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Health and wellbeing spillovers of a partner's cancer diagnosis

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ABSTRACT

Major health shocks can have far-reaching implications for the welfare of an individual's support and emotional network. This paper investigates both long-term and short-term spillover effects of a major non-communicable health shock, namely a cancer diagnosis (CD), on the health and well-being of an individual's partner. We rely on data from a longitudinal sample of individuals over fifty from 19 European countries. Our estimates provide economically relevant evidence of the spillovers of a CD on the partner's mental health and well-being. We document a robust and time persisting negative relationship between a partner's CD and several measures of well-being, which is not driven by changes in health behaviors. These findings suggest that focusing solely on the individual economic impact of a CD will likely underestimate its long-term welfare effects unless the external effects on the emotional support network are considered.

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1. Introduction

Canonical health production models in economics (Grossman, 1972) are generally agnostic about the spillover effects of decisions across individuals or assume them to be negligible. However, it is increasingly noticeable that some salient health shocks can have a significant impact on the welfare of individuals emotionally connected to those experiencing the health shock. Some evidence suggests that health shocks can exert negative spillovers effects on the healthcare behaviors of family members, which some studies refer to as 'family spillovers' (Fadlon and Nielsen, 2019).

Nonetheless, so far, we know little about the spillover effects of salient health shocks on the health and well-being of partners. It is critical to distinguish between information effects and actual experience effects when attempting to comprehend such spillover effects.[1] The fact that family members 'care about' the person who experienced the health shock has direct information effects on health and well-being, whereas experience effects stem from the burden of 'caring for' the sick person, as family members may take on informal care or other duties (Bobinac et al., 2010).[2]

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[1] Previous research finds that learning of a neighbor's lung cancer diagnosis influences smoking decisions (Lin and Sloan, 2015). However, other studies suggest that when a family member is diagnosed with lung cancer there is limited impact on behavior (Darden and Gilleskie, 2016).

[2] Increasingly, the evidence suggests that caregiving exerts independent and detrimental mental health effects (Costa-Font et al, 2022).

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We study the relationship between a major health shock - a cancer diagnosis (CD) - and a partner's health and well-being. Cancer refers to a group of non-communicable diseases that involves the uncontrolled growth and spread of abnormal cells, which can lead to death. Although survival rates have increased over time,[3] cancer remains the *second leading cause of death* after heart disease.[4] Cancer diagnoses have become more and more common as the population ages (Barben et al., 2021). One in every two men in the United States is diagnosed with cancer at some point in their lives. Cancer-related costs account for approximately 10% of total disease treatment costs in the United States.[5] However, these estimates are a lower bound because they do not account for the significant costs that cancer imposes on families.

The importance of studying cancer as opposed to other health shocks stems from the stylized fact that no other disease has sustained as strong a *negative stigma* and *fear* as cancer has (Holland, 2002). As a result, a cancer diagnosis entails an emotional shock not only on patient's well-being (Northouse, 2005; Glajchen, 2004), but especially on their emotional support network, and partners more specifically. This is because the anxiety and uncertainty that come along with a CD can be a significant disruption to partners' routines, as partners frequently become the primary caregivers of individuals (giving rise to experience or 'caring for' effects).[6] However, partners also share common beliefs so the reactions of family members may mirror those of patients due to information or 'caring about' effects (Lederberg, 1998).

Certainly, the associated spillover effects of a CD may vary depending on its severity. The severity of a CD can influence its disruptive effects and especially, the probability of survival. Similarly, such effects might differ in the short and long run, as some individuals might adjust to their new life after receiving a CD in the longer term, making it an economically relevant empirical question whether they do. Some evidence suggests peaks of negative distress (Nail, 2001) and extreme emotional reactions (Shell and Kirsch, 2001) following a cancer diagnosis. In a seminal study, Weisman and Worden (1976-1977) examined 120 patients in the first 100 days after receiving a cancer diagnosis and found periods of anxiety and depression. Similarly, Lampic et al. (2003) found that patients with a new diagnosis of breast cancer were ameliorated with closer and more positive relationships with people in their lives.

We draw data from the Survey of Health, Ageing and Retirement in Europe (SHARE) in Europe, a cross-national survey that collects detailed information on health, socioeconomic status, and family interactions of a representative sample of individuals aged 50 and over. We exploit longitudinal information on cancer diagnoses and deaths from end-of-life interviews. As cancer is potentially endogenous, we restrict our sample to married or cohabiting individuals whose partner has no cancer at baseline and we control for baseline health and health behaviors. Our empirical strategy is essentially based on the comparison of changes in health and well-being outcomes between respondents whose partners experience a CD and those who do not. Furthermore, we distinguish between changes in the short-term (about 2 years) and in the long-term (about 9 years). We study the association between a partner's CD and some well-established health outcomes (self-reported health and pain) and well-being measures (depression, loneliness, life satisfaction, use of anxiety drugs, and sleep problems), as well as a number of health-related behaviors (including drinking, physical activity, overweight and obesity) that may be contributing to the relationship.[7]

We document several important findings. First, we provide longitudinal and cross-country evidence of *family spillovers* of a CD on several health outcomes and measures of partners' well-being, indicating that unexpected health shocks exert spillover effects in the family that need to be accounted for. Second, we find evidence that, although the *associations between a CD and a partner's health and well-being* are stronger in the short run, some of these persist in the long run. In the short term, a partner's CD is associated with an increase in the probability of experiencing depression by 16 percentage points and a decrease in life satisfaction by about half a point among caregivers who face experience effects. Even more importantly, in the long term, we continue to find a 0.2-point decrease in the *life satisfaction* Likert scale among women and we document a 3.4 percentage points increase in the *experience of pain* among older partners. These results are driven by potential 'caring for' effects as well as the emotional spillovers in terms of grief and partner longing after a CD, especially when it results in the death of a partner. Third, and more importantly, we find that the relationship is not driven by changes in health behaviors, namely we do not find any evidence of parttners' behavioral disruptions after a CD.

Our study adds to the growing body of research on family health behaviours (Faldon and Nielsen, 2019; Jacobson, 2000) by documenting robust evidence of the long-term negative association between an individual's CD and the health and well-being of the partner, which is not explained by changing health behaviors. This literature suggests that purely individualistic models of health decision-making should be expanded to account for partners' joint formation of health and other behaviours. Our findings imply that these models should consider both experience and information effects, which we describe as 'caring for' versus 'caring about' effects after a CD. Second, we contribute to the literature on health shocks (Smith et al., 2001) by investigating the implications of an increasingly common CD and identifying both its fatal (when the partner does not survive a CD) and non-fatal consequences (when it does survive a CD). This is especially important in examining the role

[3] Cancer screenings and improvement in cancer treatments have reduced the number of fatalities from the illness, and about 60% survive (Sharipova and Baert, 2019; Pinto et al., 2000).

[4] The disease burden of cancer has risen from 0.85% to 1.32% between 1990 and 2017 (Abate et al., 2018).

[5] One in three women in the US will be diagnosed with cancer at some time during her lifetime (National Cancer Institute, 2017).

[6] However, most individuals are able to develop a constructive plan of action, although some respond with denial as a protective mechanism from this tremendous threat.

[7] Indeed, a CD can be an important critical time in a person's life that might entail a reconsideration of health behaviors, with knock-on effects on wellbeing.

of the severity (fatality) of a partner's health shock on an individual's well-being. Third, the paper contributes to a growing literature on spillover effects of health events, which are especially relevant in understanding the welfare consequences of a CD beyond the patients' health. Finally, it is worth pointing out that this is the first longitudinal study documenting the partner's spillovers of a CD.

The next section discusses the main features of the related literature. Section three describes the data. Section four describes the empirical strategy; Section five reports the results; Section six presents the sensitivity analysis, and a final section concludes.

2. The effects of cancer and other health shocks

Cancer effects on well-being. Estimating the well-being effects of a CD is far from trivial as cancer is a multi-step disease influenced by genetic predisposition, environmental influences, infectious agents, nutritional factors, hormonal, and reproductive factors among others. Cancer is estimated to account for 24% of avoidable mortality, ranging from less than 20% in Nordic countries to more than 30% in Mediterranean countries (Huisman et al., 2005). Still, some cancers have a poor prognosis (particularly cancers of the liver, stomach, and esophagus), which explains the disparity in fatality rates. In this study, we can identify people who die after receiving a CD, allowing us to distinguish between CDs that cause death and those that do not.

Evidence suggests significant socioeconomic heterogeneity in both cancer prevalence and survival which appears to be the result of socially disadvantaged people leading poorer lifestyles and navigating the health care system inefficiently, which explains a higher risk of lung, stomach, upper aero-digestive tract (UADT), and cervical cancer (Merletti et al., 2011; Kogevinas et al., 1997). Walsh and Laudicella (2017) document that disparities in the use of end-of-life care among those who do not survive are largely driven by the greater use of emergency inpatient care among lower socioeconomic status patients. Such evidence is economically relevant insofar as a CD results in significant job and productivity losses (Hanly et al., 2015; Pearce et al., 2018).[8] However, the consequences for other family members are frequently overlooked. Especially, Zeltzer et al. (2020) find that end-of-life spending is significantly higher for younger patients than for older patients. Hence, it is critical to better understand how a CD affects the well-being of partners and family members, particularly among older age groups where a CD is more common. Our dataset allows us to assess the impact on partners in multiple European countries.

Informational and other spillovers of health shocks. Major individual health shocks have far-reaching consequences that extend beyond their health-related effects. For instance, smokers do change their smoking habits after suffering a health setback. Little is known, however, about the link between spousal health shocks and smoking. Aguero and Beleche (2017) investigate behavioral changes following a health shock, focusing on the impact of the H1N1 pandemic in Mexico on child diarrhea. They show that geographical areas with a higher incidence of H1N1 experienced larger reductions in diarrhea-related cases among young children, acting as a natural nudge, by exploiting the spatial and temporal variation of the 2009 H1N1 influenza pandemic in Mexico. According to Philipson and Posner (1994) changes towards safer sex practises soon after the onset of the HIV pandemic resulted in a decrease in sexually transmitted diseases. An important question to add to this literature is whether the effect of a shock in a non-communicable disease such as cancer exerts similar effects on family members' health outcomes and behaviors.

Family health behaviors. A cancer diagnosis can bring couples either closer together, or further apart as additional stress is added to the relationship (Glajchen, 2004). Survivorship, on the other hand, may give rise to a new challenge, namely, that of living with a chronically ill partner among those partners who survive and have advanced cancer, or the ongoing effects of disabilities caused by cancer and its treatment. Indeed, living with a spouse who is experiencing a health shock increases the likelihood of being emotionally influenced by its consequences.[9] Although a CD is a non-communicable health shock for partners, it can influence them *via* information effects, leading them to update their subjective beliefs and potentially change their behaviors,[10] as well as *experiences effects*, as it gives rise to changes in work and gender roles,[11] and in particular, the adoption of a caregiving role ('caring for' effect). Fadlon and Nielsen (2019), the closest paper to ours, document that spouses and adult children adjust their health investments (*via* increased consumption of statins) in response to a family member's cardiovascular health shock.[12]

There is also a substantial body on the impact of one partner's health and health behaviour on the health and health behaviour of the other. Leonard and Mudar (2003) show that drinking behavior prior to marriage the subsequent drinking behaviour of partners. The empirical evidence for smoking behavior is mixed. For example, Clark and Etilé (2006) document

[8] That said, Jeon and Pohl (2019) show that cancer treatment innovations in the 1990s and 2000s already reduced the negative employment effects of cancer by up to 70%.

[9] Individuals can be secondhand smokers, and smoking is largely the result of people's choices, so evidence from behavior such as smoking is potentially endogenous.

[10] Jackson et al. (2015) found that having a healthy partner affects smoking and physical activity, but only among newly healthy partners. However, a higher risk of cancer only influences individuals' some healthy behaviors such as physical activity and sun-smart behavior rather than dietary habits (Humpel et al., 2007), which are driven by habits and household routines.

[11] Consistently, Margolis (2013) documents that when their partners experience a health shock, there are important gender differences, women are more likely to quit smoking, whilst men are more likely to start smoking.

[12] Indeed, Fadlon and Nielsen (2019) show that the effect extends to distant coworkers.

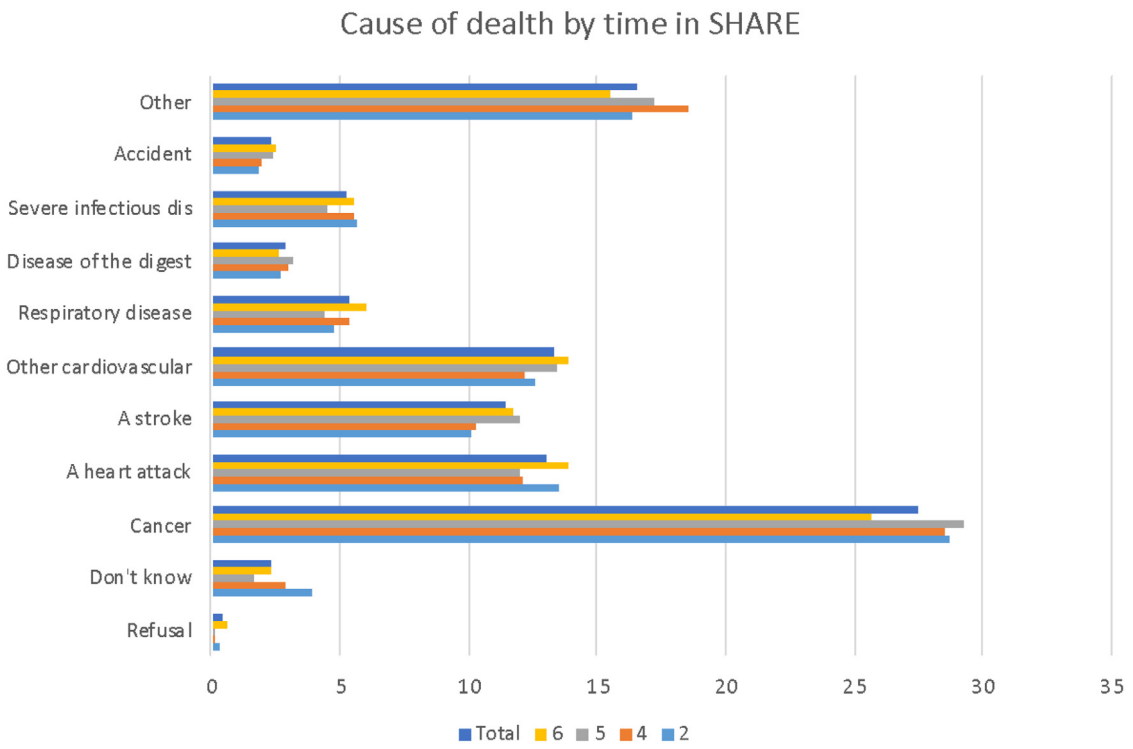

Fig. 1. Cancer cause of death in Europe.
Source: SHARE end of life questionnaire.

evidence of a correlation in partners' smoking but argue that this is entirely explained by positive assortative matching. However, while Palali and Van Ours (2017) find no evidence that quitting smoking of one spouse affects the other one quitting, Fletcher and Marksteiner (2017) show causal evidence of large spillover effects on smoking behavior between spouses.

As for health, the literature suggests a positive correlation between spouses for cardiovascular risk factors (Di Castelnuovo et al., 2009). Davillas and Pudney(2017) investigate the concordance of health biomarkers within couples and find evidence that lifestyle factors explain roughly half of such effects. Wilson (2002) documents evidence of spousal correlation in later-life health, which remains after controlling for some relevant covariates.

This paper, like previous studies, investigates the impact of unexpected health shocks in families as a result of a cancer diagnosis. We specifically investigate the following question: Do family spillovers influence the health and well-being outcomes and behaviours of partners? The remainder of this paper will attempt to answer this question.

3. Data

We use a longitudinal dataset of older people because CDs are more common in later life and can potentially have long-term effects. In other words, we use data from the Survey of Health, Ageing, and Retirement in Europe (SHARE), a cross-national survey that collects detailed information on the health, socioeconomic status, and family interactions of a representative sample of people aged 50 and up. In addition to the respondents, their current partners who live in the same household, regardless of age, are interviewed. We focus on waves 2 to 6,[13] which cover the period from 2006 to 2015, and on countries for which there are at least two waves of data: Austria, Germany, Sweden, Netherlands, France, Denmark, Spain, Italy, Greece, Switzerland, Belgium, Israel, Czech Republic, Poland, Luxembourg, Slovenia and Estonia. As cancer is potentially endogenous, we restrict our sample to married or cohabiting individuals whose partner has no cancer at baseline. SHARE includes an end-of-life questionnaire where a proxy respondent is asked about the cause of death of the individual. As a result, cancer deaths account for nearly 30% of total deaths in almost every wave, as shown in Fig. 1.

The data's richness enables us to investigate a wide range of health and well-being outcomes, as well as health behaviours, both of which are critical to our empirical strategy, as we will discuss below. More specifically, we will take advantage of the dataset's large cross-country, individual, and time variation. This enables researchers to examine both the long-term and short-term relationship between a CD and their partner's health and well-being, while accounting for cultural

[13] The third wave is excluded from the sample because it collects retrospective information on the life histories of respondents rather than on their current circumstances.

and institutional differences as well as individual-specific confounders. Cancer and other health conditions are self-reported in SHARE. Respondents are presented with a list of conditions and must select those that apply to them. In the case of cancer, they are also asked in which organ or part of the body they have cancer.

Mental health and well-being. One of the most serious potential consequences of a CD is a disruption in a person's mental health. As a result, the focus of this study is on individual depressive symptomps as measured by the EURO-D depression scale (Prince et al., 1999a, 1999b). We create a variable from this scale that equals 1 if the respondent scored more than 4 points on the scale and 0 otherwise. This cut-point has been validated against a variety of clinically relevant indicators across Europe (Prince et al., 1999a, 1999b). Loneliness is a dummy that equals 1 if the respondent reports feeling lonely frequently or occasionally, and 0 if they report feeling lonely rarely or never. Life satisfaction is a self-assessed scale ranging from 0 to 10. Life satisfaction is a self-assessed measure on a scale of 0 to 10. We also use as outcomes a dummy for whether the person takes anxiety drugs and a dummy for whether the person experiences problems with sleep.

General health and pain. Another important outcome that we focus on is a measure of self-reported general health, which is assessed by asking respondents how they would rate their current health status on a scale of 1 (poor) to 5 (excellent) (excellent). Pain is a dummy for whether or not the person is bothered by pain.

Health behaviors. We focus on several health behaviors, and alcohol is measured as a dummy equal to 1 if the person consumed at least one alcoholic beverage in the seven days preceding the interview. Physical activity is a dummy that takes the value 1 if the respondent engages in moderate-energy activities more than once per week. Finally, obesity is defined as having a BMI greater than 30, while overweight is defined as having a BMI greater than 25. According to Fig. 2 a CD is significantly associated with depression and loneliness, but not with pain, especially when the partner does not survive cancer. These trends, however, do not taken into account sample differences, which are addressed in our empirical strategy below.

4. Empirical strategy

Even though cancer is a non-communicable disease, a CD may be endogenous to a partner's health outcomes and behaviours. As a result, we limit our sample to married or cohabiting individuals whose partners did not have cancer at the start. Using a strategy similar to Brown et al. (2010) we construct two samples that distinguish between the short-run and long-run statistical links of a CD. The time horizon in the short-run sample ranges from one SHARE wave to the next, with the baseline being the wave in which the respondent participated in SHARE for the first time. The wave that follows is always referred to as the follow-up. . In contrast, the long-run sample has a baseline of wave 2 (2006) and a follow-up of wave 6 (2015), and we investigate the impact of being diagnosed with cancer at any point during these 9 years. While the long-difference approach may include long-term health and well-being associations, the short-difference approach focuses on immediate relationships. Accordingly, our main empirical specification for each of our follow-up health and well-being outcome Y_{i1} is:

$$Y_{i1} = \alpha + \beta_1 cancer\_partner_i + \beta_2 death\_cancer\_partner_i + \beta_3 death\_other\_partner_i + \gamma Y_{i0} + x'_{i0}\zeta + HS'_{i0}\eta + HB'_{i0}\theta + \varepsilon_i$$

where, $cancer\_partner_i$ refers to a dummy variable depicting whether the partner has received a cancer diagnosis between baseline and follow-up period and is still alive. Next, $death\_cancer\_partner_i$ refers to a dummy determining whether the partner was diagnosed with cancer and died as a result of it, and $death\_other\_partner_i$ indicates whether the partner died from other causes (stroke, cardiovascular condition, etc). Controlling for the death of a cause other than cancer is important to make sure that we are not just capturing the loss of a partner.

For the short sample, an alternative strategy would be to estimate a model with individual fixed effects. However, given that cancer is very rare and that in our sample it is an absorbing state, our analysis would have low statistical power. As discussed by Angrist and Pischke (2009, p. 246), fixed effects and lagged dependent variable models are not nested but can still be thought of as bounding the true effect: if fixed effects is correct and one incorrectly estimates a model with a lagged dependent variable, then the estimates would be a lower bound to the true causal effect. Controlling for the outcome at baseline Y_{i0} makes our empirical strategy similar in spirit to a first differences model, in which we essentially compare changes in outcomes between individuals whose partners experience a cancer diagnosis and those who do not. By allowing the coefficient γ for the outcome at baseline Y_{i0} to be different from 1, our specification is more flexible than a first-difference model. Guarino et al. (2015) demonstrate in the context of value-added models of teacher performance that including the baseline level of the outcome is very effective at controlling for several sources of unobserved heterogeneity. It is also worth noting that the set of baseline covariates is unusually extensive. Indeed x_{i0} is a vector of baseline characteristics including gender, age, household size, income, education, financial wealth and country dummies, while HS_{i0} and HB_{i0} are health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. Together with the baseline outcome, we believe that these are sufficient to control for potential unobserved family characteristics that might affect both whether one spouse is diagnosed with cancer and the health and well-being of the respondent. As mentioned also by Wooldridge (2010, p. 910), the ignorability assumption is more likely to hold when the set of controls is richer and good candidates to include are pre-treatement variables, including past outcomes.

We also assess the sensitivity of our estimates to selection on unobservables using the proportional selection test devised by Oster (2019), following the logic of Altonji et al. (2005). This test aims at assessing how strong the impact of

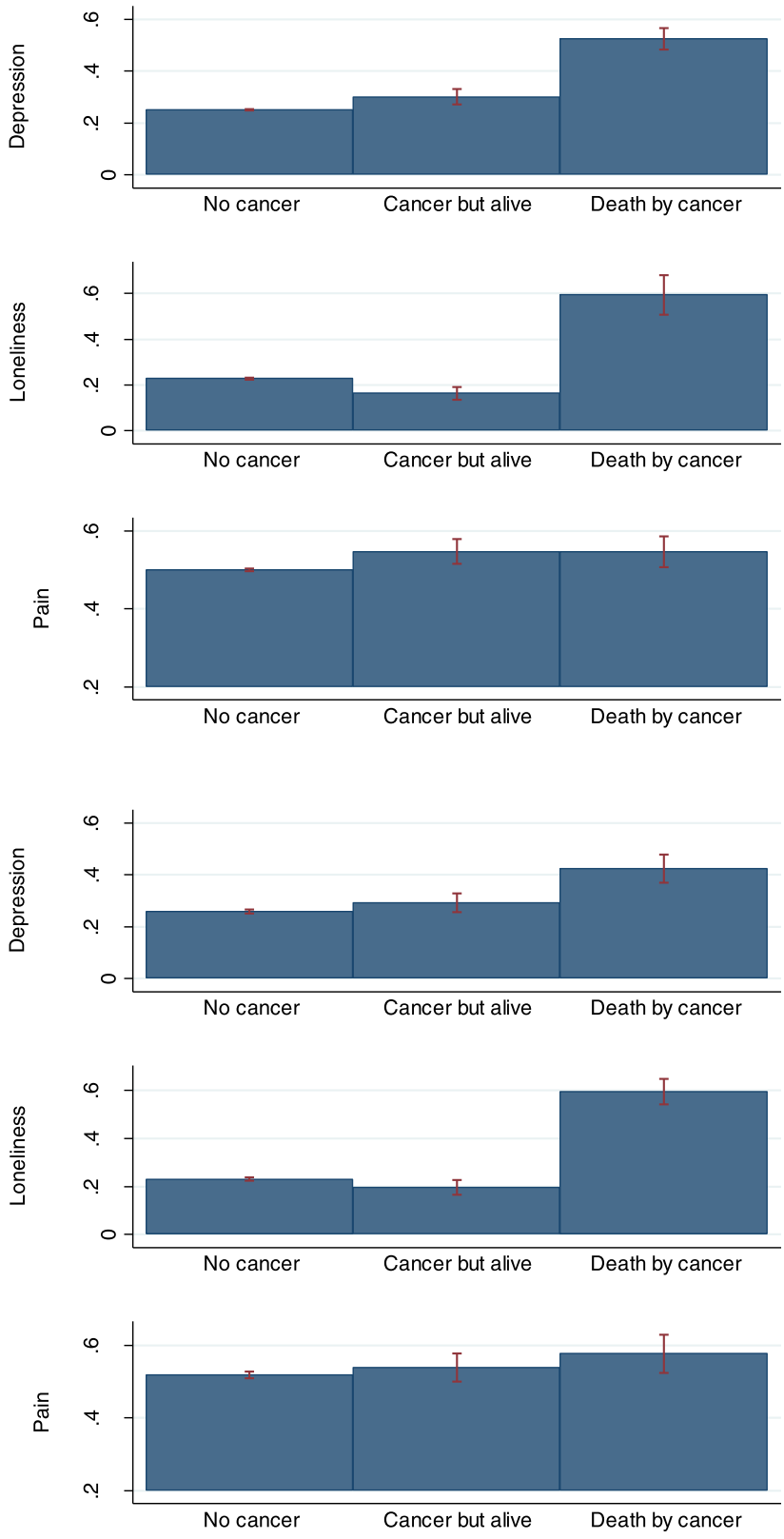

Fig. 2. Mental health and well-being by partner's cancer status.
Source; SHARE several years.

Table 1
Prevalence of a partner's cancer and death in the short and long sample.

	Short Sample %	Long Sample %
Partner Cancer (Alive)	2.35	4.98
Death of Partner (Cancer)	0.43	2.68
Death of Partner (Other)	1.57	9.62
Number of Observations	28,247	11,896

unobserved variables would have to be with respect to the impact of observed variables in order to drive down to zero our estimated coefficients. We let δ indicate this ratio of proportional selection. For example, δ=1 would imply that the impact of unobservables should be as large as the impact of the included controls to nullify our estimated coefficients. δ=1 is also the threshold suggested by Altonji et al. (2005) to rule out that the bias due to omitted unobservables is strong enough to entirely explain away our estimated association.

However, we should still be careful in giving a causal interpretation of our results as there might still be unobserved factors that we cannot fully control for. Therefore, we refrain from using causal language.

5. Results

5.1. Results layout

We first present estimates of the relationship between a cancer diagnosis and partners' health and well-being in the short and long term. We concentrate on measures of mental health and well-being (depression, loneliness, life satisfaction, use of anxiety medications, and sleeping problems), as well as general self-reported health and pain. Pain is an intriguing outcome because it is influenced not only by physical factors but also by psychological and social factors that are not always under the control of the individual. Next, we report the estimated heterogeneity by gender, distinguishing between younger (less than 70 years old) and older (70+) individuals. Age cut-off points at 70 are important because after 70 a CD becomes more common, and hence the association with well-being might be more likely to be expected.

The severity of a CD is identified by evaluating whether the partner was diagnosed with cancer but is still alive or died as a result of cancer. However, the estimates for a partner's cancer death should be interpreted with caution because they are quite imprecise due to the small number of cancer deaths in our sample, particularly in the younger sample. Table 1 compares the prevalence of cancer and death (from cancer and other causes) in the two samples. We also look at a variety of health behaviors as potential mechanisms, such as alcohol consumption, physical activity, overweight, and obesity.

5.2. Short sample

In Table 2 we report the results of the short-run association between a partner's cancer diagnosis and mental health and well-being. We find a very strong statistical link between a partner's CD and depression: the likelihood of depression increases by 6.4 percentage points after a partner's CD and this association is not statistically significantly different for men and women and is mostly driven by the younger respondents for which a CD is unexpected. Not surprisingly, death from cancer or other causes increases depression, and the association is statistically significantly stronger for death from cancer, implying that a CD has a distinct impact on mental health in addition to partner loss. This result could be explained by the potential prevention of such a condition by engaging in early health behaviors.

Although we find that a partner's cancer diagnosis is not associated with loneliness, *death increases loneliness*. The estimates are not statistically significantly different by gender, and they are mostly driven by younger respondents. Consistently with the hypothesis of detrimental mental health consequences of a CD, we find that having a partner who is diagnosed with cancer is *significantly negatively associated with life satisfaction and increases the use of anxiety drugs*. This is especially the case for women and younger respondents,[14] as a CD is an unexpected event for the latter. This finding also points to a reduction in sleep issues following a CD. This finding is somewhat surprising, but it could be related to an increase in the use of anxiety medications, which also help people.

One potential issue is whether these relationships are motivated by people caring for or concerned about their sick partner (Boninac et al., 2010). As a result, Table 3 shows the heterogeneity by caregiving role. In SHARE, respondents are asked if they have someone living in their household who they have assisted with personal care on a regular basis over the last twelve months, such as washing, getting out of bed, or dressing. If they respond positively, they are asked to whom they have provided assistance. We classify a respondent as a caregiver in our analysis if they have helped their spouse

[14] The differences by age are not statistically significant but these effects are estimated with a large degree of uncertainty.

Table 2
Short-term association between a partner's cancer diagnosis and mental health and well-being (n=28,247).

	Full	Female	Male	<70	70+
Depression					
Partner Cancer (Alive)	0.064***	0.069***	0.058**	0.082***	0.031
	(0.017)	(0.023)	(0.024)	(0.020)	(0.031)
Death of Partner (Cancer)	0.289***	0.249***	0.384***	0.245***	0.347***
	(0.044)	(0.049)	(0.085)	(0.058)	(0.064)
Death of Partner (Other)	0.167***	0.154***	0.209***	0.172***	0.144***
	(0.023)	(0.026)	(0.047)	(0.036)	(0.029)
Loneliness					
Partner Cancer (Alive)	−0.015	−0.010	−0.027	−0.006	−0.026
	(0.016)	(0.023)	(0.021)	(0.019)	(0.028)
Death of Partner (Cancer)	0.470***	0.437***	0.542***	0.475***	0.459***
	(0.061)	(0.075)	(0.105)	(0.081)	(0.089)
Death of Partner (Other)	0.421***	0.389***	0.513***	0.316***	0.492***
	(0.036)	(0.042)	(0.070)	(0.054)	(0.045)
Life Satisfaction					
Partner Cancer (Alive)	−0.150**	−0.265***	0.011	−0.146**	−0.176
	(0.062)	(0.082)	(0.092)	(0.073)	(0.114)
Death of Partner (Cancer)	−1.132***	−0.926***	−1.595***	−1.079***	−1.175***
	(0.187)	(0.228)	(0.308)	(0.238)	(0.296)
Death of Partner (Other)	−0.689***	−0.699***	−0.663***	−0.665***	−0.699***
	(0.095)	(0.112)	(0.179)	(0.135)	(0.133)
Anxiety Drugs					
Partner Cancer (Alive)	0.023**	0.039***	0.001	0.024**	0.021
	(0.009)	(0.014)	(0.010)	(0.011)	(0.016)
Death of Partner (Cancer)	0.074***	0.073**	0.076*	0.082**	0.061
	(0.028)	(0.034)	(0.046)	(0.039)	(0.040)
Death of Partner (Other)	0.035***	0.034**	0.044*	0.036*	0.030*
	(0.013)	(0.016)	(0.026)	(0.021)	(0.017)
Sleep Problems					
Partner Cancer (Alive)	−0.027	−0.049**	0.005	−0.011	−0.059**
	(0.017)	(0.022)	(0.025)	(0.021)	(0.028)
Death of Partner (Cancer)	0.173***	0.190***	0.140*	0.196***	0.143**
	(0.040)	(0.048)	(0.072)	(0.054)	(0.058)
Death of Partner (Other)	0.061***	0.071***	0.018	0.110***	0.018
	(0.023)	(0.026)	(0.043)	(0.034)	(0.030)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country and wave dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** $p<0.01$; ** $p<0.05$; * $p<0.1$.

or partner.[15] Even though the sample of caregivers is smaller (n=1844), the findings suggest that the negative association between a partner's cancer diagnosis and depression and life satisfaction is statistically significantly more pronounced for those who care for their partner. A partner's CD increases the likelihood of experiencing depression by 17 percentage points and reduces life satisfaction by almost half a point on a 1 to 10 scale for caregivers. However, the results also suggest an increase in the use of anxiety medications for those who do not provide care.

Then, in Table 4, we examine how a CD affects general self-reported health and an important proxy of well-being in old age, namely the presence of pain. Interestingly, even though cancer is a non-communicable disease, we find that a cancer diagnosis has a significant negative relationship with self-reported good health. Our findings also appear to indicate that women and older respondents are bearing the brunt of the burden, although the differences by gender and age are not statistically significant. The findings also indicate a strong positive association with the likelihood of experiencing pain, which is not significantly different for men and women, as well as for young and old respondents. These findings support the hypothesis of significant health and well-being spillovers from a partner's CD.

While the negative relationship between a partner's CD and mental health was largely driven by the additional caring responsibilities, Table 5 shows that the negative statistical link with general self-reported health and pain experience is particularly prevalent among non-caregivers. These results highlight the role of not only 'caring for' but also 'caring about' the sick person.

We then look at health behaviors as potential mechanisms driving the estimated associations. Table 6 shows that neither a cancer diagnosis nor the death of a partner have a significant statistical link with health behaviors. Only in terms of obesity do older respondents show a slight increase.

[15] It should be noted that this selection can be endogenous as the need for caregiving might reflect the severity of cancer and, therefore, the results should be interpreted with caution.

Table 3
Short-term association between a partner's cancer diagnosis and mental health and well-being by caregiving status (n=28,247).

	Full	Caregiver	Non caregiver
Depression			
Partner Cancer (Alive)	0.064***	0.167***	0.040**
	(0.017)	(0.049)	(0.017)
Death of Partner (Cancer)	0.289***	0.286***	0.274***
	(0.044)	(0.108)	(0.048)
Death of Partner (Other)	0.167***	0.246***	0.159***
	(0.023)	(0.074)	(0.024)
Loneliness			
Partner Cancer (Alive)	−0.015	0.028	−0.027*
	(0.016)	(0.053)	(0.016)
Death of Partner (Cancer)	0.470***	0.410***	0.476***
	(0.061)	(0.114)	(0.073)
Death of Partner (Other)	0.421***	0.266***	0.448***
	(0.036)	(0.097)	(0.038)
Life Satisfaction			
Partner Cancer (Alive)	−0.150**	−0.395**	−0.089
	(0.062)	(0.199)	(0.063)
Death of Partner (Cancer)	−1.132***	−2.022***	−0.890***
	(0.187)	(0.444)	(0.193)
Death of Partner (Other)	−0.689***	−0.189	−0.743***
	(0.095)	(0.323)	(0.099)
Anxiety Drugs			
Partner Cancer (Alive)	0.023**	−0.005	0.027***
	(0.009)	(0.025)	(0.010)
Death of Partner (Cancer)	0.074***	0.068	0.074**
	(0.028)	(0.069)	(0.030)
Death of Partner (Other)	0.035***	−0.005	0.040***
	(0.013)	(0.042)	(0.014)
Sleep Problems			
Partner Cancer (Alive)	−0.027	−0.061	−0.028
	(0.017)	(0.053)	(0.017)
Death of Partner (Cancer)	0.173***	0.050	0.192***
	(0.040)	(0.101)	(0.043)
Death of Partner (Other)	0.061***	−0.008	0.067***
	(0.023)	(0.079)	(0.024)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country and wave dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** $p<0.01$; ** $p<0.05$; * $p<0.1$.

Table 4
Short-term association between a partner's cancer diagnosis and general health and pain (n=28,247).

	Full	Female	Male	<70	70+
Good self-reported health					
Partner Cancer (Alive)	−0.064**	−0.075*	−0.050	−0.033	−0.132***
	(0.030)	(0.039)	(0.046)	(0.037)	(0.051)
Death of Partner (Cancer)	−0.077	−0.040	−0.160	−0.096	−0.041
	(0.078)	(0.096)	(0.135)	(0.092)	(0.136)
Death of Partner (Other)	0.033	0.012	0.080	0.106	−0.011
	(0.040)	(0.044)	(0.092)	(0.067)	(0.049)
Pain					
Partner Cancer (Alive)	0.047***	0.039*	0.055**	0.032	0.078***
	(0.017)	(0.021)	(0.027)	(0.021)	(0.029)
Death of Partner (Cancer)	0.016	0.011	0.017	−0.033	0.065
	(0.037)	(0.043)	(0.071)	(0.049)	(0.053)
Death of Partner (Other)	−0.004	−0.001	−0.015	−0.027	0.007
	(0.021)	(0.024)	(0.041)	(0.034)	(0.026)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country and wave dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** $p<0.01$; ** $p<0.05$; * $p<0.1$.

Table 5
Short-term association between a partner's cancer diagnosis and general health and pain by caregiving status (n=28,247).

	Full	Caregiver	Non caregiver
Good self-reported health			
Partner Cancer (Alive)	−0.064**	0.013	−0.071**
	(0.030)	(0.089)	(0.031)
Death of Partner (Cancer)	−0.077	−0.308*	−0.014
	(0.078)	(0.184)	(0.085)
Death of Partner (Other)	0.033	0.140	0.022
	(0.040)	(0.132)	(0.042)
Pain			
Partner Cancer (Alive)	0.047***	0.057	0.043**
	(0.017)	(0.046)	(0.018)
Death of Partner (Cancer)	0.016	−0.120	0.032
	(0.037)	(0.088)	(0.040)
Death of Partner (Other)	−0.004	0.039	−0.008
	(0.021)	(0.059)	(0.022)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country and wave dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** p<0.01; ** p<0.05; * p<0.1.

Table 6
Short-term association between a partner's cancer diagnosis and health behavior (n=28,247).

	Full	Female	Male	<70	70+
Alcohol					
Partner Cancer (Alive)	0.013	0.028	−0.017	0.024	−0.016
	(0.016)	(0.020)	(0.026)	(0.019)	(0.029)
Death of Partner (Cancer)	−0.005	−0.015	0.003	0.010	−0.027
	(0.032)	(0.034)	(0.069)	(0.038)	(0.055)
Death of Partner (Other)	−0.016	−0.041**	0.061	−0.022	0.000
	(0.017)	(0.018)	(0.039)	(0.027)	(0.022)
Physical Activity					
Partner Cancer (Alive)	−0.009	−0.010	−0.006	−0.009	−0.017
	(0.017)	(0.021)	(0.027)	(0.020)	(0.030)
Death of Partner (Cancer)	0.006	0.046	−0.076	0.037	−0.035
	(0.039)	(0.046)	(0.073)	(0.049)	(0.064)
Death of Partner (Other)	−0.035	−0.042*	−0.004	−0.011	−0.022
	(0.022)	(0.025)	(0.045)	(0.033)	(0.029)
Obesity					
Partner Cancer (Alive)	0.009	0.008	0.008	−0.006	0.039**
	(0.010)	(0.014)	(0.016)	(0.012)	(0.019)
Death of Partner (Cancer)	−0.013	0.004	−0.061**	−0.041	0.022
	(0.027)	(0.036)	(0.030)	(0.032)	(0.045)
Death of Partner (Other)	−0.004	−0.006	−0.002	−0.021	0.016
	(0.015)	(0.017)	(0.029)	(0.022)	(0.020)
Overweight					
Partner Cancer (Alive)	0.008	0.009	0.001	0.015	−0.012
	(0.014)	(0.018)	(0.021)	(0.015)	(0.026)
Death of Partner (Cancer)	−0.055	−0.068*	−0.040	−0.072*	−0.032
	(0.034)	(0.039)	(0.065)	(0.043)	(0.054)
Death of Partner (Other)	−0.009	−0.011	−0.031	−0.036	0.026
	(0.018)	(0.021)	(0.039)	(0.029)	(0.024)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** p<0.01; ** p<0.05; * p<0.1.

5.3. Long sample

An important question is whether the partner's spillovers of a CD are only a short-run phenomenon or also persist in the long run. To investigate this question further, we looked at the long-term associations of a cancer diagnosis with health and well-being. In the long run, our estimates indicate that CD is not associated with depression or loneliness. When we look at the heterogeneity by education, we find evidence of a longer-term association with an increase in depression for the less

Table 7
Long-term association between a partner's cancer diagnosis and mental health and well-being (n=11,869).

	Full	Female	Male	<70	70+
Depression					
Partner Cancer (Alive)	0.019	0.034	−0.005	0.023	0.016
	(0.017)	(0.024)	(0.025)	(0.019)	(0.040)
Death of Partner (Cancer)	0.099***	0.093***	0.104**	0.114***	0.067
	(0.026)	(0.033)	(0.044)	(0.032)	(0.046)
Death of Partner (Other)	0.069***	0.077***	0.054**	0.073***	0.055**
	(0.014)	(0.018)	(0.025)	(0.018)	(0.024)
Loneliness					
Partner Cancer (Alive)	−0.018	−0.016	−0.023	−0.011	−0.038
	(0.016)	(0.022)	(0.023)	(0.018)	(0.036)
Death of Partner (Cancer)	0.360***	0.343***	0.391***	0.366***	0.353***
	(0.027)	(0.033)	(0.050)	(0.033)	(0.047)
Death of Partner (Other)	0.270***	0.279***	0.250***	0.244***	0.305***
Life Satisfaction					
Partner Cancer (Alive)	−0.096	−0.196**	0.034	−0.069	−0.215
	(0.064)	(0.085)	(0.097)	(0.071)	(0.152)
Death of Partner (Cancer)	−0.418***	−0.465***	−0.326**	−0.403***	−0.437**
	(0.096)	(0.122)	(0.146)	(0.110)	(0.188)
Death of Partner (Other)	−0.297***	−0.349***	−0.191**	−0.328***	−0.231**
	(0.055)	(0.069)	(0.094)	(0.068)	(0.097)
Anxiety Drugs					
Partner Cancer (Alive)	0.002	0.010	−0.011	−0.004	0.022
	(0.010)	(0.015)	(0.011)	(0.011)	(0.024)
Death of Partner (Cancer)	0.026	0.037	0.002	0.038*	−0.002
	(0.017)	(0.023)	(0.021)	(0.021)	(0.028)
Death of Partner (Other)	0.029***	0.038***	0.017	0.032***	0.020
	(0.009)	(0.012)	(0.013)	(0.011)	(0.016)
Sleep Problems					
Partner Cancer (Alive)	0.016	0.035	−0.014	0.008	0.037
	(0.018)	(0.025)	(0.027)	(0.021)	(0.039)
Death of Partner (Cancer)	0.080***	0.076**	0.083*	0.088***	0.064
	(0.026)	(0.031)	(0.047)	(0.032)	(0.045)
Death of Partner (Other)	0.030**	0.022	0.054**	0.048**	0.021
	(0.015)	(0.018)	(0.025)	(0.019)	(0.024)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** p<0.01; ** p<0.05; * p<0.1.

educated. Following that, we show in Table 7 that a cancer death significantly increases a partner's loneliness years later, especially among younger respondents, who are 12 percentage points more likely to feel lonely. The estimated coefficient for cancer death is statistically significantly larger than that for death from other causes. Overall, the findings suggest that when cancer becomes a chronic condition, people adapt to it and, as a result, it has no long-term impact. However, when it results in the death of a partner, it has some long-term consequences. The associations are not explained by changes in sleep patterns because we show no relationship with sleep problems, nor with using anxiety medications as the use of these medications is usually not recommended for more than 6 months. However, *we find robust evidence of a negative statistical link between a CD and life satisfaction among women, which persists in the long run*. These gender differences are statistically significant.

Consistently, we *estimate that a partner's CD is associated with a decline in self-reported health and an increase in the experience of pain, which remain significant several years later* for people older than 70, as reported in Table 8. The estimated coefficient for pain is particularly large as it implies that a partner CD increases the probability of experiencing pain by 7 percentage points for the older respondents. As in the case of depression, also the increase in pain is particularly salient among low-educated individuals.

Finally, Table 9 shows that, also in the longer run, there does not seem to be any relationship between a cancer diagnosis and health behavior. A partner's death by cancer is negatively associated with alcohol but this association is not statistically different from that of a loss of a partner of other causes. When looking at the heterogeneity by education though, we find a small negative statistical link between the probability of being obese or overweight for the low educated.

Table 8
Long-term association between a partner's cancer diagnosis and general health and pain (n=11,869).

	Full	Female	Male	<70	70+
Good self-reported health					
Partner Cancer (Alive)	−0.044	−0.021	−0.066	−0.006	−0.183**
	(0.036)	(0.048)	(0.054)	(0.040)	(0.075)
Death of Partner (Cancer)	0.056	0.053	0.074	0.072	0.020
	(0.048)	(0.058)	(0.085)	(0.058)	(0.083)
Death of Partner (Other)	−0.004	−0.019	0.026	−0.031	0.041
	(0.027)	(0.033)	(0.046)	(0.034)	(0.043)
Pain					
Partner Cancer (Alive)	0.034*	0.026	0.042	0.024	0.068*
	(0.019)	(0.025)	(0.030)	(0.022)	(0.040)
Death of Partner (Cancer)	0.015	0.008	−0.006	−0.002	0.054
	(0.025)	(0.029)	(0.047)	(0.031)	(0.043)
Death of Partner (Other)	−0.017	−0.029*	0.002	−0.009	−0.022
	(0.014)	(0.017)	(0.026)	(0.019)	(0.023)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** p<0.01; ** p<0.05; * p<0.1.

Table 9
Long-term association between a partner's cancer diagnosis and health behavior – long sample (n=11,869).

	Full	Female	Male	<70	70+
Alcohol					
Partner Cancer (Alive)	0.012	0.002	0.020	0.005	0.028
	(0.017)	(0.023)	(0.026)	(0.020)	(0.036)
Death of Partner (Cancer)	−0.091***	−0.095***	−0.084**	−0.116***	−0.039
	(0.023)	(0.027)	(0.042)	(0.029)	(0.038)
Death of Partner (Other)	−0.073***	−0.083***	−0.048**	−0.087***	−0.028
	(0.013)	(0.015)	(0.023)	(0.017)	(0.020)
Physical Activity					
Partner Cancer (Alive)	0.026	0.016	0.042	0.038*	−0.038
	(0.018)	(0.023)	(0.027)	(0.020)	(0.038)
Death of Partner (Cancer)	−0.022	−0.029	0.005	−0.025	−0.008
	(0.024)	(0.030)	(0.043)	(0.029)	(0.044)
Death of Partner (Other)	−0.022	−0.026	−0.009	−0.025	0.012
	(0.014)	(0.018)	(0.025)	(0.018)	(0.023)
Obesity					
Partner Cancer (Alive)	0.005	−0.016	0.033	0.014	−0.027
	(0.014)	(0.018)	(0.021)	(0.016)	(0.024)
Death of Partner (Cancer)	0.022	0.012	0.039	0.027	0.016
	(0.019)	(0.022)	(0.037)	(0.024)	(0.031)
Death of Partner (Other)	0.001	−0.017	0.041**	0.012	−0.014
	(0.011)	(0.014)	(0.019)	(0.015)	(0.015)
Overweight					
Partner Cancer (Alive)	−0.008	−0.011	−0.005	0.003	−0.046
	(0.015)	(0.020)	(0.022)	(0.016)	(0.035)
Death of Partner (Cancer)	−0.022	0.008	−0.096**	−0.009	−0.051
	(0.022)	(0.025)	(0.043)	(0.026)	(0.041)
Death of Partner (Other)	0.001	−0.005	0.010	0.007	−0.001
	(0.012)	(0.015)	(0.020)	(0.015)	(0.022)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** p<0.01; ** p<0.05; * p<0.1.

6. Sensitivity analysis

One potential concern is that, although our specification is quite demanding, our lagged outcome and controls might not entirely capture all the unobserved heterogeneity across households, which affects both the probability of the spouse developing cancer and the health of the respondent, for example, early health risky behavior. For this reason, in Table 10 we run a series of robustness checks to test whether a partner's CD affects other physical health outcomes of the respondent

Table 10
Short and long-term association between a partner's cancer diagnosis and health conditions.

	ADL	Stroke	Heart attack	Diabetes
Short-term effect				
Partner Cancer (Alive)	0.009	−0.002	0.014	0.008
	(0.011)	(0.006)	(0.009)	(0.012)
Death of Partner (Cancer)	0.046	0.017	0.068**	0.008
	(0.030)	(0.018)	(0.029)	(0.027)
Death of Partner (Other)	−0.002	−0.003	−0.001	0.006
	(0.016)	(0.008)	(0.012)	(0.017)
Long-term effect				
Partner Cancer (Alive)	0.012	−0.008	0.010	0.002
	(0.013)	(0.007)	(0.011)	(0.011)
Death of Partner (Cancer)	0.010	0.007	0.021	0.002
	(0.019)	(0.012)	(0.016)	(0.016)
Death of Partner (Other)	0.020*	−0.005	0.020**	0.010
	(0.011)	(0.006)	(0.009)	(0.009)

Note: OLS estimates with robust standard errors in parentheses. The controls are the same as in Table 2 for the short-term effect and as in Table 7 for the long-term effect. *** $p<0.01$; ** $p<0.05$; * $p<0.1$.

himself/herself, in the short and longer term. As physical health outcomes, we construct indicators for having at least two limitations with activities of daily living (ADL), experiencing a stroke, a heart attack and having diabetes. The only significant relationship that we find is with a heart attack in the short run if the partner dies of cancer, but the medical literature also shows an important link between strong emotional stress and heart attacks. Overall, these results support the idea that the controls and outcome at baseline capture the relevant unobserved family heterogeneity.

Furthermore, we examine whether a spouse's cancer diagnosis increases the likelihood that the respondent will develop cancer himself/herself. However, in the short sample, there are no cases in which the partner has cancer and the respondent him/herself develops cancer. In the long sample, there are very few cases in which the respondent has cancer, and the partner was diagnosed with cancer and is still alive (14) or died from it (20). What we find is that, if anything, there seems to be a negative relationship between a spouse CD and the probability that the respondent develops cancer. Given the small sample size, these findings should be interpreted with caution, and they are likely due to the fact that families in which both the respondent and the partner have cancer are less likely to participate in the survey. Therefore, our findings should be interpreted as a lower bound of the true effect because we are likely to overlook the most severe cases.

Finally, for the short-term significant results, we also assess the sensitivity of our estimates of the effect of a partner's CD to selection on unobservables using the proportional selection test devised by Oster (2019), following the logic of Altonji et al. (2005). Our estimated degree of proportional selection δ is 1.56 for good health, 3.46 for pain, 7.82 for depression, 11.04 for anxiety drugs and 12.97 for life satisfaction. These values are all well above the threshold $\delta=1$ suggested by Altonji et al. (2005) to rule out that the bias due to omitted unobservables is strong enough to entirely explain away our estimated associations.

7. Conclusion

This paper studies the impact of a cancer diagnosis (CD) on the health and well-being of partners using data from a longitudinal sample of the older European population that controls for baseline health status and health behaviors. The longitudinal dimension of the data allows us to distinguish between short and long-term relations, as well as to take into account time-invariant confounders and potential institutional and cultural differences between countries. In addition, we consider whether the partner is a survivor of a CD or died of cancer, which also proxies for the severity of cancer. Furthermore, we control for a partner's death from other causes, which could otherwise confound our results.

We report evidence of economically significant *family health spillovers of a CD* on the health and subjective well-being of the partner, especially on measures of life satisfaction, self-reported health, pain experience, and loneliness, some of which persist over time. These spillovers can be explained by both the fact that the person 'cares for' and 'cares about' the sick partner and are not driven by changes in behavior caused by a CD. Because severely ill respondents and their partners are less likely to take the survey, the prevalence of cancer in our data is lower than in the general population, particularly for more aggressive cancers. As a result, we should consider our findings to be a lower bound on the true effect.

The findings show that previous studies focusing on individual effects understate the true impact of cancer. Our estimates are important for policy because they suggest that when evaluating the effects of cancer treatments and their costs, it is important to consider significant unreported spillover effects on partners which survive to the longer term, often going unaccounted for. Furthermore, our estimates suggest that if employment policies are to respond to shocks affecting individuals' lives, partner spillovers of a CD should be considered in the design of sick leave policies. Our findings have implications for economic theory as well, implying that economic analysis should extend beyond individualistic health production models.

Declaration of Competing Interest

The authors have received no funding for this research and have no conflict of interest

Data availability

The authors do not have permission to share data.

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Appendix not intended for publication

Table A1, Table A2

Table A1
Estimates of the effect of partner's cancer on mental health and well-being by geographical area (n=28,247).

	Full	north	center	South	East
Depression					
Partner Cancer (Alive)	0.064***	0.001	0.062**	0.068	0.091***
	(0.017)	(0.040)	(0.026)	(0.042)	(0.030)
Death of Partner (Cancer)	0.289***	0.211	0.382***	0.237***	0.248***
	(0.044)	(0.159)	(0.074)	(0.089)	(0.072)
Death of Partner (Other)	0.167***	0.167*	0.228***	0.298***	0.092***
	(0.023)	(0.093)	(0.050)	(0.051)	(0.030)
Loneliness					
Partner Cancer (Alive)	−0.015	−0.065**	−0.019	0.074	−0.047
	(0.016)	(0.026)	(0.022)	(0.047)	(0.032)
Death of Partner (Cancer)	0.470***	0.293	0.525***	0.402***	0.562***
	(0.061)	(0.217)	(0.090)	(0.106)	(0.159)
Death of Partner (Other)	0.421***	0.278**	0.418***	0.538***	0.318***
	(0.036)	(0.130)	(0.064)	(0.055)	(0.071)
Life Satisfaction					
Partner Cancer (Alive)	−0.150**	−0.250*	−0.008	−0.404**	−0.175
	(0.062)	(0.146)	(0.074)	(0.182)	(0.127)
Death of Partner (Cancer)	−1.132***	−0.460	−0.974***	−1.632***	−1.186***
	(0.187)	(0.319)	(0.288)	(0.494)	(0.331)
Death of Partner (Other)	−0.689***	−0.179	−0.655***	−1.088***	−0.625***
	(0.095)	(0.328)	(0.208)	(0.220)	(0.129)
Anxiety Drugs					
Partner Cancer (Alive)	0.023**	0.029	0.013	0.093***	−0.002
	(0.009)	(0.024)	(0.015)	(0.033)	(0.012)
Death of Partner (Cancer)	0.074***	−0.030***	0.167***	0.119*	−0.007
	(0.028)	(0.009)	(0.059)	(0.066)	(0.033)
Death of Partner (Other)	0.035***	0.022	−0.006	0.145***	0.015
	(0.013)	(0.038)	(0.018)	(0.047)	(0.016)
Sleep Problems					
Partner Cancer (Alive)	−0.027	−0.081*	−0.009	−0.006	−0.040
	(0.017)	(0.044)	(0.026)	(0.041)	(0.030)
Death of Partner (Cancer)	0.173***	0.307***	0.186**	0.161*	0.116**
	(0.040)	(0.108)	(0.076)	(0.092)	(0.059)
Death of Partner (Other)	0.061***	0.057	0.102**	0.175***	−0.000
	(0.023)	(0.093)	(0.052)	(0.054)	(0.030)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country and wave dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** p<0.01; ** p<0.05; * p<0.1.

Table A2
Estimates of the effect of partner's cancer on general health and pain by geographical area.

	Full	north	center	South	East
Good self-reported health					
Partner Cancer (Alive)	−0.064**	−0.083**	−0.034	−0.031	−0.130***
	(0.030)	(0.039)	(0.045)	(0.036)	(0.050)
Death of Partner (Cancer)	−0.077	−0.055	−0.235	−0.201*	−0.020
	(0.078)	(0.103)	(0.168)	(0.111)	(0.145)
Death of Partner (Other)	0.033	−0.005	0.078	0.089	−0.025
	(0.040)	(0.044)	(0.095)	(0.068)	(0.049)
Pain					
Partner Cancer (Alive)	0.047***	0.051**	0.062**	0.045**	0.079***
	(0.017)	(0.021)	(0.027)	(0.021)	(0.030)
Death of Partner (Cancer)	0.016	−0.000	0.036	−0.015	0.047
	(0.037)	(0.049)	(0.084)	(0.060)	(0.059)
Death of Partner (Other)	−0.004	0.028	0.003	0.003	0.027
	(0.021)	(0.023)	(0.043)	(0.034)	(0.026)

Note: OLS estimates with robust standard errors in parentheses. Controls include the outcome at baseline, in addition to gender, age, household size, income, education, financial wealth, country and wave dummies, health status (obesity, overweight, having depression symptoms, having limitations with activities of daily living and self-reported health) and health behavior (alcohol consumption, physical activity) at baseline. *** p<0.01; ** p<0.05; * p<0.1.

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