (2010) showed that unmarried older adults who reported having a history of cancer were significantly more likely to have elevated CRP as compared to their married counterparts, while there was no difference between unmarried and married adults without a history of cancer in a US sample. C-reactive protein level is a marker for inflammation and elevated levels have been well associated with cardiovascular pathophysiology (Clearfield et al, 2005; Lloyd-Jones et al, 2006), as well as with diabetes (Dehghan et al, 2007; Pradhan et al, 2001). C-reactive protein is an acute phase protein, which means that the level of CRP increases when certain diseases are present and it is measured in a blood sample. Inflammation (swelling) of the arteries has been linked to an increased risk of heart disease, heart attack, stroke, and peripheral arterial disease. High CRP levels have been linked to low socioeconomic status in young adults (Panagiotakos et al, 20014; Gruenwald et al, 2009) low SES in Mexian American women (Gallo et al, 2012) and to low levels of social integration for older men (Ford, Loucks and Berkman, 2006). High CRP was positively associated with neighborhood disorder and negatively related to neighborhood social capital (Holmes and Marcelli, 2012) and positively related to worse life-course SES trajectories (Nazmi et al, 2010).

The association between partnership and inflammation is not well documented or understood and merits further investigation. Previous research investigating CRP and social relationships in cancer patients found that greater social isolation defined by lower numbers of social network ties was associated with multiple markers of innate immunity such as an elevated CRP concentration (Yang, Li and Frenk, 2014), Yang, McClintock and Kozloski, 2013). Interpersonal stress from romantic partners, family and friends was associated with higher CRP six months later (Kiecolt-Glaser et al., 2005), while Yang, Schorpp, and Harris (2014) found no association between CRP and social support from family, spouse and friends (effects were found for other biomarkers). Research also found that psychological distress was associated with elevated CRP levels (Puustinen et al, 2011). Based on previous empirical research that showed CRP to be related to stress, we assume that partnership will be related to varying levels of CRP through stress

mechanisms that underlay physiological processes. Therefore, we hypothesize that individuals who have non-normative transitions in their partnership trajectory (such as divorce) will be more likely to have higher CRP level (H1a). In addition, we expect that individuals who have non-normative transitions in their partnership trajectory related to bereavement might be also more likely to have higher CRP level (H1b).

HbA1c (hemoglobin)

Another marker that has been studied in relation to social relationships is HbA1c. HbA1c is a form of hemoglobin that is measured primarily to identify the average plasma glucose concentration in blood over prolonged periods of time, such as 2-3 months prior to the measurement (Care, 2010; International Expert Committee, 2009). HbA1c is a marker for checking the blood sugar control in people who might be pre-diabetic and monitoring blood sugar control in patients with more elevated levels (diabetes mellitus). A a significant proportion of people are unaware of their elevated HbA_{1c} level before they are tested (Walid et al, 2010). Previous research investigating the association between HbA1c and social factors found that metabolic functions marked by HbA1c were significantly worse for those with low social integration than those with high social integration (Yang, Li and Ji, 2013). With regards to partnership, studies found that stressful life transitions may compromise the glycemic levels of older adults as women who provided caregiving scored higher on HbA1c. A study found that decline in spousal health is associated with increased HbA1c levels for women, but not for men. The death of a healthy spouse is associated with increased HbA1c levels for both genders (Lee et al, 2014). Trief and colleagues (2001) found no differences with regards to marital status on the HbA1c in patients with diabetes. HbA1c has been investigated in the context of diabetes patients' success in adhering to a prescribed self-care regimen (Forasnder and Sundelin, 2001; Huang et al, 2008). Life-course partnership dynamic might be related to HbA1c through the lifestyle choice and practices that individuals take while living with a partner. In light with previous research which proposed that married individuals and individuals in cohabitation relationships benefit from monitoring and social control over their eating, drinking and physical exercise habits, as well as reaping wider benefits social support, we assume that partnership and especially duration of partnership will be crucial for self-regulation, and thus might influence HbA1c (Konen, Summerson and Dignan, 1993; Quintana et al, 2008). We hypothesize that that individuals who have normative transitions in their partnership trajectory (and experience stability over time) will be more likely to have lower HbA1c level (H2).

Blood pressure

Blood pressure (BP) has previously been studied in relation to social integration, partnership and other social aspects as it is relatively easy and less costly to be measured than other biomarkers which require blood samples and laboratory analyses. Having a high mean level of social integration decreased the odds of high risk HbA1c, high waist circumference, and high BP at a

later point in time (Yang, Li and Ji, 2013). With regards to partnership, research found that being married is independently associated with a greater likelihood of night-time dipping BP and with lower night-time seated BP among individuals participating in a controlled dietary intervention. This association was particularly strong in married men (Causland, Sacks and Forman, 2014). Another study showed that participants who reported higher degrees of divorce-related emotional intrusion and physical hyperarousal demonstrated significantly elevated resting BP at the beginning of the study. When assessing change between two study time points, the study showed that there is a three-way interaction for men reporting high divorce-specific mental activation task scores (they also showed significant increases in BP), whereas men reporting low scores showed significant decreases in BP. The results were not found for women in BP across the study periods. These results suggest that divorce-related emotional intrusion-hyperarousal and real-time ratings of emotional difficulty (when people think about their separation experience) may play a specific role in BP reactivity, especially for men (Sbarra et al, 2009).

Marital strain confers risk of cardiovascular disease (CVD), perhaps though cardiovascular reactivity (CVR) to stressful marital interactions. CVR to marital stressors may differ between middle-age and older adults. Another study examined CVR to a marital conflict discussion and collaborative problem solving and found that marital conflict evoked greater increases in blood pressure than did collaboration. Women did not display greater CVR than men on any measure or in either interaction context (Smith et al, 2009). Therefore, a proposed mechanism why stress related to marriage increases the risk of high BP is through cardiovascular reactivity (CVR). A study tested the specific effects of marital stress on CVR through giving tasks related to positive, neutral, or negative interactions between married partners. Results showed that compared to positive and neutral conditions, negative discussions evoked larger increases in systolic blood pressure, heart rate, and cardiac output similarly for men and women (Nealey-Moore et al, 2007).

A possible mechanism linking troubled marriages to health outcomes is depressed immune functioning, however another mechanism proposed is poorer stress-related biological response (Barnet, Steptoe and Gareis, 2005). Studies found a statistically significant decreasing trend for systolic BP with marriage duration (Knuiman et al, 1996), a rise in BP after divorce (Krietsch, Mason and Sbarra, 2014; Lee et al, 2011) and men living alone had the highest mean systolic BP (Gliksman et al, 1995). We expect that longitudinal partnership might affect current BP through a poorer stress related response, and we hypothesize that individuals who have non-normative transitions in their partnership trajectory related to divorce might be also more likely to have higher BP (H3).

Data and methods

Data

We address our research question using data from the third and the fourth wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) (Börsch-Supan, Hank, Jürges, & Schröder, 2008). We use the third wave SHARELIFE (Börsch-Supan et al, 2011; 2013a, Schröder, 2011) collected in 2008 and the fourth SHARE wave (Release 1.1.1) collected in 2011 (Börsch-Supan et al, 2013b; Malter and Börsch-Supan, 2013). SHARE is a nationally representative longitudinal panel survey of non-institutionalized respondents aged 50 or older from 18 European countries (started with 11 in the first wave). The third wave SHARELIFE contains retrospective life-histories on the occurrence and timing of partnership events spanning over the entire life of the respondents until the date of interview. SHARELIFE also includes retrospective questions on childhood health and socioeconomic conditions. Previous assessment of the reliability of SHARELIFE found the retrospective reports reliable (Haas, 2007, Havari and Mazzonna, 2011). The fourth wave of SHARE contains biomarker data for the German sample as well as information on other socio-demographic characteristics; therefore we limit our analyses only to Germany.

The initial sample contained 1,183 respondents out of which 695 respondents consented to have all their biomarker data collected and made available. Complete biomarker data was available for 661 individuals. After removing missing information on all other variables, including information on age, partnership, childhood socioeconomic conditions, education, parental background, physical activity, smoking, self-rated health, taking medicines, depression and disability our final sample contains 621 individuals, 296 men and 325 women.

Measures

Indicators of partnership status

Respondents reported the starting and (if relevant) ending dates of all cohabiting and martial unions, as well as the occurrence and timing of all possible marital disruptions such as divorce or death of a spouse. Due to the objectives of the study to describe the partnership trajectories of older individuals, the analytical strategy includes sequence analysis, optimal matching (OM), and cluster analysis (Abbott, 1995; Abbott and Tsay, 2000). Because of already established gender differences in childbearing and marital timing, we performed the analysis separately for men and women.

We created complete sequences of yearly partnership states from the age of 15 until the date of the interview. The age of 15 was chosen as a start of partnership history as a customary point in previous research regarding partnership and fertility histories (Barban, 2013) and in order not to overlap with the period of early childhood. The state space was designed to take 5 possible

values: S (single), C (cohabiting), M (married), D (divorced), and W (widowed). Every trajectory was made up of a number of values that corresponds to the number of years each individual is observed. We exploited sequence analysis to identify specific typologies of partnership trajectories dealing simultaneously with timing, quantum, and sequencing. The analytical strategy adopted in this case is Optimal Matching (OM) algorithm as a method to compare different life sequences (Abbott, 1995). The basic idea behind OM is to measure the dissimilarity of two sequences by considering how much effort is required to transform one sequence into the other one. Transforming sequences entails three basic operations: insertion, deletion and substitution. Thus, the distance between two sequences can be defined as the minimum cost of transforming one sequence into the other one. Following the approach of McVicar and Anyadike-Danes (2002), a cluster analysis using Ward's algorithm identified four clusters of partnership sequences for each gender. This group characterization of partnership sequences was later used as an input for further analysis, in particular regression analyses in order to explore the effects of different partnership trajectories on biomarkers.

Biomarkers in late life

We use 3 biomarkers from the fourth wave of the SHARE data. C-reactive protein (CRP) is used as an indicator of inflammation, and indicators for the risk of developing cardiovascular diseases included are HbA1c (blood sugar level), systolic and diastolic blood pressure. The average values of all biomarkers of the respondents in our sample are reported in Table 2. Biomarkers are coded using standard clinical protocol cut-off values. We use the log of CRP mg/l (Zhou et al, 2014); HbA1c is dichotomizes following the standard cut-off of 6.4 % (Bennett, Guo and Dharmage, 2007); systolic BP is dichotomized using the standard cut-off of over 130 mm Hg (Port et al, 2000); and diastolic BP is dichotomized using the standard cut-off of over 85 mm Hg (Fardella et al, 2000).

Additional control variables

To control for possible selection into partnership trajectory we included various early life characteristics in our models. Previous studies point out that selection into partnership status could be driven by income, educational attainment and health status (Martikainen et al, 2005). We use four different indicators for childhood socioeconomic status collected in SHARELIFE: housing conditions (people per room); cultural capital (number of books); parental socio-economic background (main breadwinner's occupation); and an indicator for family condition (absent biological parent). We also controlled for variables measured contemporaneously with biomarkers such as age, respondent's education (adapted from ISCED to low, medium or high), number of children (from 0 to 3 and more), if respondents are currently smoking, if respondents are currently exercising, self-rated health (from 1 to 5), current depression (binary indicator of EURO-D scale), and if respondents have a disability.

Analytical strategy

By using sequence analysis, optimal matching (OM) and cluster analysis we constructed a main explanatory variable of interest, life-course partnership trajectory. This rendered a four cluster solution distinguishing standard, never married, disrupted and cohabiting trajectories for men; and standard, never married, widowed and divorced trajectories for women. Life-course partnership and additional confounding variables were included as independent variables in four separate models where each biomarker was included as a dependent variable (OLS regression of the log of CPR, logistic regression for all others; models not shown). We use a post estimation technique to adjust the parameter estimates and associated (co)variance matrices into one parameter vector and simultaneous (co)variance matrix of the sandwich/robust type[1]. This renders a joint model combining estimation results for all four biomarkers, shown in Table 3.

Results

Life-course partnership trajectories

Figure 1 shows the distribution of partnership states from age 15 to 80. At age 24 the number of women being in a married state rapidly raises, as for men this also happens a few years later, around age 26. At age 30 very few women are single (because they did not enter a union, or because of a divorce). Cohabitation is much less frequent than marriage for both men and women and seems to be stable over age. The proportion of widowed individuals rises rapidly, especially in women after the age of 50 and as expected, widowhood in men is much less prevalent.

Figure 1 around here

Cluster analysis identified four groups of trajectories as representative of the entire set of sequences. Clusters are described using their medoid sequences in Table 1 (Aassve et al., 2007). Below, a graphical description of the sequences in each group is presented (Figure 2). Notably, there are qualitative differences between the groups with regards to gender. Most men (74.05%) and women (80.85%) follow a standard partnership trajectory of entering marriage by their thirties and remaining married for the rest of observation period. Another distinctive cluster is the never married group in men (3.45%) that never experience a transition; and the never

[1]Suest posestimation command in Stata is used. Suest produces (co)variance matrix that is appropriate even if the estimates were obtained on the same or on overlapping data. Thus allows us to combine different estimators from OLS and logistic models. Alternative analytical strategy such as path models using structural equation models should be explored further.

married/cohabiting group in women that (4.11%) has higher chance to experience permanent cohabitation. The third group is comprised of 20.87% of men who experience mostly divorce, label disrupted partnership trajectory; and in women there is 7.59% who experience divorce. Last distinctive group is a very small cohabiting group in men (1.63%); and a larger group of widowed women (7.44%).

Table 1 around here

Figure 2 around here

The association of life-course partnership trajectories and biomarkers

In Table 3 we present the estimated parameters and 95% confidence intervals that capture the association between the longitudinal partnership typology and biomarkers in late-life. Linear regression coefficients and standard errors are presented for CPR, odds ratios are presented for HbA1c, systolic and diastolic blood pressure. Multinomial logistic regression risk rations are presented for total cholesterol. Combined estimation results from models using complete data on 296 men revealed that men in a cohabiting trajectory score higher on the inflammation marker (CRP) compared to the reference group (men in the standard trajectory), b=0.82 (SE=3.51), thus partially supporting our hypothesis that individuals who have non-normative transitions in their partnership trajectory will be more likely to have higher CRP level. However, we did not find such effects for the disrupted category as we originally expected (H1a and H1b). No statistically significant differences were found in men for the HbA1c marker and the systolic blood pressure, thus we were not able to find evidence for the hypothesis stating that individuals who have normative transitions in their partnership trajectory and experience stability over time will be more likely to have lower HbA1c level (H2) . Men in the never married partnership trajectory scored higher on diastolic blood pressure compared to the reference group (men in the standard trajectory), OR=6.15 (CI = 1.20, 31.45). This yielded partial support for the third hypothesis that individuals who have non-normative transitions in their partnership trajectory might be also more likely to have higher BP (H3), although we did not find similar evidence for the disrupted trajectory. Using complete data on 325 women, none of the results were statistically significant.

Discussion

A longitudinal typology of partnership status spanning at least 35 years was associated with several biomarkers, namely with the inflammatory marker CPR for men as well blood pressure in late-life after controlling for well-known selection mechanisms. The observed effects differed significantly and substantively in size between men and women. This implies that the mechanisms that link life-course partnership status and health may be gender specific. This finding corroborates previous

studies using self-reported health outcomes (ref) as well as the previous research on longitudinal partnership trajectories and biomarkers (Ploubidis et al, 2014). A different result appeared in women, where the absence of association is most notable. This yields further investigation about the possible evidence that early life socioeconomic factors might have with respect to the biomarkers used in this study. The observed effects of the longitudinal partnership typology might be more or less pronounced in women that were healthy and in a financially more affluent position during their childhood. Another possibility is that the biomarkers used are a less sensitive instrument for women as opposed to men, as men are more likely to suffer from coronary and heart problems in later age.

Because of small sample size, we were not able to fully explore the possible protective effects of cohabitation, especially for men that have been found in other research using European data (Ploubidis et al, 2014). However, our study is among the first ones to focus on biomarkers of older adults who have longer partnership histories that allows a better view of possible accumulation effects. Further research is needed to discern if lack of effects of longitudinal partnership histories on several biomarkers is due to low sample size or due to a leveling-out effect where biological factors precede social factor in later life. The availability of data to control for selection mechanisms (early life conditions, lifestyle behaviors like smoking and physical activity) contributes to reducing bias in the estimators. All effects reported in the present study were observed after controlling for factors that influence partnership status (direct selection) or both partnership status and health (indirect selection). Further advances need to be attentive of the possible explanations of the mechanism that link partnership status and health in later life that social support, health related behaviour and socio-economic position, as well fertility.

Several limitations must be noted when interpreting the results of this study. We included only available biomarkers, however incorporating very narrow range of biomarkers as health outcomes. It may be the case that other biomarkers are associated differently with life-course partnership status. In addition, we employed retrospective observational data and despite the wealth and the quality of the SHARE and the SARELIFE data, ideally we would like to test the relationship between partnership and biomarkers using prospective data with higher sample size. The longitudinal typology captured the cumulative effect of different trajectories of partnership status on biomarkers in late-life and it was not possible to investigate the short term effects of stressful events such as marital dissolution on health. Alternative strategy using different statistical techniques might share more light on the short term effects of partnership disruptions. Finally, we note that our results can be generalised to older individuals (older than 50 years at the time of the collection of the biomarkers). The partnership status trajectories, as well as the association between partnership and health may be different in younger adults.

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Table 1. Partnership trajectory clusters (original sample N = 919)

Men	n	%	Women	n	%
Standard	408	74.05	Standard	511	80.85
Never married	19	3.45	Never married/Cohabiting	26	4.11
Disrupted	115	20.87	Widowed	47	7.44
Cohabiting	9	1.63	Divorced	48	7.59

Table 2. Average values of biomarkers

	Men		Women	
	mean	SD	mean	SD
Blood pressure – systolic	147.81	18.56	146.93	18.54
Blood pressure – diastolic	82.86	11.20	81.04	10.19
HbA1c	6.23	0.86	6.19	0.88
C-reactive protein	1	1.29	1.09	1.32
N	296		323	

Table 3. Model parameters and 95 % CI for C-reactive protein (OLS), HbA1c, systolic and diastolic pressure (logistic regressions)

	CRP		HbA1c		Systolic BP		Diastolic BP	
	b	SE	OR	CI	OR	CI	OR	CI
Men								
Never married	0.08	(0.22)	2.99	(0.80,11.12)	1.7	(0.18,15.95)	6.15*	(1.20,31.45)
Disrupted	-0.14	(-0.89)	1.28	(0.65,2.51)	0.81	(0.34,1.92)	0.75	(0.39,1.47)
Cohabiting	0.82***	(3.51)	0.72	(0.05,10.69)			1.38	(0.10,18.41)
Women								
Never married/Cohabiting	0.49	(1.68)	1.71	(0.50,5.84)	0.97	(0.18,5.29)	1.47	(0.38,5.63)
Widowed	0.02	(0.11)	1.81	(0.64,5.14)	1.32	(0.20,8.63)	1.12	(0.45,2.74)
Divorced	0.31	(1.52)	1.23	(0.49,3.07)	0.79	(0.26,2.46)	1.12	(0.48,2.60)

Notes: OR = odds ratios; CI= confidence intervals, SE = standard error

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Low cell size in the cohabiting category for men renders no results in the combined estimation results for systolic BP

Figure 1. State distribution plots for men and women (age truncated at 80)

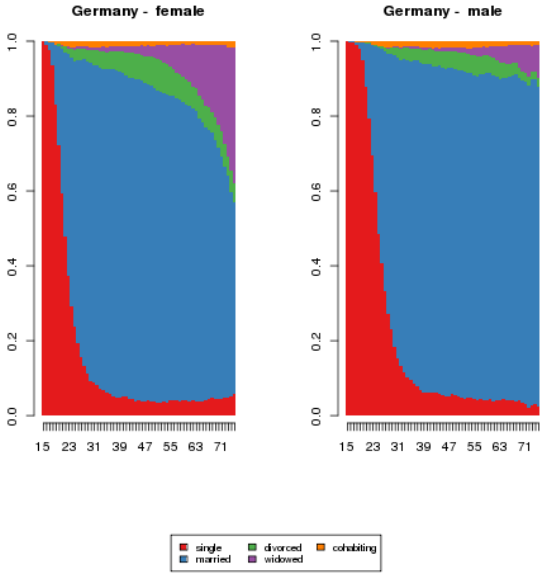

Figure 2. Clusters of partnership trajectories

Men (n=296) Women (n=325)