

## **For better *and* for worse: The relationship between divorce and self-assessed health in European panel data**

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We investigate the association between divorce and self-assessed health in European panel data. Previous studies suggest that this association is negative, yet it is unclear to what extent this reflects causation (an effect of divorce on health) and/or selection (an effect of health on divorce). We analyze the relationship between self-assessed health and 3,894 divorces in about 60,000 respondents aged 18-59 across eight waves of the European Community Household Panel (ECHP). Fixed effect panel analyses show that the negative association between divorce and self-assessed health is not due to a general negative effect of divorce on health. Rather, after divorce self-assessed health improves among some divorcees, while for others it declines. Compared to the continuously married divorce seems to cause increases and decreases in health. We also find evidence for a negative effect of self-assessed health on divorce risks. This selection effect is caused by prolonged poor health rather than by an immediate effect of a decline in self-assessed health. Our results support the idea that the association between divorce and self-assessed health is an outcome of both causation and selection and that the effect of divorce is highly heterogeneous.

Key words: divorce, self-assessed health, panel data, fixed effects models, event history analysis, Europe

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## 1. Introduction

Divorce is thought to have negative consequences in many life domains. With regard to economic outcomes and social contacts the empirical evidence tells a relatively clear story of negative effects although it is often complicated by difference between men and women (Amato, 2000). Marital and non-marital union dissolution lead, on average, to a reduction in household income for women (Andreß, Borgloh, Bröckel, Giesselmann, & Hummelsheim, 2006; Burkhauser, Duncan, Hauser, & Roland, 1991; Smock, 1993, 1994; Uunk, 2004), increased poverty risks for women (Aassve, Betti, Mazzuco, & Mencarini, 2007; Avellar & Smock, 2005; Dewilde, 2002; Jenkins, 2008; Vandecasteele, 2010), a decline in social contacts with neighbors and adult children for men (Booth, Edwards, & Johnson, 1991; Kalmijn & Broese van Groenou, 2005; Seltzer, 1991), and increased feelings of loneliness for men and women (Peters & Liefbroer, 1997).

If we turn to the health domain, the evidence is less straightforward (Carr & Springer, 2010; Wood, Goesling, & Avellar, 2007). Three main outcomes can be distinguished in this domain: mortality, mental health, and physical health. Mortality statistics provide the clearest pattern: life expectancy of divorced people is lower than that of married people (Brockmann & Klein, 2004; Hu & Goldman, 1990; Lillard & Waite, 1995; Lund, Holstein, & Osler, 2004). This implies that divorce has a causal effect on mortality, but few studies can control for selection into divorced status and it is not clear whether the event of a divorce is detrimental or the prolonged state of being divorced (i.e. not repartnering).

The majority of studies in the literature on health and divorce have focused on various indicators of mental health, such as psychological distress, depressive symptoms, mental well-being, and happiness (Amato, 2000; Carr & Springer, 2010; Wood, et al., 2007). These studies show that divorced people report higher levels of mental health than married individuals (Wade & Pevalin, 2004). Again, the causality behind this association is not straightforward. There is evidence suggesting the association between divorce and measures of mental health represents both an effect of mental health on divorce (selection) and an effect of divorce on mental health (causation) (Aseltine & Kessler, 1993; Wade & Pevalin, 2004; Wu & Hart, 2002). Lower mental health increases the risk of

divorce and divorce has negative effects on mental health as well, although it seem to be short term effects, lasting perhaps a couple of years (Blekesaune, 2008; Wade & Pevalin, 2004).

It is somewhat surprising that the relationship between divorce and self-assessed health has been addressed in only a few studies (Wood, et al., 2007). Self-assessed health is one of the most frequently used indicators of general health in the social sciences (McHorney, 2000). This one-item question that measures a person's perceived general health status predicts mortality longitudinally (Yael Benyamini & Idler, 1999; DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Idler & Benyamini, 1997; Idler & Kasl, 1995; Mossey & Shapiro, 1982) and although it clearly captures some mental and socio-psychological aspects of health as well, its main driver is physical health (Yael Benyamini, Leventhal, & Leventhal, 1999; Krause & Jay, 1994; Mavaddat et al., 2010). It is one of the indicators recommended by the WHO and EU for monitoring population health (Robine, Jagger, & Group, 2003; World Health Organisation, 1996).

Self-assessed health shows the expected correlation with divorce: divorced people report worse health than married people (Liu & Umberson, 2008). Hughes and Waite (2009) report that previously married respondents in the 1992 wave of the US Health and Retirement Study have worse self-assessed health than continuously married respondents. Longitudinal studies of divorce and self-assessed health are scarce. One of the few studies is Williams and Umberson's (2004) analysis of three waves of the Americans' Changing Lives survey. They find no significant effect of divorce for women and both negative and positive effects depending on age for men. It is unclear, however, how robust these findings are as the number of divorces was quite small (about 100 for men and women combined).<sup>i</sup> We are not aware of studies that use bigger samples with more divorces and more observations across time. It remains an open question how divorce and self-assessed health are related in a longitudinal design.

In this paper we investigate the association between divorce and self-assessed health with European cross-national comparative, longitudinal panel data covering up to eight annual waves. The research questions are: (1) *What is the strength and direction of the association between divorce and self-assessed health?* (2) *To what extent does the association between divorce and self-assessed health represent causation*

*effects and/or selection effects? (3) To what extent do the above effects differ between men and women?*

With this study we aim to make three contributions to the literature on divorce and health. First, we provide a longitudinal study of the relationship between divorce and self-assessed health that has an unprecedented number of divorces. In comparison to earlier panel studies, the high number of divorces and the availability of more than two panel waves not only increases statistical power, but also provides the opportunity to apply more appropriate statistical techniques (Halaby, 2004; Johnson, 2005). We introduce random and fixed effects panel regression models to the analyses of divorce and self-assessed health. Fixed effects models are especially important as they control for unobserved time-constant variables—such as personality traits – that might be responsible for the association between divorce and self-assessed health.

Second, to our knowledge, for Europe there is no longitudinal analysis of the relationship between divorce and self-assessed health (see Amato & Spencer (2010) for a recent review). In Europe most longitudinal studies are based on mental distress outcomes in the British Household Panel Study. To fill in this gap in the literature and we use data from the European Community Household Panel (ECHP).

The third and perhaps most important contribution lies in studying both increases and decreases in self-assessed health, in addition to investigating mean differences in self-assessed health between divorced and non-divorced persons. This is important because a zero-difference in mean self-assessed health between divorced and non-divorced persons (implying a ‘null effect’ of divorce) may obscure distinct but different changes in health: for some divorced persons health deteriorates, while for others health improves. Studies with low statistical power are particularly vulnerable to finding null-effects while there is actually more going on. Recently there has been a growing interest in the heterogeneity of divorce effects, especially effects on mental health (Carr & Springer, 2010). Under certain conditions, divorce may have more or less negative or even positive effects. Marital quality has been studied from this perspective as a modifier of the divorce effect (Amato & Hohmann-Marriott, 2007; Kalmijn & Monden, 2006; Williams, 2003) and so has age of children (Williams & Dunne-Bryant, 2006). Many more modifying factors can be thought of (Amato, 2000) both at the individual, couple and context level. It

would seem worthwhile, therefore, to test for the existence of heterogeneity as well as an average negative effect of divorce on self-assessed health. For that purpose we estimate both ‘standard’ panel regression models of the overall (mean) effect of divorce, and multinomial models of the effect of divorce on the likelihood of an increase in health, a decrease in health, or stability.

In the analyses we also test whether divorce and selection effects are different for men and women. Gender is an important modifier of the financial, social and emotional consequences of divorce, and also modifies the relationship between divorce and some health outcomes (Amato, 2000). Men, for example, seem to suffer less from depression after divorce than women, while they appear to be more vulnerable with regard to physical health (Wu & Hart, 2002).

## **2. Explanations for the association**

We discuss explanations that have been given for an effect of divorce on self-assessed health and vice versa. We start with the social causation hypothesis because this idea has received most attention in the literature so far.

### *2.1. Social causation hypothesis*

Three general mechanisms have been proposed to account for a causal link from divorce to health: economic, social support and social control, and stress. First, divorce may be detrimental for health, especially of women, because a divorce generally leads to a deterioration of the financial situation of women (Aassve, et al., 2007; Andrefß, et al., 2006; Burkhauser, et al., 1991; Dewilde, 2002; Uunk, 2004). Having less income after than before divorce may affect health through stress, reduced (preventive) health care, cutting down on money spend on healthy food and exercise, and worsened housing conditions. This explanation is less likely to be important in Western-Europe compared to the US because of the low or absent financial barriers to access in health and more generous welfare regimes. Since it is especially women who loose financially after divorce, the economic explanation of the divorce effect postulates that women suffer in health from a divorce. For men, the health consequences should be less negative, if negative at all, since men’s income drop after

separation is substantially lower than women's, and in some European countries men even show income increases (Andreß, et al., 2006).

The second mechanism stresses the importance of social contact and social support. Men in particular suffer a decrease in social contacts and support after divorce and report an increase in feelings of loneliness (Booth, et al., 1991; Kalmijn & Broese van Groenou, 2005; Seltzer, 1991). Social contacts seem to be important for general health (Berkman & Syme, 1979). For men, one way in which social contacts matter is the positive effect social control can have on curbing health damaging behavior, such as excessive alcohol consumption. Some studies report an increase in social contacts for women after divorce, especially contacts with friends. For women, marriage is often regarded as a form of 'dyadic withdrawal' from the social world (Milardo & Allan, 2000); divorce intensifies and increases the number of social contacts, and therefore health may actually improve for women.

Finally, the divorce process itself could affect health. Divorce is a process that often puts a substantial amount of stress on both partners. Financial matters have to be settled, and if present, child custody has to be arranged. In addition, divorce may intensify pre-existing problems between the partners (Fischer, De Graaf, & Kalmijn, 2005). The stress that is caused by the divorce process could have negative affect on overall physical health, for instance through its effects on the immune system (Seegerstrom & Miller, 2004). Since we neither assume gender differences in the stress from divorce for men and women, nor gender differences in the handling of these problems, this explanation postulates a negative effect of divorce on health for both men and women.

### *2.2 Selection hypothesis [to be elaborated]*

An effect of divorce on health does not exclude the possibility that there is also an effect of health on the likelihood of divorce (Joung, Van de Mheen, Stronks, Van Poppel, & Mackenbach, 1998; see also: Wilson & Waddoups, 2002). Why poor health or a decline in health would increase divorce risks may be explained from several perspectives of which financial strain and stress are the most important ones.

Again, we start with an economic explanation: poor health decreases income and employability. Health problems may imply working fewer hours or

leaving the labor market, and thus having less income. Lower earnings capacity of ego might decrease the gain to marriage of the spouse and increase the likelihood of divorce. Becker's (1991) theory of task specialization would predict that the decreased gain to marriage depends on which of two partners has a reduced earning capacity. It can be expected that a reduction of husband's income increases divorce risks more than reduction in the wife's income because men are still most often the prime breadwinner in the EU. If their economic dominant position in marriage decreases, they become a less attractive match. Thus the economic perspective predicts that poor health of men in particular will increase divorce risks. It could even be argued that poor health among women will lower divorce risks if it means they become more economically dependent on their husband.

A second explanation of a positive effect of poor health on divorce is that poor health of one of the partners creates stress for both partners and puts strain on the relationship. Providing care can be stressful and reduce relationship quality, both of which can increase divorce risks. [to be elaborated]

A third explanation of a positive effect of poor health on divorce has to do with traditional gender roles within the household. Women still spend significantly more time on household work than men, despite substantial historical changes in women's economic position. If the husband falls ill, women are put under stress (especially when they have children), yet they might be more capable to cope with this than when a husband has to take care for his wife. Thus: poor health can be expected to raise divorce risks for women more than for men. Stated more bluntly; men are more likely to leave their ill partner than women.

We would argue that the above-mentioned explanations only imply an effect of poor health on divorce if the change in health is substantial. A minor or short-term change in self-assessed health will not restrict working hours and income, will not create much stress, or involve substantial spousal caring.

Similarly, we would want to argue that the explanations imply that it is not so much an immediate change in health that results in divorce, but accumulation of years in poor health. Being in poor health for a prolonged period will restrain working hours and income more, can put the relationship under more stress, and is more likely to involve substantial spousal care compared to immediate and short-term health changes.

Summing all expectations for men and women does not result in clearly different expectations for the sexes. For both men and women, there seem good reasons to expect effects of health on divorce and vice versa. Some of the presumed effects are obviously more likely to have long-term rather than short-term or immediate effects. It is, however, difficult to give precise predictions on the timing. Note that our data only allow examining effects across a couple of years. We therefore take a rather explorative empirical approach and do not theorize in detail about the time dimension of above-mentioned effects.

### **3. Data and methods**

#### *3.1. European Community Household Panel (ECHP)*

We analyze data from the European Community Household Panel (ECHP) 1994 to 2001. The ECHP is a large-scale, cross-national comparative, longitudinal data set containing panel data from 15 Member States of the European Union (for further details see (Clemenceau & Verma, 1996; Eurostat, 1996; Wirtz & Mejer, 2002). The surveys are household surveys in which detailed questions on income and employment and more limited questions on demographic and social characteristics were asked to adult

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In the first wave (1994) of the ECHP, a sample of some 60,500 nationally representative households—approximately 130,000 adults aged 16 years and over—were interviewed in the then 12 Member States. Austria (in 1995), Finland (in 1996) and Sweden (in 1997) have joined the project since then. In our analyses we include all available waves for 12 countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, Spain, and the United Kingdom. Sweden is excluded in the analyses because the data for this country are pooled cross-sections.<sup>ii</sup> Luxembourg and Greece report too few divorces to be included (checks for country effects are impossible with this size). It has to be noted that the ECHP data can be well compared cross-nationally because national panel surveys followed similar sampling, interview and follow-up rules. A study of Watson (2003) on attrition rates in the ECHP data did not show much country variation. For the current version of the paper, we use a sample that is restricted to the 18-59 age-group.

### *3.2 Self-assessed health*

General health is measured by the following single item question: “How would you characterize your health in general? Very good, good, fair (average, moderate), poor or very poor.” Self-assessed health has been shown to be a good indicator of general physical health. It predicts mortality and correlates highly with more objective health measures (Yeal Benyamini & Idler, 1999; DeSalvo, et al., 2006; Ferraro & Farmer, 1999; Idler & Benyamini, 1997; Idler & Kasl, 1995; McHorney, 2000; Mossey & Shapiro, 1982).

### *3.3 Divorce*

Divorce is defined as a transition from consensual and marital cohabitation at the time of interview to living single at the time of the subsequent interview, at later interviews respondents can be living with a (new) partner again.<sup>iii</sup> In the remainder of this paper, we will use divorce and separation interchangeably. We focus on the timing of actual separation and not on the timing of legal divorce because legal divorce can be a lengthy process during which people already experience a change in their well-being. Since the ECHP does not contain information on prior marriages, the separations refer to first and later separations. A small number of respondent experiences two or more divorces. We exclude respondents with multiple-divorces from the sample. In total, our analytical sample contains 3,894 divorces.

### *3.4 Control variables*

Control variables are age, sex (men are the reference group), education, income, presence of children, and employment status. We include these variables in some of our analyses because these characteristics are known to be associated with self-assessed health and divorce. Education is measured as the highest achieved level of education. The ECHP data make a distinction in three levels: (a) less than second stage of secondary education (International Standard Classification of Education [ISCED] levels 0-2), (b) second stage of secondary education (ISCED level 3), (c) tertiary education (university degree or comparable degree; ISCED levels 5-7). Those still at school without a certificate are assigned the lowest educational level.

Income refers to the yearly disposable household income, adjusted for the size and the needs of the household. Disposable household income is the sum of the incomes of all household members from labour, capital transfers, private transfers and social transfers, minus negative transfers like taxes and paid alimony. The equivalence scale we use for the adjustment for household composition is the modified OECD equivalence scale. The first adult in the household is weighed with factor 1, and other household members of 14 years and over with a factor 0.5. Children under 14 are weighted with a factor 0.3. Household income is further adjusted for inflation based on the Consumer Price Index of the OECD and is presented in Purchasing Power Parity (PPP) indexed on 1995 U.S. Dollars. Since income questions in the ECHP refer to income earned in the prior calendar year, we use income measured at the subsequent interview wave to measure income at the current interview wave. To deal with the skewed distribution of income, we use the logarithm of income.

Presence of children refers to one or more children under the age of 12 living in the household. Employment status is measured as being employed for pay or not. It is obtained from the question whether the respondent is at present working in a job or business normally involving at least 15 hours of work a week. We include a quadratic term for age to capture non-linear effects of age. Table 1 present some basic descriptives of the analytical sample.

#### **4. Analytic strategy**

To test the social causation hypothesis we use two types of models: random effects panel models and fixed effects panel models in which self-assessed health is regressed on divorce. Fixed effects models are the preferred models to test (short-term) effects of a transition because they take into account stable unobserved characteristics (Halaby, 2004; Johnson, 2005). Our primary interest lies in the gross or total effect of a divorce. Age and age squared are the only (time-varying) control variables. We present results for a pooled sample of men and women as well as sex-specific results and a test for the difference in coefficients between men and women.<sup>iv</sup>

In addition to the standard panel models, we use multinomial models to test whether there is more volatility in self-assessed health after a divorce compared to being continuously married. These multinomial models, which are basically fixed effects models with only two waves, allow us to examine whether a divorce is associated with an increase and or decrease in self-assessed health rather than with stability in health. As there are eight waves, several two-wave before-and-after comparisons are possible. We present two sets of changes scores. In the first set, we examine changes in self-assessed health from  $t=-1$  (year before divorce, respondent is living with a partner) to  $t=0$  (year of divorce, respondent is single) and  $t=-2$  to  $t=0$ . The second set compares self-assessed health scores in  $t=1$  and  $t=-1$  and  $t=-2$  respectively. This second set is presented to detect health changes beyond the turbulent year of divorce. Continuously married respondents are assigned  $t=0$  to the middle wave of their observation period if observed for an odd number of waves. When a continuously married respondent is observed  $k$  even number of waves, we randomly assign  $t=0$  to wave  $\frac{1}{2}k+1$  or wave  $\frac{1}{2}k-1$ .

Finally, we also use two methods to test whether poor self-assessed health increases the chance of a divorce: (1) random and fixed effects panel models, and (2) event history models. The panel models are similar to those for the effect of divorce on self-assessed health, the only difference being that now we use a logit model and swap the dependent and independent variables. The fixed effects panel model tests whether a change in self-assessed health increases the likelihood of divorce. The dependent variable *divorce* is 0 when a respondent is married or cohabiting and 1 when the respondent is divorced and not living with a partner; after remarriage it becomes 0 again. The fixed effects panel model estimates the so-called transition effect of health on divorce risks; does experiencing a change in self-assessed health immediately affect the divorce risk? We argue this might be plausible when a big health shock occurs, but we also want to examine whether being in poor health for a longer time increase the likelihood of a divorce. This can be investigated by using discrete time event history models as proposed by Allison (Allison, 1984). At risk of divorce are all respondents who are either married or cohabiting. Respondents are observed as long as they are at risk or up to the last available wave; after the divorce the respondent is no longer at risk and subsequent waves are not included in the person period file. Logistic regression

is applied on the person period file, while controlling for country differences in divorce rates by adding country dummies. Time is modeled by including dummy variable for the waves.

## 5. Results

### *5.1 Does divorce lead to worse self-assessed health?*

Table 2 presents the results of random and fixed effects panel regression models where we model the effect of divorce on health. The random effects models show that age has a reversed U-shaped association with self-assessed health, and that women report their self-assessed health to be significantly worse than men. The random effects models display that divorce has a significant negative effect on self-assessed health. After a divorce the health score is 0.028 points lower. On the 5-points scale (with a standard deviation of 0.84) this is a small effect—the effects of age and gender are substantially larger in size. The divorce effect appears equally strong for men and women (final column of Table 2; the gender difference in effect is non-significant;  $p > 0.05$ ).

The fixed effects panel models, however, do not show an effect of divorce whatsoever; the coefficient for divorce is insignificant for both men and women. Because the fixed effects panel models estimate the effect of changes in the independent variable on changes in the dependent variable, the insignificant divorce effect means that a transition from being married or from cohabitation to living single due to divorce is not associated with a change self-assessed health.

### *5.2 Does divorce lead to changes (vs stability) in self-assessed health?*

As discussed earlier, an overall null-effect, might hide interesting heterogeneity in the effect. Table 4 tests whether a divorce effect shows up when the direction of change is considered in a series of simple change models. The results from these two-wave fixed effects models show that divorcees are more likely to experience a change in self-assessed health than non-divorced persons. When comparing year  $t-1$  with year  $t=0$ , divorced persons show up to have a 63 percent higher odds to increase health and a 49 higher odds to decline health than the continuously married in the same time period.<sup>v</sup> The higher probability of change for divorced than for non-divorced persons holds

both for men and women. Yet, in the  $t-1$  versus  $t=0$  comparison women display a relatively higher chance to experience a decline in self-assessed health than men, as evidenced by the significant interaction parameter of gender and the odds of a decline. While divorced women have an 83 percent higher odds to decrease health than non-divorced women, and a 76 percent higher odds to increase health, for divorced men these numbers are respectively 10 percent and 46 percent.

The specific time window chosen – comparing two subsequent interview waves or waves with one or two intermediate waves – does not alter the general finding of greater volatility among divorced than non-divorced persons. The time window does, however, make some difference with respect to the gender dissimilarity in the odds of a decline in health. Only when comparing the year just before divorce ( $t-1$ ) to the year(s) after ( $t=0$  or  $t=1$ ), this gender dissimilarity appears significant, showing higher decline chances for women. When comparing two years before divorce ( $t-2$ ) to the year(s) after, this gender difference is not significant. This may indicate some form of selection prior to divorce, whereby women's health changes in a different fashion than men's health. For example, if prior to divorce women's health increases from wave  $t-2$  to wave  $t-1$  and men's health not, a comparison of the post-divorce situation with  $t-2$  will show less of a decline for women than a comparison with wave  $t-1$ .

To sum up, while there does not seem to be a general increase or decrease in health associated with divorce in the panel, our analyses suggest that for some persons divorce results in lower health while for others in better health. The continuously married show much more stable patterns of self-assessed health.

### *5.3 Does poor self-assessed health increase the chance of divorce?*

The association between poor self-assessed health and divorce could be driven by the increased likelihood of divorce among people in poor self-assessed health. We test this idea by performing panel regression and event history analysis.

First, we turn to the panel models (in Table 5) that estimate the (immediate) effect of a change in health on the likelihood of divorce – these models are similar to those in Table 3, but with the dependent and

independent variable reversed. The random effects models show a negative effect of self-assessed health on divorce. The better one's health is, the lower the likelihood to experience a divorce. Again, however, the fixed effects models give a different result: there is no support for an effect of a health change on the likelihood of divorce.

The above findings have two implications. First, changes in self-assessed health may be too small to affect divorce. There could be a threshold: only very severe changes (health shock) may have an effect. Our data lack the information and the statistical power to estimate such shock effects. Second, the higher likelihood of divorce among less healthy respondents may not so much reflect the effect of an immediate health change on divorce, but an effect of being in poor health for a prolonged period. Such an effect is not picked up by the fixed effects models, but may underlie the effect observed in the random effects models.

To estimate the effect of a prolonged period of poor health on divorce, we estimate event history models (Table 6). In the first model (Model A), we model the effect of self-assessed health controlling for age and sex. Similar to the random effects panel model of Table 5, we find a negative effect of health on the odds of divorce. Unfortunately we are not able to run a discrete time event history model with fixed effects. To control for some important differences between the respondents, in the second event history model of Table 6 (Model B), we include standard socio-demographic variables: education, income, employment, and the presence of children. Statistical control for these characteristics does not alter the effect of health greatly: the health effect is still significantly negative, although the effect has become less pronounced. An important drawback of this model is that we cannot control for unobserved time constant factors. Possible unobserved constant factors could be personality traits, in particular neuroticism. The fixed effects panel models we estimated in Table 5 – that control for such time constant unobserved factors by design – have shown such control to be important since the effect of health (change) on divorce appears no longer significant.

The third event history model of Table 6 (Model C) tests whether total years in poor health (self-assessed health less than good) has an effect on divorce, rather than health status in a given year. The model shows evidence for an effect of health duration: having lived more years in poor health (both

consecutive years as total years of poor health in the observation period) is positively related to the likelihood of divorce. These findings are about equal for men and women.

## **6. Discussion and conclusion**

### *6.1. Limitations*

Before drawing conclusions and discussing implications of this study, some limitations need to be addressed as well. We limit ourselves to what we see as the four most important issues: definition of divorce, long term effects, causality and generalizability.

Our definition of divorce excludes, for practical data reasons, respondents who did not live on their own for at least a short period after the divorce (during which they were interviewed). That is, to qualify as a divorcee a respondent has to have lived alone before cohabiting or remarrying again. Hence, we observe fewer divorces than there actually were, although we have no data to suggest how many cases are excluded. If rapid repartnering is related to smaller negative health effects of divorce, which we argue is more likely than not, our definition would make it more likely to find negative effects of divorce. Our group of divorcees is bias towards those who spend more time in the status of single divorced after the divorce. The design we use is strong in terms of number of divorces, which is important if the expected effect size is small. The non-significant effect of divorce on self-assessed health is unlikely to be the result of a lack of statistical power. This is even more unlikely if we take into account the bias for divorcees who did not repartner quickly.

The effect of divorce on self-assessed health may only show up in the long term, say five to ten or even more years after the divorce. Modeling such long effects is impossible with the ECHP data. We hope future research will address long term effects. With regard to the current paper, however, it is important to stress that the lack of short-term effects does not exclude the possibility that divorce has effects on self-assessed health later in the life of divorcees. It is possible that the negative social, financial and mental health effects of divorce lead to physical health problems over time. Then again, it should be noted that several of these social, financial and emotional effects also seem to be short term effects, which perhaps reduces the possibility of accumulating to a

detrimental physical effect, but there are still many questions about the duration of most effects (Amato, 2000, 2010; Carr & Springer, 2010).

Panel data allow us to take into account unobserved heterogeneity (as far as it is stable over time) but it does not solve the problem of causality entirely (Halaby, 2004). Divorce is obviously not random in any way, so we should be careful about drawing firm conclusion about causal effects. With regard to divorce an instrumental variable approach would perhaps seem the most logical step to address causality further as other options, such as experiments or even natural experiments seem unlikely candidates. Unfortunately, we could not find identify a strong instrument in the ECHP data.

Finally, one should be careful in generalizing these findings. Obviously the age restriction (18-59) should be taken into account although. And although self-assessed health is an indicator of general health, this does not mean we can simple translate the findings of this study to other health outcomes.

Replications of our analyses with other longitudinal data and other health outcomes are much needed. To increase statistical power we have pooled data from different European countries. Replications for separate countries and for countries in Central and Eastern Europe, which are not included in the ECHP, are also needed.

### *6.2. Main findings*

Our analysis of the association between divorce and self-assessed health in European panel data of 18-59 year old men and women has shown two important new findings. First, the results suggest that the negative association between divorce and self-assessed health is not due to an overall negative effect of divorce on self-assessed health. Rather, we find that after divorce self-assessed health improves among some divorcees, while for others it declines. In comparison to the continuously married divorcees experience more change in self-assessed health, for better *and* for worse.

Second, we also find evidence for a negative effect of self-assessed health on divorce risks. This selection effect seems to be caused by prolonged poor health rather than by an immediate effect of a decline in self-assessed health. Selection effects of poor self-assessed health on divorce have rarely been investigated (but see: Joung, et al., 1998), yet they may form an important part of the puzzle of why divorcees show worse health.

### *6.3. Implications*

The results of this study raise some questions and suggestions for further research. A first question is what mechanisms are responsible for the reported greater volatility in self-assessed health of divorced persons and for the effect of prolonged poor health on divorce? We mentioned a number of explanations in the theory section, but due to data limitations we were not able to test these explanations. The higher probability of change among divorcees may both be an outcome of changes in economic and social resources that accompany divorce, the loss of social control by a partner, and the stress the process of divorce entails. That divorced women have higher chances of a decrease in self-assessed health than divorced men, suggests that the economic explanation fares best since it is women who suffer financially more from divorce than men. The positive effect of prolonged poor health on divorce may be an outcome of economic stress, marital stress, or difficulties in caring for the ill partner. The economic explanation seems to fare worse here, since poor health may make women economic more dependent on their husbands, and lowers their divorce risks. However, because we could not test these explanations in detail, this remains speculation and we await more thorough tests of detailed mechanisms.

A second question that can be raised involves the long term effects of divorce on health. The European panel data we used are relatively short-running and do not enable us to test effects beyond three years of divorce duration. The earlier mentioned mortality statistics strongly suggest that there are effects in the long run. The question is when these effects kick in. Longer running panel data are needed to solve this question. A related question would be whether physical health is influenced (more strongly or only) by being divorced and repartnered or by being single after divorce for a prolonged period. The ECHP has information on repartnering, although only for a very short period after divorce. The BHPS and GSOEP would allow for a more in-depth analysis of the effects of being in continuously divorce status and selection into remarriage.

Finally, our findings may not only be relevant for scientist involved in research on divorce and health, but also more generally. Our results have demonstrated that modeling only mean effects, even in panel models, has its

shortcomings. It may hide substantial heterogeneity in outcomes; this may not be the case for divorcees only.

## Notes

<sup>i</sup> Moreover, the conclusion for men is based on a three-way interaction effect (divorce\*sex\*age). There are only about 30-50 cases of divorce among the men in these data. The exact number of divorces and the distribution of divorce by age and sex is not reported in the article but the number divorces can be derived from table 1 (p.86).

<sup>ii</sup> Because in the fourth wave of the ECHP (1997) the original ECHP surveys were ended in Germany and the United Kingdom, we use longitudinal panel data from the underlying country panel surveys (respectively the German Socio-Economic Panel and the British Household Panel Survey), back from 1994 onwards.

<sup>iii</sup> This means we do not observe divorces where the divorce respondent is living with a new partner very soon after the divorce.

<sup>iv</sup> We do not control for income, children, or other time-varying characteristics as these would be relevant only if we were interested in determining how a divorce leads to worse health: is it the loss of income, or the loss of contact with children (for fathers), etcetera? We argue that before one sets out to determine the importance of such mechanisms, the total association should be assessed properly first.

<sup>v</sup> The difference in the odds to increase health and to decrease health is not significant ( $p > 0.05$ ), which indicates that divorced persons are as likely to show increases or decreases in self-assessed health.

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**Table 1**  
**Basic descriptives of the analytic sample (ECPH)**

	Men		Women	
	mean	s.d.	mean	s.d.
age (at t=-1)	41.28	9.91	39.74	10.35
health at t=-1	3.888	0.855	3.809	0.855
health at t=0	3.875	0.842	3.796	0.858
avg # waves	6.02	2.07	6.13	2.05
# divorces	1,813	6.1%	2,081	6.5%
# respondents	29,668		32,238	

**Table 2****Random and fixed effects panel regression of self-assessed health on divorce**

	Pooled			Men			Women			$\Delta$ sex <sup>a</sup>
	coeff.	s.e.	p	coeff.	s.e.	p	coeff.	s.e.	p	
<i>Random effects</i>										
age	0.0025	0.0014	0.0790	-0.0008	0.0022	0.7000	0.0049	0.0019	0.0100	
age2	-0.0003	0.0000	0.0000	-0.0003	0.0000	0.0000	-0.0003	0.0000	0.0000	
female	-0.1045	0.0050	0.0000							
divorce	-0.0276	0.0076	0.0000	-0.0200	0.0112	0.0730	-0.0342	0.0104	0.0010	p=0.349
<i>Fixed effects</i>										
age	-0.0168	0.0022	0.0000	-0.0184	0.0033	0.0000	-0.0162	0.0029	0.0000	
age2	-0.0001	0.0000	0.0000	-0.0001	0.0000	0.0070	-0.0001	0.0000	0.0040	
divorce	0.0095	0.0086	0.2700	0.0134	0.0127	0.2900	0.0061	0.0117	0.6020	p=0.673

*Notes.*

*a* = *P*-value of the interaction effect of decline and increase by sex

**Table 3****Multinomial change score models regressing self-assessed health on divorce**

<i>Time frame</i>	Pooled			Men			Women			$\Delta$ sex <sup>a</sup>
	OR	95% c.i.		OR	95% c.i.		OR	95% c.i.		
<i>t0 -- t-1</i>										
decline	1.49	1.23	1.80	1.10	0.80	1.50	1.83	1.45	2.33	p=0.009
stable	1.00			1.00			1.00			
increase	1.63	1.33	1.99	1.46	1.07	2.01	1.76	1.35	2.29	p=0.383
$\Delta$ dec - inc <sup>b</sup>	ns			ns			ns			
<i>t0 -- t-2</i>										
decline	1.47	1.20	1.80	1.48	1.08	2.01	1.46	1.11	1.92	p=0.975
stable	1.00			1.00			1.00			
increase	1.41	1.10	1.82	1.55	1.07	2.25	1.31	0.93	1.84	p=0.527
$\Delta$ dec - inc	ns			ns			ns			
<i>t1 -- t-1</i>										
decline	1.26	1.01	1.56	1.03	0.72	1.47	1.45	1.10	1.91	p=0.025
stable	1.00			1.00			1.00			
increase	2.15	1.73	2.67	1.90	1.34	2.71	2.33	1.77	3.07	p=0.446
$\Delta$ dec - inc	sig			sig			sig			
<i>t1 -- t-2</i>										
decline	1.39	1.09	1.78	1.27	0.86	1.87	1.48	1.08	2.04	p=0.337
stable	1.00			1.00			1.00			
increase	1.79	1.35	2.37	1.91	1.24	2.95	1.70	1.17	2.47	p=0.869
$\Delta$ dec - inc	ns			ns			ns			

*Notes.*

*a* = *P*-value of the interaction effect of decline and increase by sex

*b* = Chi-square test for the difference in coefficient size between decline and increase

**Table 4****Panel regression models of self-assessed health on divorce, ECPH wave 1-8**

	Pooled			Men			Women			$\Delta$ sex <sup>a</sup>
	coeff.	s.e.	p	coeff.	s.e.	p	coeff.	s.e.	p	
<i>Random effects</i>										
age	0.446	0.027	0.000	0.247	0.034	0.000	0.652	0.042	0.010	
age <sup>2</sup>	-0.005	0.000	0.000	-0.003	0.000	0.000	-0.008	0.000	0.000	
female	0.125	0.060	0.037							
self-assessed health	-0.082	0.022	0.000	-0.068	0.033	0.038	-0.095	0.030	0.001	p=0.485
	Pooled			Men			Women			$\Delta$ sex <sup>a</sup>
<i>Fixed effects</i>	coeff.	s.e.	p	coeff.	s.e.	p	coeff.	s.e.	p	
age	0.502	0.046	0.000	0.626	0.068	0.000	0.366	0.063	0.000	
age <sup>2</sup>	0.002	0.006	0.000	0.000	0.001	0.827	0.005	0.001	0.000	
self-assessed health	-0.016	0.030	0.604	-0.038	0.046	0.410	0.003	0.040	0.947	p=0.504

*Notes.*

*a* = *P*-value of the interaction effect of decline and increase by sex

