Mortality Differences by Partnership Status in England and Wales: The Effect of Living Arrangements or Health Selection?

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Abstract:

This paper investigates the relationship between partnership status and mortality in England and Wales. Using data from the Office for National Statistics Longitudinal Study (ONS LS) for the period between 2001 and 2011, we examine whether married people have lower mortality levels than unmarried individuals; whether individuals who cohabit have mortality levels similar to those of married or single persons; and how much the fact that married couples live with someone rather than alone explains their low mortality. Our analysis shows first that married individuals have lower mortality than unmarried persons. Second, men and women in pre-marital unions exhibit mortality levels similar to those of married men and women, whereas mortality levels are elevated for post-marital cohabitants. Third, controlling for household size and the presence of children reduces mortality differences between married and unmarried non-partnered individuals, but significant differences persist. The study supports both protection and selection theory. The increase in mortality differences by age group between never-married cohabitants and married couples is likely a sign of the long-term accumulation of health and wealth benefits of marriage. Similar mortality levels of cohabiting and married couples at younger ages suggest that healthier individuals are more likely to find a partner.

Keywords

England and Wales; Survival analysis; Mortality differences; Marital status; Cohabitation; ONS LS;

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1. Introduction

The relationship between health and partnership status has been of interest to social scientists for a long time. Previous research in European and other industrialised countries shows that married persons have a lower risk of mortality than non-married individuals (e.g., Dupre et al. 2009, Johnson et al. 2000, Guner et al. 2014, Murray 2000, Ben-Shlomo et al. 1993, Blomgren et al. 2012, Murphy et al. 2007, Brockmann and Klein 2004). These differences are typically greater for men than for women (Murphy et al. 2007, Hu and Goldman 1990, Wu and Hart 2002) and persist in industrialised countries even when socio-demographic and socio-economic differences are controlled for (Murphy et al. 2007; Staehelin et al. 2012). The results raise a number of questions. For instance, are healthier people more likely to marry and to stay married? Do widowed people suffer from poor health because of the loss of a spouse or because their own poor health was the main reason for marrying a person of poor health? Does marriage provide better health protection than cohabitation?

A large body of literature investigates these questions from a variety of perspectives, and in various contexts. Espinosa and Evans (2008), Joung et al. (1998) and Guner et al. (2014) examined the dynamics of partnership status with the focus on assortative mating – the process of choosing a mate similar to oneself. Other researchers such as Lillard and Panis (1996), Cheung (1998), Cheung and Sloggett (1998) and Joung et al. (1998) studied positive and adverse selection. Still others included partnership histories to control for the immediate and cumulative effect of marriage (Blomgren et al. 2012; Brockmann and Klein 2004; Dupre and Meadows 2007; Dupre et al. 2009; Grundy and Tomassini 2010). Underlying all of these approaches are two competing theories: selection and protection. The selection theory states that healthier people are more likely to get married and stay married, whereas the protection theory claims that marriage provides a subset of advantages that improve health.

To date cohabitation has been included in only a few mortality studies which either look almost exclusively at older populations (e.g. Scafato et al. 2008, Lund et al. 2002) or at Scandinavian countries (Drefahl 2012, Koskinen et al. 2007). Most of this literature shows higher mortality for cohabitants than for married individuals, as expected, because cohabitants belong either to the group of never-married or to the groups of divorced or widowed,.

This paper examines mortality differences by partnership status in England and Wales between 2001 and 2011 using the ONS Longitudinal Study, a one-percent sample of the population of England and Wales. The decline in marriages and increase in other partnership forms in the last decades as well as the decrease in mortality rates pose two questions: a) "Does the decrease in marriages also lead to a decrease in the marital health and mortality advantage?", and b) "How does the mortality of individuals in the 'new' (or 'non-conventional') partnership forms compare to those in the 'old' (or 'conventional') marital statuses?".

We extend the previous research in the following ways. First, we include in the study cohabitants whose proportion has significantly increased in the last two decades in all industrialised countries, both among young adults and older populations (Thomson 2014). Individuals who appear as 'single', 'divorced' or 'widowed' in the official statistics are thus divided into those living with a partner and those living alone. Whereas previous research considering cohabitants has analysed them as one group (e.g. Drehfahl 2012, Kilpi et al. 2015, Scafato et al. 2008), we analyse pre-marital cohabitants and post-marital cohabitants separately. Post-marital cohabitants include 'divorced (including separated)' and 'widowed' people who live with a partner, whereas pre-marital cohabitants are all 'single (never-married)' individuals with a partner. The inclusion of cohabitants is an important step to adjust for the changing realities but also to properly consider the effect of relationships on

mortality patterns. This is the first contribution of this study. A similar approach has only been used in a Finnish study (Koskinen et al. 2007).

Second, we include a set of variables to examine the extent to which household size and structure explains mortality differences by partnership status. It is important to consider household structure and the presence of other individuals in the household when investigating mortality differences between married and unmarried people (Drehfahl 2012). Depending on age, different kinds of living arrangement are possible; therefore, we conduct a separate analysis of three different age-groups: 30-49, 50-64 and 65-85. This is another contribution of our study. Finally, we use a large-scale longitudinal study allowing for the detailed study of mortality variation by partnership status in a contemporary industrialised society. We conduct two types of sensitivity analyses. We investigate the sensitivity of the results to unregistered emigration, which is a component of all panel and longitudinal studies. We also examine the sensitivity of the results to the length of the observation window. This examination is necessary as marital status in the ONS Longitudinal Study is measured only at the time of the population census. Testing the sensitivity of the results of the analysis of this large-scale longitudinal data is the third contribution of this study.

2. Background and Literature Review

2.1 Mortality and health differences by marital status

Research shows that mortality differences by marital status are partly affected by health differences and, further, that health differences can be attributed to a reduction in negative health behaviours (e.g., Rendall et al. 2011, Waite 1995). However, it remains far from clear whether these reductions occur as a result of marriage or are a prerequisite of marriage, i.e. whether healthier individuals opt into marriage and unhealthy individuals remain single (Goldman 2001, Lillard and Panis 1996). The literature on mortality differences by marital

status can be divided into two main theories (or hypotheses): selection theory and protection theory.

Selection theory states that married people are individuals who have been selected by health from the entire population. Individuals who are physically and psychically healthier have a greater chance of finding a partner and getting married and are less likely to get divorced than unhealthier people. Thus, the married population is, on average, healthier than the unmarried population. In addition to health factors, there are other factors, e.g., income or health-related habits, which play a role in mate selection. For example, research shows that people who are obese, heavy drinkers or drug users are less likely to marry (Fu and Goldman 1996, Goldman and Hu 1993, Goldman 2001). Moreover, healthier men are more likely to marry; however, Lillard and Panis (1996) show that they are more likely to postpone marriage.

There may also be selection into widowhood. The deteriorated health among widowed people (e.g., see Cox and Ford 1964, Gove 1973, Lillard and Panis 1996, Manor and Eisenbach 2003) could be the result of the loss of their spouse, also known as bereavement effect. Alternatively, a person may marry an individual with poor health or the health of both spouses may deteriorate during the marriage for some common (e.g., environmental and behavioural) reasons (Joung et al. 1998). Because the measurement of relevant health variables is costly, especially in longitudinal studies, it is hard in studies to control for selection by health. Measurements such as weight, height and BMI are easier to obtain and with minimal error than blood samples for hormone levels or simple blood pressure measurements, but their explanatory power may not be sufficient. Lillard and Panis (1996) were the first to use simultaneous equation models to control for unobserved selection into marriage, and thus use a latent health variable to control for observed and unobserved health measures.

Protection theory holds that marriage provides a set of advantages which help to protect against various unhealthy activities; marriage discourages risk-taking behaviours, provides

ways to cope with stress, and provides emotional, medical, and financial support (Goldman 2001, Rendall et al. 2011). For example, preparing a meal for two individuals requires fewer resources than preparing two meals for one person; it should be evident how marriage or having a partner would have a positive effect on one's finances. This is consistent with the idea of wealth accumulation of married couples. Research shows that men profit more from the reduction in risk-taking behaviour and women from the financial support (Lillard and Waite 1995). Additionally, married men earn more because of the 'marriage premium' (Wilcox et al. 2005). However, it is not yet clear whether this premium is due to the greater commitment of those men, greater support from home or other factors. It is also likely that the emotional support a stable partnership provides plays a role, as a partner can encourage, for instance, certain career moves as well as help to cope with work-related stress. Those protective effects seem to vanish (at least partly) after the dissolution of a union (Wu and Hart 2002, Rendall et al. 2011).

It is important to consider the effect of 'living together' and to distinguish between partners/cohabitants and living mates. Whereas the financial benefits of marriage and cohabitation may be different, the support of a partner while coping with stress should not. Mastekaasa (2006) shows that both marriage and cohabitation lead to stress reduction in Norwegian students in their early 20s and onward. In contrast, Gardner and Oswald (2004) did not find any evidence that married persons live longer due to reduced stress levels (Band and Weisz 1988).

In the last two decades, research has moved from the question 'Selection OR protection?' to 'When is selection and when is protection responsible for the better health of married people?' Studies by Waldron et al. (1996), Murray (2000), and Guner et al. (2014) supported both theories. They showed that health selection and assortative mating operate at younger ages, and health protection through an accumulation of (positive) health is important at older

ages. Similarly, Brockmann and Klein (2004) argued that the protection effect of marriage is due to the 'long-term accumulation of survival advantages'. Using data from Germany, they also showed that women usually benefit longer from those advantages, even after the end of a marriage. Lillard and Panis (1996) found that there is no immediate health benefit from entering a first marriage. Additionally, their analysis showed a health gain among divorced men who remarry, which is a sign of adverse selection. Horwitz et al. (1996) showed that significant benefits of marriage include, for example, a reduction in depression for women and a reduction in alcohol abuse for men. A recent study by Guner et al. (2014) supported earlier findings of Fu and Goldman (1994) showing that entry into a first marriage is delayed by unhealthy behaviour.

Analyses of mortality differences by marital status are usually conducted separately for men and women. Many studies have shown that mortality differences by marital status are larger for men than women (Lund et al. 2002, Waldron et al. 1996). These sex differences may be due to differences in the protective effect, i.e. married men profit more due to a reduction in risk-taking behaviour and women more due to financial support (Lillard and Waite 1995). Further, research suggests that the emotional support gained through being married is greater for men than for women, as women do not find social support solely from their partner (Shumaker and Hill 1991).

2.2 The emergence of cohabitation

Partnership patterns have significantly changed in Britain over the last 40 years, as elsewhere in Europe. These changes, which are likely to influence partner selection and union formation, include, among others, the role and rights of women in society; the acceptance of non-marital cohabitation; and technological advantages such as the spread of Internet and mobile phones,

which affect the way people today form relationships and interact in their private lives. Some researchers refer to those changes as the 'second demographic transition' (McRae 1999; Lesthaeghe and Van de Kaa 1986).

Since the 1970s, household diversity has increased in England and Wales. While the typical family in the 1950s and 1960s consisted of a father, a mother and two children, the number of lone-parent families tripled between the mid-60s and the mid-90s; the prevalence of premarital cohabitation rose from 5% to 70% (McRae 1999:16). The incidence of getting married because of an unplanned or pre-marital pregnancy declined (the so-called 'shotgun' marriage). The rise in divorce and separation rates explained the increase in lone parent families and was one reason for the decline in the number of married couples. Another reason has been the increase in pre- as well as post-marital cohabitation. On the one hand, the increase in the cohabitation rate has occurred because of changes in norms and values, and on the other hand, because low-income couples are generally less likely to marry (see Allan and Crow 2001; McRae 1999; Wilson and Stuchbury 2010).

In recent decades, young couples in the UK have preferred cohabitation as their first partnership, which still seem to be short lasting and ending either in marriage or union dissolution (Ermisch and Francesconi 2000). This is supported by the fact that the share of ever-cohabited women at age 30 rose from just above 20% among the 1940-49 cohort to 70% for the 1970-79 and 1980-89 cohorts (Hannemann and Kulu 2015). The postponement of first marriage and stable marriage rates suggest that cohabitation for most people is merely a transition state, either into marriage, back into the single state or into single parenthood (Ermisch and Francesconi 2000). Other research suggests that cohabitations are less stable than marriages (Hayward and Brandon 2010; Kennedy and Bumpass 2008) and that pre-marital cohabitation has a strong association with marital dissolution (Wagner and Weiss 2004). However, Kulu and Boyle (2010), controlling for observed and unobserved

characteristics, found that the risk of marriage dissolution was in fact lower for pre-marital cohabitants than for their directly marrying counterparts. Soons and Kalmijn (2009) showed that, after married couples, cohabiting couples have the lowest mortality rates. Nevertheless, living in a relationship seems not to have the same impact as being married. Although research has identified different factors that could be responsible for the lower mortality rates of married persons relative to unmarried individuals, the contribution of each factor to mortality differences by marital status is far from clear. The never-married population has generally been considered as one group, without differentiating between people who live alone, people who live with a partner, or people who live with someone else, such as a parent, for example. With regards to the protection theory, 'living apart together' is another form of partnership which provides the intimacy of a relationship, but where the partners are not living together because of practical reasons or personal preferences (Duncan and Phillips 2010).

While there is an increase of one-person households in all age groups (McRae 1999), one should not regard these just as people who live alone. An individual who lives in a one-person household may nevertheless be in a relationship. For example, even if a couple is living together (which could count as cohabiting), they may have a socio-economic arrangement which results in a strict separation of property and assets, thus being recorded as two one-person households, rather than as one two-person household. Another consideration is the idea of unobserved characteristics and past life histories. Grundy (2000) showed that a specific partnership history of an elderly person will influence the likelihood of living alone but also that living alone can have a different (positive, negative, or neutral) effect on different individuals. Therefore, we should be careful with assumptions such as 'old and alone' equals 'poor health and higher mortality risk'.

3. Hypotheses

Based on previous research, we first expect to observe significant mortality differences by marital status, with lower mortality levels for married people. The differences should be greater for men than for women, because of the different protective effects for both sexes. Second, we also expect to find lower mortality for cohabitants, although an interesting question is whether and how much their mortality levels differ from those of married people and whether the patterns change by age. We anticipate that premarital cohabitants have similar mortality rates than married, especially at younger ages, because here the same selection mechanisms should operate. That is, if married individuals found a partner due to better health, this should also apply to cohabitants. Third, we expect that living arrangements, the presence of children and household size will explain some health advantages of individuals who are in partnerships compared to those who are not. Again, an interesting question is how much these factors explain initial mortality variation by partnership status. The answer will improve our understanding of the role of various factors in shaping population health and mortality.

4. Data

We use the Office for National Statistics Longitudinal Study (ONS LS) to analyse the mortality differences in England and Wales by partnership status. The ONS LS is a 1% sample of the population in England and Wales whose census records are linked with annually life events, such as widowhood, death and births to sample mothers. The ONS started in 1974 with a sample population drawn from the 1971 census and had a sample size of 540,000 people in 2001 (Lynch et al. 2011). Our sample population comprises the ONS LS members aged 30 to 85 in 2001. This group consists of 329,767 people: 76,368 men and 79,408 women in ages 30-49 in 2001; 47,665 men and 49,076 women in ages 50-64; and 34,028 men and 43,222 women in ages 65-85. We excluded five individuals without a country

of birth (COB). For other individuals without a COB in 2001, we used the COB of the most recent previous census or the 2011 census, if available. Further, we excluded ten individuals without marital status in 2001.

All individuals were followed until the event of death, emigration or censoring at the 2011 census, whichever came first. Each individual has four possible outcomes: a) death; b) leaving at a known embarkation date (i.e., registered emigration); c) leaving at an unknown embarkation date (i.e., unregistered emigration); and d) censored at the end of the observation interval (Figure 1).

figure 1 here

Fig 1 Lexis Diagram with sample population; Each individual has 4 possibilities of leaving the sample, 1 (solid line) censored at the end of the observation interval (diamond) – death, 2 (diamond) – leaving at a known embarkation date, 3 (square) – censored at the end of the observation interval, 4 (triangle) - leaving at an unknown embarkation date

Table 1 here – number of people by MS and sex

Table 1 shows that most individuals are married and, except for women over 65 years of age, the married group always forms more than 60% of the population. The single group of men and women in ages 30-49 are roughly three times larger than in the two other age groups. The proportion of the divorced/separated group over 65 years of age is only a half to one third compared to the two younger age groups. As expected, the widowed groups increase exponentially with age, so that they form the second largest group in ages 65-85.

Table 2 here – number of people by PS and sex

After the identification of pre- and post-marital cohabitants, the single category becomes the second largest for the youngest age group, the divorced/separated category for the middle age group, and the widowed category for the oldest age group. The share of cohabitants decreases by age. However, because pre- and post-marital cohabitants aged 65-85 each comprise less

than 1 percent in their respective subpopulation, the groups are small, which leads to large confidence intervals in the analysis.

Our main variable of interest is marital/partnership status. We first prepared a covariate *marital status* with the following categories: 'married (first marriage, as well as second and higher-order marriages)', 'single (never married)', 'divorced/separated' and 'widowed'. We then prepared a covariate *partnership status*, which divided the group of 'single' into 'single (not cohabiting)' and 'premarital cohabitation', and the groups of 'divorced/separated' and 'widowed' in 'divorced/separated (not cohabiting)', 'widowed (not cohabiting)' and 'post-marital cohabitation'. We used the variable *household composition 2001* as an indicator for cohabitation.

We control for a set of demographic and socio-economic variables when investigating mortality differences by marital/partnership status. The covariates are as follows: Country of Birth ('England & Wales', 'Scotland or Northern Ireland', and 'Others'); Ethnicity ('White', 'White mixed', 'Asian', 'Black', 'Chinese' and 'Other'); Education ('No qualification', 'Low qualification'(Level 1 and 2), 'Medium qualification'(Level 3), 'High qualification'(Level 4/5), and 'Missing'); and Socio-economic status using the National Statistic Socio-economic classification, 2001 ('Higher managerial and professional occupations' (NS-SEC code 1-6), 'Lower managerial and professional occupations' (NS-SEC code 7-12), 'Intermediate occupations (clerical, sales, service)' (NS-SEC code 13-16), 'Small employers and own account workers' (NS-SEC code 17-20), 'Lower supervisory and technical occupations' (NS-SEC code 21-23), 'Semi-routine occupations' (NS-SEC code 24-30), and 'Routine occupations' (NS-SEC code 31-35), and Others). We also include in the analysis two variables on living arrangements: Household size ('1 person', '2 persons', '3 persons', '4 persons', '5 and more persons' and 'Unknown') and Dependent Children ('No children', 'Dependent children', 'Non-dependent children', 'Not applicable').

Table 3 here

Table 3 contains the person-months lived, the percentage compared to all person-months lived and the number of events for each covariate category. Each major category has a sufficient number of deaths (events), with only a few exceptions.

All variables have been measured in 2001 and are assumed to remain time-constant until censoring in 2011 or prior due to embarkation or death. All control variables have been selected as having an effect on partnership status and thus would alter the mortality estimates, if not controlled for. Education and socio-economic status are well known determinants of health and mortality (Drehfahl 2012). Changes in household structures make it necessary to include household compositions to control for the effect of cohabitation or lone parenthood (Drehfahl 2012). In addition to ethnicity, which has been shown to affect mortality by partnership status (e.g. Johnson et al. 2000), we further include COB to control for the healthy migrant effect (Wallace and Kulu 2014a, Wallace and Kulu 2014b).

5. Methods

In our analysis, we used the Cox proportional hazards model to estimate the mortality differences by marital status. The Cox model is defined as:

$$h_i(t) = h_0(t)\exp(\beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik})$$

The individual hazard rate h_i is defined as the product between the baseline hazard rate h_0 and a set of covariates x_1, x_2, ..., x_k (Fox 2002). The Cox model was chosen because the shape of the baseline function can be left unspecified. The Cox model assumes proportional hazards, i.e. that the effect of partnership status on mortality is similar by age; however, if this assumption is not met then the results can still be viewed as average hazard rates (Allison 2010).

The process time in our model is an individual's age in months. The impact of age on mortality is thus controlled in our models, although the shape of the baseline (i.e. the effect of age on mortality) is left unspecified. Alternatively, one could fit a parametric survival model; we also fitted a model with the Gompertz baseline, the main results were identical to those obtained by using the Cox model.

Our modelling strategy is the following. Our first model (model 1 (MS)) contains the two covariates *marital status* and *country of birth*. Because our main focus is on the population born in England and Wales, we decided to combine all foreign-born individuals into one group; we assumed that migrants are a select sub-group of their home population, on average with better health. An exception to this rule are people born in the neighbouring countries of Scotland and Northern Ireland (Popham and Boyle 2011, Wallace and Kulu 2014a, Wallace and Kulu 2014b). The 43 individuals who reported 'UK' or 'Britain' as their country of birth were assigned to be born in 'England & Wales'. As such, the inclusion of COB in the analysis prevents an underestimation of mortality differences.

The second model (model 1 (PS)) uses *partnership status* instead of *marital status*. Due to the different proportions of cohabiting groups regarding their non-cohabiting counterparts and the entire population, we decided to split the cohabiting population into a premarital cohabiting group and a post-marital-cohabiting group, rather than using a single cohabitation dummy variable. In the next step (model 2 (PS)), we include a set of demographic and socio-economic covariates (ethnicity, SES, education). The last model (model 3 (PS)) includes covariates measuring the effect of living arrangement: *household size* and *dependent children.* We decided to use the two-person household as reference group because married couples typically live in pairs. We derived our *dependent children* covariate from the 'household composition 2001' variable.

We fit each model for both men and women, first to the whole study population (individuals in ages 30-85) and then separately to the age groups 30-49, 50-64 and 65-85. We censor all emigrants after 3.9 years, following the findings by Wallace and Kulu (2014b) on average duration of stay for prospective return migrants in destination country. However, we also conduct sensitivity analyses to determine whether the mortality differences are over- or under-estimated given the length of the observation window and the uncertainty of the emigration dates among people who leave the country. Both sensitivity tests can be found at the end of the results section.

6. Results

Model 1 (MS) controls for COB. All unmarried men have a significantly higher mortality risk than married men (Table 4, Model 1). Single men have a 75% higher mortality risk; divorced/separated men have a 58% higher mortality risk; and widowed men have a 35% higher mortality risk. The results are similar for women, although mortality differences between married and unmarried women are smaller (Table 5, Model 1). Single women have a 43% higher mortality risk; divorced/separated women have a 37% higher mortality risk; and widowed women have a 26% higher mortality risk. Model 1 (PS) distinguishes between unmarried people who cohabit and those who do not cohabit. While mortality levels of individuals remain high for those who are neither married nor cohabit, cohabitants show lower mortality levels. Those who have not been previously married exhibit mortality levels similar to those of married individuals. However, post-marital cohabitants have still significantly higher mortality levels. This applies both to males and females.

Model 2 controls for ethnicity, socio-economic status and educational level. Mortality differences between married and unmarried individuals decline slightly, with the exception of single women (Tables 4 and 5, Model 2). Model 3 additionally controls for household size and the presence of dependent children. Mortality differences between married and unmarried

individuals stay on the same level or further decline, particularly for males, but significant differences persist (Tables 4 and 5, Model 3). Mortality levels remain high among men and women who are neither married nor cohabit, and among post-marital cohabitants. Interestingly, the inclusion of additional covariates (especially those related to living arrangements) leads to a decline in the mortality differences of non-married people without a partner.

Table 4 and 5 here

To gain a better understanding of mortality variation by partnership status, we separately analysed individuals aged 30-49, 50-64 and 65-85. The analysis by age groups reveals that mortality differences by marital status are the largest for the population aged 50-64 and lowest for the population aged 65-85, with the exception of 'widowed' individuals. Once we controlled for cohabitation, the patterns changed for men. The most interesting finding is the difference between the single and premarital cohabitation groups for the two younger age groups. Single and non-cohabiting men and women have significantly higher mortality levels than married men and women (Tables 6 and 7). Mortality levels among singles in the younger age group are much higher in the model where we control for cohabitation due to the exclusion of those who cohabit. By contrast, men and women aged 30-49 in a premarital cohabitation have even lower estimated mortality levels than married individuals. Those differences are significant because our married group also includes remarried individuals. For older ages, single cohabiting men and women exhibit higher mortality rates than married people.

Tables 6 and 7 here

All models have been checked for multi-collinearity, using the correlation matrix of the coefficients. Further, all age-stratified Model 3(PS) (tables 6 and 7) fulfil the proportional hazard assumption.

6.1 Sensitivity analysis I - Observation window

Information on partnership status was measured only at the time of the 2001 census. We conducted a series of analyses to determine how sensitive the results are to different observation windows used in the study. The analysis shows that the results do not change very much depending on whether we followed individuals for 10, 7.5, 5 or 2.5 years (Figure 2). This could be explained by the fact that on average fewer than 15% of individuals (singles less than 10%, married/remarried 20%, divorced/separated less than 15% and widowed less than 5%) had a different partnership status at death than at the 2001 census, emphasizing that marriage is an accumulation of good health, and therefore the married population of 2001 'started' with a health advantage at the beginning of the analysis. The confidence intervals do not vary much across the length of the observation window. Most importantly, the main mortality differences by marital status are robust to different sample specifications. Further analysis by age group confirms this finding, showing larger confidence intervals for the younger age groups. (Results are available upon request.)

Figure 2 here

Fig 2 Sensitivity to observation window: (I) – 10 years; (II) – 7.5years; (III) – 5years; (IV) – 2.5years.
Source: Authors' calculations based on the ONS LS.

6.2 Sensitivity analysis II - Embarkation date

We also studied sensitivity of the results to unregistered emigration. In our analysis, a person had emigrated without registration if he or she was not present at the 2011 census and had no recorded death prior to the 2011 census date. There were approximately 28,000 individuals

with missing embarkation dates. We therefore fitted different scenarios using the mean emigration date as calculated by Wallace and Kulu (2014b) and by using the mean embarkation date based on the 2,000 emigrants with known date. We used four different censoring scenarios for emigrants: 1) all emigrants leave the country at the calculated mean embarkation date; 2) migrants leave either after 3.9 years or at their known emigration date; 3) all emigrants leave after 3.9 years, which was the mean emigration date in previous decades (Wallace and Kulu 2014b); 4) emigrants are excluded from the analysis. Analysis showed that the emigration date did not affect the estimates much, unless we completely excluded the emigrants (Figure 3). Again, the analysis by age group showed similar results, with the exception of small groups such as the widowed in the youngest age group. (Results are available upon request.)

Figure 3 here

Fig 3 Sensitivity to Embarkation date: FIRST – all leave after 3.9years; SECOND – all leave after 3.9 years or their known embarkation date; THIRD – all leave on average embarkation date; FOURTH – no emigrants
Source: Authors' calculations based on the ONS LS.

7. Conclusion

Our study shows that unmarried non-partnered people in England and Wales have significantly higher mortality levels than married individuals. The differences in mortality decrease after controlling for individuals' socio-economic and socio-demographic characteristics. Adjusting for household size and the presence of children further reduces mortality differences between married and unmarried non-partnered individuals, but significant differences persist. As in previous research, we found that mortality differences are greater for men than for women, although gender differences are significantly reduced after adjusting for socio-economic variables (e.g. Brockmann and Klein 2004, Koskinen et al. 2007, Murphy et al. 2007, Staehelin et al. 2012).

This is one of the first studies to include cohabitants in the analysis. We showed that cohabitation plays a significant role in estimating mortality differences by partnership status, especially for the youngest age groups. Similarly to previous studies, we found higher mortality of cohabitants with respect to married and lower with respect to non-married individuals (see e.g. Drehfahl 2012, Koskinen et al 2007, Scafato et al. 2008). Complementary to previous research, our analysis showed that in ages 30-49 cohabitants have mortality levels similar to, or even lower than, married individuals, whereas the single population has much higher mortality than previous studies have shown. Albeit unsurprising, this is an important finding.

Although we do not know how long cohabitants stay in their (respective) groups (e.g., cohabitants either continue cohabiting or dissolve their union or get married), their lower mortality risk at younger ages in comparison to married individuals suggests that this group is not simply a mix of (soon-to-be) married and never-married but rather that, in the short run, young cohabiting couples have as good health as married couples. Therefore, some of the protective effects of marriage, as described for example by Goldman (2001), such as emotional support, are also provided in cohabitation. In the long run, however, it seems that the accumulation of these advantages might be a challenge for cohabiting people because cohabitations are less stable than marriages, and cohabitants therefore are more likely to experience stress. Further, the lower mortality of cohabiting men compared to married men supports the selection hypothesis, i.e. healthier men are more likely to find a partner and that healthier men may also postpone first marriages (Lillard and Panis 1996). Dupre et al. (2009) showed that the increase in mortality risk with age slows down with years of marriage, which could be due to the accumulation of health and wealth. We believe that the accumulation of material wealth in particular is not as effective for cohabitants than for married people. Because cohabitation is seen as a ‘trial marriage’ (Kulu and Boyle 2010), with a possible

dissolution already in mind, it may restrict long-term investments, such as a mortgage for a house, whereas married couples still often pay off the mortgage together. This might not be the case for cohabiting couples where only one party may be left with the house.

The second contribution of this paper was the inclusion of household structure and size in the analysis. Studies have shown that living with someone and combining resources leads to an obvious economic advantage (e.g. Arber 2004). Therefore, it was expected that the mortality differences would decline if we included variables such as household size and dependent children in the analysis. Including household characteristics in the models led to a pronounced decrease in the mortality differences across partnership status for men, but not for women. Research has shown that the mortality risk is lower for men living with someone than for men living alone; however, for women the differences are negligible (Staehelin et al. 2012). Interestingly, the study showed the importance of household structure and size in explaining mortality differences across partnership status for men, but mortality variation by household size and structure was relatively small to deserve longer discussion. Still, the presence of children seems to have a mortality reducing effect both for men and women.

The strength of this study is the use of a large sample (over 300,000 people with more than 45,000 deaths). There are also some challenges. As the ONS LS is census-based, we only have a full record of individuals at two censuses (2001 and 2011), and we can only use information on the marital and partnership status at the beginning of our observation period, which is 2001. Although the marital status at death is available, we could not exploit this information because there is no information on marital status changes for individuals who survive our observation period (from 2001 to 2011). Further, we did not include in the analysis marital histories. Although, an individual's marital status is also available at previous censuses (e.g. 1991), the histories would have been not detailed enough to improve the analysis. Most importantly, our sensitivity analyses showed that the main results of the study

were robust to different specification of the length of observation window (to reduce the uncertainty related to unrecorded changes in partnership status) and expected duration of stay for prospective return migrants. These sensitivity tests were the third contribution of this study.

Using register-based longitudinal data, this study showed large mortality differences between married and unmarried individuals. The differences between groups declined after adjusting for the socio-demographic and socio-economic characteristics of individuals, but persisted. The study showed that when controlling for cohabitation we should not just consider the 'state' of the cohabitation (pre- or post-marital), but also the age-groups. If healthy individuals are more likely to find a partner, then cohabitants at younger ages should have good health similar to married individuals. We showed that cohabitants younger than 50 have similar if not lower mortality rates than married couples. This provides some support to the selection theory – those in good health are more likely to find a partner. However, it could also be evidence supporting the protection theory, i.e. among those with a partner, the 'worst of the best' marry and the 'best of the best' postpone entry into marriage.

The relatively low mortality among married individuals at older ages could be a sign of the protective effects of marriage as well as the accumulation of good health and wealth. Assuming the importance of accumulation, the differences could also be due to differences in partnership length between marriages and cohabitations. Further research should investigate the cause of death by partnership status. Such an analysis would further improve our understanding of the causes of mortality variation by partnership status. It is also important to explicitly investigate the effect of health on partnership changes; such research would require annual information on the health status of individuals and partnership histories. Several panel studies, including the British Household Panel Study, provide such information.

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Figures

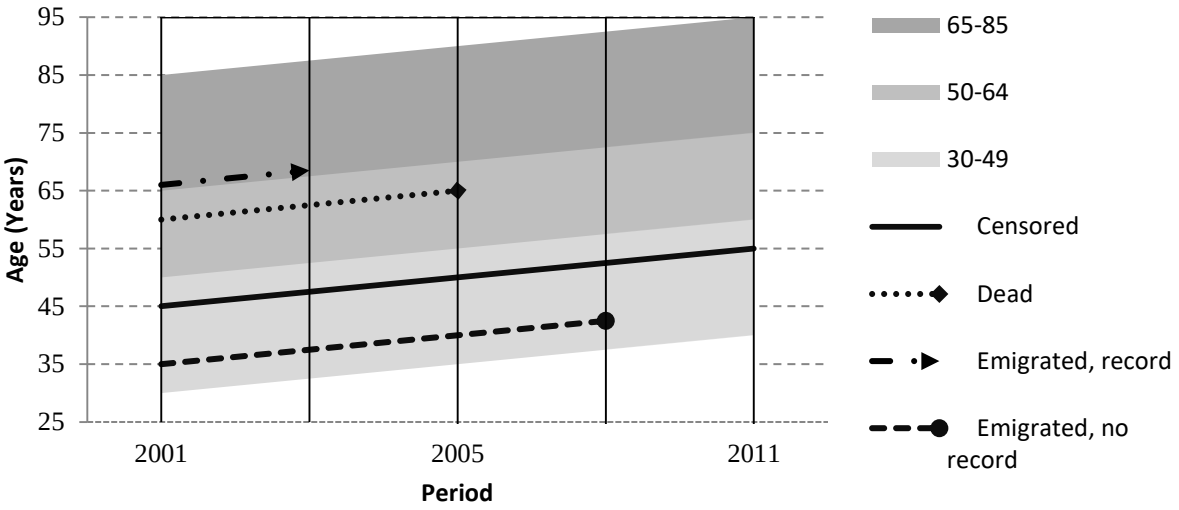

Fig 1 Lexis Diagram with sample population; Each individual has 4 possibilities of leaving the sample, 1 () censored at the end of the observation interval(diamond) – death, 2 (diamond) – leaving at a known embarkation date, 3 (square) – censored at the end of the observation interval, 4 (triangle) - leaving at an unknown embarkation date.

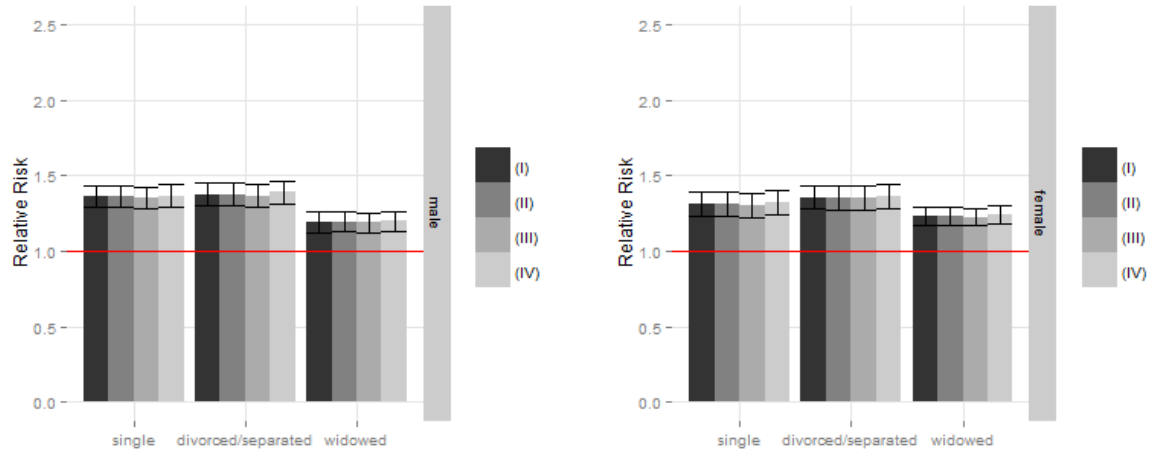

Fig 2 Sensitivity to observation window: (I) – 10 years; (II) – 7.5years; (III) – 5years; (IV) – 2.5years.
Source: Authors' calculations based on the ONS LS.

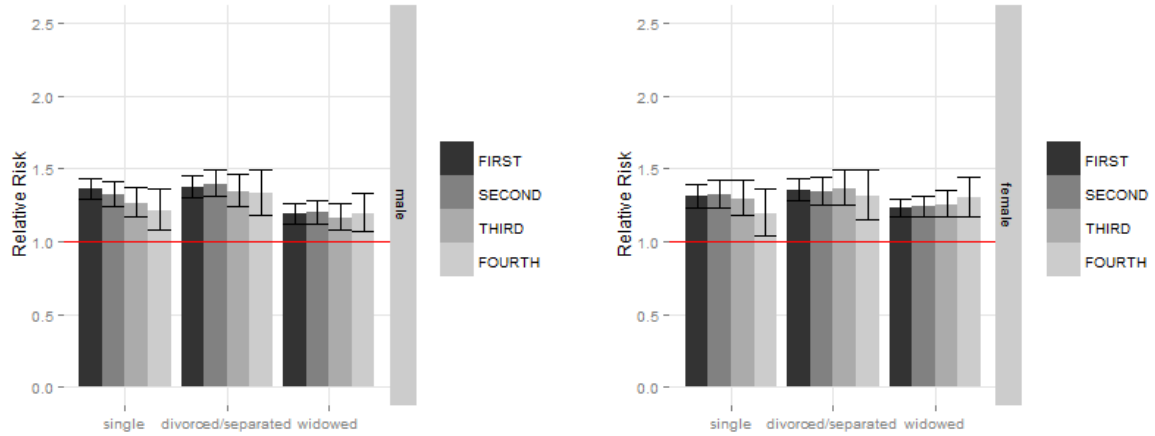

Fig 3 Sensitivity to Embarkation date: FIRST – all leave after 3.9years; SECOND – all leave after 3.9years or their known embarkation date; THIRD – all leave on average embarkation date; FOURTH – no emigrants
Source: Authors' calculations based on the ONS LS.

Tables

Table 1:

Number of individuals by marital status, sex and age group

Marital Status 2001	aged 30-49				aged 50-64				aged 65-85			
	Male	%	Female	%	Male	%	Female	%	Male	%	Female	%
Single	19349	25	14322	18	3951	8	2414	5	2288	7	2505	6
Married	47035	62	50214	63	36354	76	34829	71	24774	73	19687	46
Divorced/Separated	9721	13	13983	18	6235	13	7739	16	2063	6	2689	6
Widowed	263	<1	889	1	1125	2	4094	8	4903	14	18341	42
Total	76368		79408		47665		49076		34028		43222	

Percentages maybe not sum up to 100 due to rounding. Source: Authors' calculations based on the ONS LS.

Table 2

Number of individuals by partnership status, sex and age group

Partnership status 2001	aged 30-49				aged 50-64				aged 65-85			
	Male	%	Female	%	Male	%	Female	%	Male	%	Female	%
Single	13264	17	9929	13	3537	7	2176	4	2264	7	2495	6
Married	47035	62	50214	63	36354	76	34829	71	24774	73	19687	46
Divorced/Separated	6228	8	10322	13	4548	10	6364	13	1932	6	2627	6
Widowed	229	<1	770	1	988	2	3938	8	4863	14	18296	42
Premarital cohab	6085	8	4393	6	414	1	238	<1	24	<1	<10	<1
Postmarital cohab	3527	5	3780	5	1824	4	1531	3	171	<1	107	<1
Total	76368		79408		47665		49076		34028		43222	

Percentages maybe not sum up to 100 due to rounding. Source: Authors' calculations based on the ONS LS.

Table 3

Person-years at risk (PY) and number of events (E) by covariates, sex and age group.

	30-85 male			female			30-49 male			female			50-64 male			female			65-85 male			female		
	PY	%	E	PY	%	E	PY	%	E	PY	%	E	PY	%	E	PY	%	E	PY	%	E	PY	%	E
Marital status																								
Single	222787.6	16.1	2555	172902.2	11.2	1686	172823.8	24.7	588	132406.1	17.7	257	34169.8	7.9	699	21773.8	4.8	270	15793.9	6.2	1268	18722.3	5.5	1159
Married	964568.5	69.6	15000	965061.3	62.6	9123	438616.2	62.6	891	476363.9	63.7	734	335473	77.4	3430	325253.9	71.6	2254	190479.3	75.3	10679	163443.4	48.2	6135
Divorced	155486.5	11.2	2269	222916.9	14.5	2009	86608.3	12.4	359	130590.5	17.5	305	54069.7	12.5	909	70630.8	15.5	767	14808.5	5.9	1001	21695.7	6.4	937
Widowed	43819.3	3.2	3304	180361.3	11.7	9592	2392.5	0.3	11	8205.5	1.1	26	9696	2.2	222	36678.8	8.1	535	31730.8	12.6	3071	135477.1	39.9	9031
Country of Birth																								
England & Wales	1199386.7	86.5	20361	1332929.7	86.5	19893	600969.1	85.8	1614	639161.7	85.5	1137	377088.6	87	4630	393252.3	86.6	3301	221329	87.5	14110	300515.8	88.6	15452
Scotland & N. I.	35428.2	2.6	703	35764.2	2.3	635	16784	2.4	49	16237.1	2.2	33	12265.8	2.8	180	11429.3	2.5	134	6378.3	2.5	469	8097.8	2.4	460
Other	151346.2	10.9	2054	172357.9	11.2	1872	82264.3	11.7	176	92042.9	12.3	142	44023.8	10.2	440	49611.5	10.9	381	25058	9.9	1430	30703.5	9	1340
Missing	500.9	<0.1	<10	189.9	<0.1	<10	423.4	0.1	<10	124.3	<0.1	<10	30.3	<0.1	<10	44.3	<0.1	<10	47.3	<0.1	<10	21.3	<0.1	<10
Ethnicity																								
White	1283571.4	92.6	22233	1430118.1	92.8	21734	635057.7	90.7	1703	673380.6	90.1	1197	407069.3	93.9	5000	427157.8	94	3624	241444.4	95.5	15520	329579.7	97.1	16902
White Mixed	7479.1	0.5	66	8492.8	0.6	60	5669	0.8	11	6170.8	0.8	<10	1307.6	0.3	12	1592.5	0.4	13	502.5	0.2	40	729.6	0.2	40
Asian	65581.7	4.7	569	63753.3	4.1	390	40192.6	5.7	89	41511.6	5.6	61	18104.2	4.2	173	16935.7	3.7	126	7284.9	2.9	304	5306	1.6	195
Black	21036.4	1.5	203	27227.7	1.8	176	13820.6	2	26	18529.2	2.5	34	4513.3	1	52	5794.9	1.3	43	2702.5	1.1	122	2903.6	0.9	91
Chinese	5009.8	0.4	39	5308.8	0.3	31	3025.1	0.4	<10	3420.8	0.5	<10	1364.3	0.3	13	1340.4	0.3	<10	620.4	0.2	21	547.6	0.2	24
Other	3983.5	0.3	18	6341.1	0.4	19	2675.9	0.4	<10	4553.2	0.6	<10	1049.8	0.2	<10	1515.9	0.3	<10	257.8	0.1	12	272	0.1	<10
Dep. Children																								
None	322833.2	23.3	2882	307565.2	20	1654	115098.5	16.4	229	115298.8	15.4	227	195139.6	45	2206	184895.1	40.7	1243	12595.1	5	447	7371.3	2.2	184
dependent	458845.4	33.1	1583	528224	34.3	1219	386337.3	55.2	721	479394.9	64.1	615	65938	15.2	516	41655.2	9.2	271	6570.2	2.6	346	7173.9	2.1	333
No dependent	193476	14	2691	201075.8	13	2505	75709	10.8	310	72921.4	9.8	212	93389.2	21.5	975	96930.9	21.3	702	24377.8	9.6	1406	31223.5	9.2	1591
Not applicable	411507.3	29.7	15972	504376.7	32.7	17032	123296.1	17.6	589	79950.9	10.7	268	78941.8	18.2	1563	130856.1	28.8	1610	209269.5	82.8	13820	293569.7	86.5	15154
Household size																								
1 person	187456.8	13.5	5305	263199.8	17.1	9159	88629.1	12.7	419	55629.3	7.4	173	52686.9	12.2	1058	70714.6	15.6	929	46140.8	18.3	3828	136855.8	40.3	8057
2 persons	531964.8	38.4	12683	583035.9	37.8	8928	146683.6	20.9	365	167085.8	22.4	344	213931	49.4	2533	248779.7	54.8	1948	171350.2	67.8	9785	167170.4	49.3	6636
3 persons	263266.8	19	2557	281682.7	18.3	1782	147216.8	21	380	175964.2	23.5	317	93000.7	21.5	913	85669.8	18.9	576	23049.4	9.1	1264	20048.8	5.9	889
4 persons	255439.5	18.4	1091	259996.1	16.9	723	200660.9	28.6	387	222739.3	29.8	276	49434.2	11.4	416	32532.7	7.2	190	5344.4	2.1	288	4724.1	1.4	257
5+ persons	137895.8	9.9	699	143500	9.3	531	111331.5	15.9	235	123344.3	16.5	173	21967.2	5.1	207	15017.8	3.3	108	4597.2	1.8	257	5137.9	1.5	250
unknown	10638.2	0.8	793	9827.3	0.6	1287	5919	0.8	63	2803	0.4	39	2388.6	0.6	133	1622.8	0.4	75	2330.6	0.9	597	5401.4	1.6	1173
Education																								
No qualifications	408706	29.5	8301	505864.8	32.8	7360	136153	19.4	622	153282.6	20.5	508	171649.8	39.6	2812	213663.8	47	2290	100903.2	39.9	4863	138918.3	40.9	4554
Low qual.	563341.7	40.6	4133	566941.3	36.8	2530	353961.3	50.5	833	375755.6	50.3	537	165023.8	38.1	1680	150979.2	33.2	1004	44356.6	17.5	1615	40206.5	11.8	987
Medium qual.	70786.8	5.1	546	70806.3	4.6	258	46128	6.6	107	51138.3	6.8	63	18705	4.3	177	15587	3.4	104	5953.8	2.4	261	4080.9	1.2	90
Degree level +	265170.4	19.1	1655	264780.6	17.2	1159	163109.3	23.3	277	166664.5	22.3	204	77810.3	18	581	73860.8	16.3	418	24250.8	9.6	796	24255.3	7.1	536
Unknown	78657	5.7	8493	132848.8	8.6	11103	1089.2	0.2	<10	725	0.1	<10	219.7	0.1	<10	246.4	0.1	<10	77348.2	30.6	8484	131877.4	38.9	11095
Partnership st.																								
Single	163291	11.8	2430	129267.1	8.4	1631	117155.3	16.7	529	91043.3	12.2	219	30495.4	7	644	19569.6	4.3	256	15640.3	6.2	1257	18654.2	5.5	1153
Married	964568.5	69.6	15000	965061.3	62.6	9123	438616.2	62.6	891	476363.9	63.7	734	335473	77.4	3430	325253.9	71.6	2254	190479.3	75.3	10679	163443.4	48.2	6135
Divorced	107566.7	7.8	1962	175292.7	11.4	1825	54754.9	7.8	273	96171.3	12.9	235	39102.2	9	726	57926.3	12.7	671	13709.6	5.4	963	21195	6.2	919
Widowed	41954	3	3270	177483.2	11.5	9567	2080.5	0.3	11	7122.8	1	26	8442.4	1.9	204	35250.7	7.8	523	31431.1	12.4	3055	135109.8	39.8	9014
Premarital Coh	59496.6	4.3	125	43635.1	2.8	55	55668.5	7.9	59	41362.8	5.5	38	3674.4	0.8	55	2204.3	0.5	14	153.7	0.1	11	68.1	<0.1	<10
Postmarital Coh	49785.2	3.6	341	50502.4	3.3	209	32165.4	4.6	86	35501.9	4.7	70	16221.1	3.7	201	14132.5	3.1	108	1398.7	0.6	54	868	0.3	31
SES																								
Higher manag.	203099.6	14.6	1318	73620.4	4.8	225	118927.5	17	210	51984.6	7	51	62277.8	14.4	458	17619.6	3.9	96	21894.3	8.7	650	4016.3	1.2	78
Lower manag.	300606.3	21.7	2539	335786.7	21.8	1715	168958.3	24.1	313	197966.2	26.5	281	95454.3	22	926	103014.4	22.7	653	36193.7	14.3	1299	34806.1	10.3	776
Intermediate	65881.1	4.8	586	253628.9	16.5	1614	38050.1	5.4	93	134912.8	18	194	20510.4	4.7	213	82198.4	18.1	570	7320.6	2.9	280	36517.8	10.8	850
Small employers	189211.3	13.6	1824	81695.5	5.3	496	94972.6	13.6	238	42239.3	5.7	71	72433.6	16.7	796	30461.6	6.7	220	21805.1	8.6	789	8994.6	2.7	204
Lower supervis.	180983.2	13.1	2294	80876.8	5.2	686	95374.8	13.6	267	41821.7	5.6	78	57480.9	13.3	760	27333.5	6	243	28127.4	11.1	1263	11721.6	3.5	364
Semi-routine	130686.3	9.4	1711	296776.6	19.3	2270	68293.4	9.8	231	152070.7	20.3	310	45318.1	10.5	678	105129.3	23.1	914	17074.8	6.8	801	39576.6	11.7	1046
Routine	183964.7	13.3	2720	172684.4	11.2	1884	90233.9	12.9	330	78500.3	10.5	181	68471.4	15.8	1138	63883.3	14.1	673	25259.3	10	1251	30300.9	8.9	1029
Other	53852	3.9	1650	113413.8	7.4	2423	24781.8	3.5	157	47341.6	6.3	146	11189.3	2.6	281	24421.5	5.4	447	17880.9	7.1	1211	41650.7	12.3	1829
missing	78377.6	5.7	8486	132758.7	8.6	11097	848.4	0.1	<10	729	0.1	<10	272.7	0.1	<10	275.7	0.1	<10	77256.5	30.6	8475	131754	38.8	11086
Total	1386661.9		23128	1541241.7		22410	700440.8		1849	747566		1322	433408.5		5260	454337.2		3826	252812.6		16019	339338.4		17262

Percentages maybe not sum up to 100 due to rounding. Source: Authors' calculations based on the ONS LS.

Table 4

Relative Risk of mortality by marital and partnership status in England and Wales for men aged 30-85

	Model1 (MS)			Model1 (PS)			Model2 (PS)			Model3 (PS)		
30-85 male	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI
Marital Status												
Married	1			1			1			1		
Single	1.75	***	(1.68-1.83)	1.81	***	(1.73-1.89)	1.67	***	(1.6-1.74)	1.42	***	(1.34-1.5)
Divorced/separated	1.58	***	(1.51-1.65)	1.66	***	(1.58-1.74)	1.57	***	(1.5-1.65)	1.44	***	(1.35-1.53)
Widowed	1.35	***	(1.3-1.41)	1.36	***	(1.31-1.42)	1.31	***	(1.26-1.36)	1.23	***	(1.16-1.3)
Premarital cohab				0.99		(0.82-1.18)	0.96		(0.81-1.16)	1.00		(0.84-1.2)
Postmarital cohab				1.17	**	(1.05-1.3)	1.17	**	(1.05-1.31)	1.23	***	(1.1-1.37)
Country of Birth												
England & Wales	1			1			1			1		
Scotland and N. Ireland	1.17	***	(1.08-1.26)	1.17	***	(1.09-1.26)	1.19	***	(1.1-1.28)	1.18	***	(1.09-1.27)
Other	0.91	***	(0.87-0.95)	0.91	***	(0.87-0.95)	0.96		(0.91-1.02)	0.95		(0.9-1.01)
Missing	0.71		(0.23-2.2)	0.70		(0.23-2.17)	1.15		(0.34-3.91)	0.41		(0.12-1.37)
Ethnicity												
White							1			1		
White Mixed							1.10		(0.86-1.4)	1.11		(0.87-1.42)
Asian							0.84	***	(0.76-0.93)	0.87	**	(0.79-0.97)
Black							0.74	***	(0.64-0.86)	0.76	***	(0.66-0.88)
Chinese							0.69	*	(0.5-0.95)	0.73	*	(0.53-1.)
Other							0.53	**	(0.33-0.84)	0.55	*	(0.35-0.88)
SES												
Higher managerial							1			1		
Lower managerial							1.15	***	(1.07-1.23)	1.15	***	(1.07-1.23)
Intermediate							1.18	**	(1.07-1.31)	1.18	**	(1.07-1.31)
Small employers							1.19	***	(1.1-1.28)	1.19	***	(1.11-1.28)
Lower supervisory							1.37	***	(1.27-1.47)	1.37	***	(1.27-1.47)
Semi-routine							1.46	***	(1.35-1.58)	1.46	***	(1.36-1.58)
Routine occupations							1.54	***	(1.43-1.65)	1.54	***	(1.43-1.66)
Other							2.01	***	(1.86-2.17)	1.84	***	(1.7-1.99)
Missing							1.97	*	(1.11-3.5)	1.18		(0.74-1.91)
Education												
No qualifications							1.21	***	(1.16-1.26)	1.20	***	(1.15-1.25)
Low qualification							1			1		
Medium qualification							1.11	*	(1.01-1.21)	1.11	*	(1.01-1.21)
High qualification							0.88	***	(0.83-0.93)	0.88	***	(0.83-0.94)
NA / Missing							0.82		(0.46-1.46)	1.30		(0.81-2.09)
Hhsize												
2 persons										1		
1 person										1.03		(0.98-1.09)
3 persons										0.99		(0.92-1.06)
4 persons										0.97		(0.89-1.06)
5+ persons										1.08		(0.97-1.2)
Unknown										2.86	***	(2.63-3.1)
Children												
no children										1		
Dependent										0.93		(0.84-1.03)
No dependent										1.15	**	(1.06-1.25)
Not applicable										1.13	***	(1.08-1.2)

*** p-value<0.001, ** p-value<0.01, * p-value < 0.05

Source: Authors' calculations based on the ONS LS.

Table 5

Relative Risk of mortality by marital and partnership status in England and Wales for women aged 30-85

	Model1 (MS)			Model1 (PS)			Model2 (PS)			Model3 (PS)		
	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI
Marital Status												
Married	1			1			1			1		
Single	1.43	***	(1.35-1.5)	1.45	***	(1.38-1.53)	1.47	***	(1.39-1.55)	1.34	***	(1.25-1.42)
Divorced/separated	1.37	***	(1.3-1.43)	1.38	***	(1.31-1.45)	1.35	***	(1.29-1.42)	1.37	***	(1.29-1.46)
Widowed	1.26	***	(1.22-1.3)	1.27	***	(1.23-1.31)	1.24	***	(1.2-1.28)	1.25	***	(1.18-1.31)
Premarital cohab				0.94		(0.72-1.23)	0.98		(0.75-1.28)	0.98		(0.75-1.28)
Postmarital cohab				1.23	**	(1.07-1.42)	1.22	**	(1.06-1.4)	1.24	**	(1.08-1.43)
Country of Birth												
England & Wales	1			1			1			1		
Scotland and N. Ireland	1.17	***	(1.08-1.27)	1.17	***	(1.08-1.27)	1.19	***	(1.1-1.29)	1.20	***	(1.1-1.29)
Other	0.95	*	(0.9-0.99)	0.95	*	(0.9-0.99)	0.96		(0.91-1.02)	0.95		(0.9-1.01)
Missing	1.17		(0.29-4.7)	1.17		(0.29-4.68)	3.45		(0.75-15.9)	1.24		(0.28-5.43)
Ethnicity												
White							1			1		
White Mixed							1.01		(0.78-1.31)	1.02		(0.79-1.32)
Asian							0.83	**	(0.74-0.93)	0.85	**	(0.76-0.96)
Black							0.83	*	(0.71-0.97)	0.85	*	(0.73-0.99)
Chinese							0.73		(0.51-1.05)	0.76		(0.53-1.09)
Other							0.61	*	(0.39-0.96)	0.63	*	(0.4-0.99)
SES												
Higher managerial							1			1		
Lower managerial							1.16	*	(1.01-1.34)	1.16	*	(1.01-1.33)
Intermediate							1.13		(0.98-1.3)	1.12		(0.97-1.29)
Small employers							1.18	*	(1.01-1.39)	1.17		(1.0-1.37)
Lower supervisory							1.39	***	(1.19-1.63)	1.38	***	(1.19-1.61)
Semi-routine							1.29	***	(1.12-1.49)	1.28	**	(1.11-1.48)
Routine occupations							1.54	***	(1.34-1.78)	1.52	***	(1.32-1.76)
Other							2.02	***	(1.75-2.32)	1.90	***	(1.65-2.19)
Missing							3.03	**	(1.59-5.75)	2.14	**	(1.29-3.53)
Education												
No qualifications							1.25	***	(1.19-1.31)	1.24	***	(1.18-1.3)
Low qualification							1			1		
Medium qualification							0.93		(0.81-1.05)	0.93		(0.82-1.06)
High qualification							0.88	**	(0.82-0.95)	0.89	**	(0.82-0.95)
NA / Missing							0.51	*	(0.27-0.96)	0.68		(0.42-1.1)
Hhsize												
2 persons										1		
1 person										0.95	*	(0.9-1.)
3 persons										1.03		(0.96-1.09)
4 persons										1.01		(0.92-1.1)
5+ persons										1.11		(0.99-1.24)
Unknown										2.96	***	(2.76-3.18)
Children												
No children										1		
Dependent										0.90		(0.81-1.01)
No dependent										1.08		(1.0-1.17)
Not applicable										1.04		(0.98-1.12)

*** p-value<0.001, ** p-value<0.01, * p-value < 0.05

Source: Authors' calculations based on the ONS LS.

Table 6

Relative Risk of male mortality by marital and partnership status in England and Wales by age group

age group	30-49						50-64						65-85					
	model 3 (MS)			model 3 (PS)			model 3 (MS)			model 3 (PS)			model 3 (MS)			model 3 (PS)		
	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI
Marital Status																		
Married	1			1			1			1			1			1		
Single	1.38	***	(1.19-1.6)	2.07	***	(1.7-2.52)	1.57	***	(1.4-1.77)	1.62	***	(1.4-1.88)	1.19	***	(1.1-1.28)	1.19	***	(1.11-1.29)
Divorced/separated	1.32	***	(1.13-1.54)	1.79	***	(1.46-2.2)	1.45	***	(1.31-1.6)	1.53	***	(1.32-1.77)	1.28	***	(1.18-1.38)	1.30	***	(1.2-1.41)
Widowed	1.14		(.62-2.08)	1.55		(.84-2.84)	1.56	***	(1.33-1.82)	1.67	***	(1.39-2.)	1.15	***	(1.08-1.23)	1.16	***	(1.08-1.24)
Premarital cohab				0.76	*	(.58-.99)				1.75	***	(1.34-2.29)				1.95	*	(1.07-3.53)
Postmarital cohab				1.26	*	(1.-1.57)				1.35	***	(1.17-1.56)				0.99		(.75-1.3)

*** p-value<0.001, ** p-value<0.01, * p-value < 0.05; Other covariates omitted, available upon request
Source: Authors' calculations based on the ONS LS.

Table 7

Relative Risk of female mortality by marital and partnership status in England and Wales by age group

age group	30-49						50-64						65-85					
	model 3 (MS)			model 3 (PS)			model 3 (MS)			model 3 (PS)			model 3 (MS)			model 3 (PS)		
	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI	RR	Sign	CI
Marital Status																		
Married	1.00			1.00									1.00			1.00		
Single	1.23	*	(1.02-1.47)	1.42	**	(1.14-1.77)	1.56	***	(1.34-1.81)	1.66	***	(1.41-1.96)	1.15	***	(1.07-1.24)	1.15	***	(1.07-1.24)
Divorced/separated	1.19	*	(1.02-1.4)	1.25	*	(1.03-1.52)	1.50	***	(1.34-1.67)	1.62	***	(1.42-1.85)	1.17	***	(1.08-1.27)	1.16	***	(1.07-1.27)
Widowed	1.08		(.72-1.62)	1.29		(.85-1.95)	1.44	***	(1.27-1.63)	1.54	***	(1.34-1.76)	1.14	***	(1.08-1.21)	1.14	***	(1.08-1.21)
Premarital cohab				0.90		(.64-1.25)				1.26		(.75-2.14)				1.25		(.4-3.89)
Postmarital cohab				1.19		(.93-1.53)				1.27	*	(1.05-1.54)				1.25		(.86-1.8)

*** p-value<0.001, ** p-value<0.01, * p-value < 0.05; Other covariates omitted, available upon request
Source: Authors' calculations based on the ONS LS