



Miscellaneous

Caregiving reduces mortality risk for most caregivers: a census-based record linkage study

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Abstract

Background: Countries with advanced welfare systems are increasingly relying on the input of informal caregivers, and there are growing concerns for their mental and physical wellbeing. However, the evidence about the relationship between caregiving and mortality risk is less clear.

Methods: A census-based record linkage study with mortality follow-up of 33 months: participants totalled 1 122 779 individuals including 183 842 caregivers, of whom 28.2% (51 927) were providing 50 or more hours caregiving per week.

Results: Over 33 months of follow-up a total of 29 335 deaths occurred, 2443 of these among caregivers. Mortality risk for caregivers was lower than for non-caregivers [hazard ratio (HR) = 0.72: 95% confidence interval (CI) = 0.69, 0.75 in the fully adjusted model], and the lower risk was evident even for those providing 50 or more h of caregiving per week (adjusted HR = 0.77: 95% CI = 0.71, 0.83 and 0.76: 95% CI = 0.69, 0.83 for men and women, respectively). There was no evidence that this relationship varied by either age or marital status. Even among people with chronic health problems such as poor mental health, caregivers had lower mortality risk than non-caregivers. Caregiving is associated with reduced mortality risk for most causes—for example, the risk of death from ischaemic heart disease for caregivers providing 50 or more h was 27% and 31% lower for men and for women, respectively, compared with non-caregivers (HR = 0.73: 95% CI = 0.60, 0.88 and HR = 0.69: 95% CI = 0.51, 0.92).

Conclusions: This large population-based study confirms that for the majority of caregivers the beneficial effects of caregiving in terms of short-term mortality risk appear to outweigh any negative effects, even among people with significant health problems. These results underscore the need for a reappraisal of how caregiving is perceived.

Key words: Caregiving, carers, mortality, longitudinal follow-up

Key Messages

- Caregiving is thought to be associated with a range of adverse health consequences, but the evidence regarding its association with mortality risk is limited.
- Caregiving is also considered to increase stress levels and should therefore be associated with increased cardiovascular risk.
- Using a census-based longitudinal study we demonstrate that caregiving, even at very intense levels, is associated with a substantially reduced mortality risk. This is true even for caregivers with poor physical or mental health.
- The mortality risk for cardiovascular disease was also substantially lower for caregivers than for non-caregivers.

Background

The ageing of Westernised populations and the rising trend for looking after people in non-institutionalized settings leads to increasing numbers of people living in the community in need of ongoing support and assistance. Whereas some of this is provided by formal agencies, the majority is provided by family, friends and neighbours who deliver a wide range of assistance for which they receive no formal recompense.¹ It is thought that in the USA, informal caregivers provide unpaid services to family and friends each year valued at approximately \$375 billion. Further, it is likely that recent restriction on public finances is placing an increasing dependence on these informal caregivers.

Caregiving can be both distressing and physically demanding and there are ongoing concerns about the potentially deleterious effects it may have on the health of those providing care. Much of the research evidence has focused on the mental and psychological effects of caregiving^{2,3} and less is known about its effects on physical health. Early reports asserting an increased mortality risk associated with caregiving referenced studies of people whose partners had been hospitalized⁴ or the spouses of patients with chronic diseases such as Parkinson's⁵; the most cited study was by Schulz and Beach⁶ who detected a 63% higher mortality risk among spousal caregivers and reported mental or emotional strain when compared with spouses or partners of persons without disability, though there was no difference in mortality between non-strained caregivers and non-caregivers. Similarly, an early report from the REGARDS (Reasons for Geographical and Racial Differences in Stroke) study found that among caregivers, those who reported high levels of caregiving strain had an excess 55% mortality risk when compared with those reporting no stress.⁷ A more recent study of telomere length (which may be a biomarker for ageing or mortality risk) found that, although there was no overall difference in telomere length between caregivers and non-caregivers, those providing more hours of care for a child or young adult, or those reporting greater strain, recorded shorter

telomere length and therefore possibly greater risks of poor health outcomes.⁸

Evidence regarding the effects of caregiving on cause-specific mortality is more tenuous, though increased risks of cardiovascular disease would be expected given the consensus regarding an association between caregiving and stress⁹ and the more established relationship between stress and cardiovascular disease (CVD).¹⁰ Being a 'strained' caregiver is associated with a less healthy lifestyle,¹¹ higher Framingham Stroke Risk Scores¹² and higher Framingham Coronary Heart Disease Risk Scores.¹³ The Health and Retirement Study found that spousal caregiving was associated with higher CVD incidence over 8 years of follow-up in people free of CVD at baseline, though only for White caregivers,¹⁴ and a follow-up of participants in the Nurses' Health Study showed higher coronary heart disease incidence among spousal caregivers (but this was not mediated by stress¹⁵).

However, there is now an increasing consensus that caregiving is associated with reduced mortality risk.¹⁶ Brown *et al.*¹⁷ showed that caregiving at least 14 h per week was associated with a 26% lower mortality risk, and two large UK census-based studies found that even those caregivers providing very significant amounts of caregiving (i.e. averaging 50 or more hs per week) had lower mortality risk than non-carers.^{18,19} Fredman *et al.* found a 26% lower mortality risk among elderly caregivers than non-caregivers,²⁰ and a more recent follow-up analysis of the REGARDS study using propensity matching found: that the mortality risk among all caregivers was 18% lower than that of non-caregivers; that most caregivers reported either low or moderate levels of caregiver stress; and that these caregivers do not show elevated mortality rates compared with propensity-matched samples of non-caregivers.²¹

Overall, it appears that many of the studies specifically designed to examine the health effects of caregiving have been small and often selective, either in terms of the types of caregiver or in respect of the type of care-recipient studied, with consequent difficulty in generalizing to the wider population of caregivers. On the other hand, census-

based studies, although large and representative, have been limited in their ability to adjust for the fact that more healthy people may be more likely to take on and persist with caregiving roles (the healthy worker effect²²). The current study utilizes a population-level record linkage study to provide more clarity about the effects of caregiving on mortality risk and to address the following questions: (i) is caregiving associated with reduced mortality risk? (ii) does this lower risk disappear after adjustment for baseline health? (iii) is caregiving hazardous for people with particular health problems? and (iv) is caregiving associated with an increased risk of mortality due to cardiovascular disease? The setting is Northern Ireland, with a universal health care system, where access to all aspects of health and social care is free at the point of use.

Methods

The Northern Ireland Mortality Study (NIMS) is a prospective record-linkage study derived from the linkage of the census returns for the whole enumerated population and subsequently registered deaths. Details of both NIMS and linkage processes are described elsewhere.²³ For this study, the March 2011 Census returns were linked with subsequent associated mortality records, following up until the end of 2013. The research reported here is based on analyses of that subset comprising those aged 25 and over at the Census, and not living in institutional settings. All personal characteristics were drawn from the Census: these include age, gender and marital status (grouped as: married; never married; and those widowed, separated or divorced). Because Northern Ireland is an ethnically homogeneous country, ethnic diversity was summarized as White/non-White.

Caregiver status

The assessment of caregiving responsibilities was derived from the Census: 'Do you look after, or give any help or support to family members, friends, neighbours or others because of either: long-term physical or mental ill health/disability; problems related to old age?' Respondents were instructed not to include anything they did as part of their paid employment. The four response categories comprised: none (non-caregiver); caregiving for 1–19 h; 20–49 h; or 50 or more h per week. There were no Census questions related to either the care recipient or the nature of the caregiving duties.

Health status

While previous United Kingdom (UK) censuses have included questions on self-reported morbidity, the 2011 Northern Ireland (NI) Census has extended this to three

questions which elicit in more comprehensive detail the types of morbidity. The first asks if people had a health problem or disability which limited day-to-day activity a little or a lot (and had lasted, or was expected to last, at least 12 months); a second asked 'how is your health in general', with five responses ranging from very good to very bad; and the third 'Do you have any of the following conditions which have lasted, or are expected to last, at least 12 months?' These allowed people to tick all conditions from a list of 10 that related to them. For this study, we selected four of these items to see if the effects of caregiving on mortality vary by presence of specific health conditions: (i) 'a mobility or dexterity difficulty (a condition that substantially limits one or more basic physical activities such as walking, climbing stairs, lifting or carrying)'; (ii) 'an emotional, psychological or mental health condition (such as depression or schizophrenia)'; (iii) 'long-term pain or discomfort'; and finally, (iv) 'shortness of breath or difficulty breathing (such as asthma)'. No options related directly to cardiovascular disease were included in the list.

Additional socioeconomic and area factors known to be associated with either caregiver status or mortality risk were also included. Socioeconomic status was assessed using: (i) household car availability (two or more cars, one only, no household access); and (ii) a combination of housing tenure and the capital value of the property. Tenure was derived directly from the Census (owner occupiers, private renting or social renting). Capital value had been derived as part of an exercise by central government in 2005 to determine the level of local tax payable by each household. These data were linked and combined with tenure to produce an 8-fold classification defining tenure/rateable value of property: private renting; social renting; and for owner-occupiers, five groups ranging rateable value from less than £75k to over £200k (see Table 1), with a separate category for owners with unvalued homes. An indicator of urban-rural residence was based on the NISRA classification of Settlements²⁴ (grouped as urban, intermediate and rural locales representing settlements of > 75 000 people, 25 000–75 000 and < 2500 people, respectively).

The resulting linked data were anonymized, held in a safe setting by the Northern Ireland Statistics and Research Agency (NISRA) and made available to the research team for the purpose of this study. The use of the NIMS for research was approved by the Office for Research Ethics Committees Northern Ireland (ORECNI).

Analysis strategy

Descriptive statistics recorded the socio-demographic characteristics and variations in health status by levels of caregiving activity. The relationship between caregiving and

Table 1. Characteristics of men and women aged 25 and over by hours of caregiving commitment per week. Results represents percentage in the caregiving category

	Non-caregiver	Caregiver (number of hours per week)		
		1–19	20–49	50 or more
Number in category (and proportion of sample)	938 937 (83.6%)	101 696 (9.1%)	30 219 (2.7%)	51 927 (4.6%)
Age 25–44	42.1	34.8	35.9	28.2
45–64	35.2	53.1	48.6	44.1
65+	22.7	12.1	15.5	27.7
Sex				
Male	48.8	40.5	41.3	40.0
Female	51.2	59.5	58.7	60.0
Ethnicity				
White	98.4	99.3	98.7	99.2
Non-White	1.6	0.7	1.3	0.8
Marital status				
Married	55.1	67.7	62.3	72.3
Never married	24.7	19.0	23.3	15.6
Widowed/separated/divorced	20.2	13.4	14.4	12.1
Tenure/property value				
£200k	9.7	16.4	8.3	7.7
£150–199k	11.9	17.2	11.7	11.2
£100–149k	22.6	25.6	23.3	22.4
£75–99.9k	14.2	13.0	15.0	15.1
< £75k	9.7	7.2	10.3	9.8
Missing value	6.0	6.5	4.6	4.2
Private renting	14.1	8.0	11.6	11.1
Social renting	11.8	6.2	15.2	18.7
Household car access				
Two or more	45.1	59.6	43.7	34.9
One	37.9	33.2	41.3	48.8
None	17.0	7.1	15.0	16.4
Limiting long term illness				
None	71.4	82.4	73.8	63.8
Limiting a little	11.3	11.6	14.7	17.4
Limiting a lot	17.2	6.0	11.5	18.8
General health				
Very good	35.4	38.9	28.8	22.7
Good	35.5	43.2	42.3	38.6
Fair	20.4	15.5	23.4	30.0
Bad	6.9	2.1	4.7	7.1
Very bad	1.9	0.3	0.8	1.5
Chronic conditions				
Mental ill-health	8.0	5.7	8.5	10.4
Mobility problems	17.0	8.3	13.3	19.7
Chronic pain	15.1	10.6	14.9	20.5
Breathing difficulties	10.3	7.1	9.6	13.0
Area of residence				
Urban	37.8	39.0	38.9	40.6
Intermediate	34.4	31.3	33.8	33.4
Rural	27.8	29.7	27.3	26.1

baseline health status was examined using: (i) logistic regression for binary health outcomes such as self-reported chronic mobility or mental health problems; and (ii) ordinal logistic regression for ordered health measures such as general

health. Finally, Cox proportional hazards models were used to examine mortality risk. Initial models explored the relationship between caregiving status and all-cause mortality (with adjustment for baseline health status to control for

health selection effects). Tests for interaction were used to determine whether the health effects associated with caregiving differed by age or sex. Further analyses explored whether caregiving was associated with increased mortality among those recording specific chronic conditions. Cause-specific mortality was explored using the following broad ICD10 classifications: circulatory disease (I00-I99); ischaemic heart disease (I20-I25); cerebrovascular disease (I60-I69); respiratory disease (J00-J99); external causes (V01-Y98); accidents (V01-V99 and W00-X59); suicides (X60-X84, Y10-Y34, Y87.0); and alcohol-related deaths (F10, G31.2, G62.1, I42.6, K29.2, K70, K73, K74 (excluding K74.3-K74), K86.0, X45, X65, Y15).²⁵ Suicide was included, as caregiving has been shown in cohort studies to predict the onset of depression²⁶ and, in an Adult Psychiatric Morbidity survey, to be associated with a higher prevalence of common mental disorders and suicidal thoughts.²⁷

Results

Of the 1 122 779 individuals included for analysis: 16.4% (183 842) were caregivers of 44.7% (82 146) and provided 20 or more hours care per week; 28.2% (51 927) provided

50 or more hours caregiving per week; and 59.5% of caregivers were women. Table 1 shows the baseline characteristics of the cohort by levels of caregiving—findings which correspond with other UK reports.^{28,29} Caregivers providing less than 20 h per week were compared with both non-caregivers and those with more significant caregiving commitments, disproportionately middle-aged, more likely to own a more expensive house and to have household access to two or more cars. Of those providing 50 h or more caregiving: 27.7% were aged 65 or older; 72.3% were married; 18.7% were in social rented accommodation; and 18.8% reported a health problem that limited their activities a lot. There were no marked differences in the distribution of caregivers by urban/rural locale.

Table 2 shows that caregivers providing fewer than 20 h per week were healthier than non-caregivers, whereas those providing 50 or more hours of caregiving tended to have the worst health across a range of dimensions including general health, chronic pain and breathing difficulties. Chronic mental health problems were more likely among more intensive, though this was more pronounced among women than men [odds ratio (OR) = 1.20; 95% confidence interval (CI) = 1.16, 1.25 and OR = 1.09; 95% CI = 1.03,

Table 2. Self-reported health status of caregivers by hours of caregiving compared with non-caregivers. Data represent the odds ratios (and 95% confidence intervals) from separate logistic regression models, with adjustment for those demographic, socioeconomic and area-level factors listed in Table 1

	Non-caregiver	Caregiver (number of hours per week)		
		1–19 hours	20–49 hours	50 and over
Men				
Limiting illness	1.00	0.74 (0.72, 0.76)***	0.89 (0.86, 0.93)***	1.14 (1.10, 1.17)***
General health	1.00	0.87 (0.85, 0.89)***	1.07 (1.04, 1.11)***	1.25 (1.22, 1.28)***
Mental health problem	1.00	0.81 (0.77, 0.85)***	0.85 (0.79, 0.92)***	1.09 (1.03, 1.15)**
Mobility and dexterity	1.00	0.63 (0.61, 0.66)***	0.85 (0.81, 0.90)***	1.01 (0.97, 1.05)
Long-term pain	1.00	0.87 (0.84, 0.90)***	1.00 (0.95, 1.06)	1.25 (1.20, 1.29)***
Breathing difficulties	1.00	0.86 (0.83, 0.90)***	1.00 (0.94, 1.07)	1.14 (1.09, 1.19)***
Women				
Limiting illness	1.00	0.61 (0.59, 0.62)***	0.81 (0.78, 0.84)***	1.00 (0.98, 1.03)
General health	1.00	0.81 (0.80, 0.83)***	1.08 (1.05, 1.11)***	1.23 (1.21, 1.26)***
Mental health problem	1.00	0.73 (0.71, 0.76)***	0.91 (0.86, 0.96)**	1.20 (1.16, 1.25)***
Mobility and dexterity	1.00	0.55 (0.53, 0.56)***	0.74 (0.70, 0.77)***	0.90 (0.87, 0.92)***
Long-term pain	1.00	0.75 (0.73, 0.77)***	0.94 (0.90, 0.98)*	1.11 (1.07, 1.14)***
Breathing difficulties	1.00	0.82 (0.80, 0.85)***	0.92 (0.87, 0.97)**	1.11 (1.07, 1.15)***
Persons^a				
Limiting illness	1.00	0.67 (0.65, 0.68)***	0.85 (0.83, 0.87)***	1.06 (1.04, 1.08)***
General health	1.00	0.84 (0.83, 0.85)***	1.08 (1.06, 1.10)***	1.24 (1.22, 1.26)***
Mental health problem	1.00	0.76 (0.74, 0.79)***	0.89 (0.86, 0.93)***	1.17 (1.13, 1.21)***
Mobility and dexterity	1.00	0.58 (0.57, 0.60)***	0.78 (0.76, 0.81)***	0.94 (0.92, 0.96)***
Long-term pain	1.00	0.79 (0.78, 0.81)***	0.96 (0.93, 0.99)*	1.16 (1.13, 1.19)***
Breathing difficulties	1.00	0.84 (0.82, 0.87)***	0.96 (0.92, 1.00)	1.13 (1.10, 1.16)***

^aPersons analysis additionally adjusted for gender.

***P-value = 0.000; **P < 0.001; *P < 0.01.

Table 3. All-cause mortality risk associated with number of hours spent caring for 533 082 men and 589 697 women in Northern Ireland aged 25 and over. Data represent hazard ratios (and 95% CIs) from Cox proportional hazards models

Hours/week spent caring	Deaths	Adjusted for age	+ Marital status and ethnicity	+ Socioeconomic status and area	+ Health status ^a
Men					
None	13 392	1.00	1.00	1.00	1.00
1–19 hours	480	0.50(0.45, 0.54)***	0.54(0.49, 0.59)***	0.59(0.54, 0.65)***	0.70(0.64, 0.77)***
20–49 hours	241	0.71(0.63, 0.81)***	0.77(0.68, 0.88)***	0.75(0.66, 0.86)***	0.81(0.71, 0.92)**
50 and over	703	0.72(0.67, 0.78)***	0.82(0.76, 0.89)***	0.76(0.70, 0.82)***	0.77(0.71, 0.83)***
Women					
None	13 500	1.00	1.00	1.00	1.00
1–19 hours	357	0.40(0.36, 0.45)***	0.43(0.39, 0.48)***	0.48(0.43, 0.53)***	0.62(0.56, 0.69)***
20–49 hours	159	0.53(0.45, 0.61)***	0.59(0.50, 0.69)***	0.59(0.51, 0.70)***	0.66(0.57, 0.78)***
50 and over	503	0.62(0.57, 0.68)***	0.73(0.67, 0.80)***	0.70(0.64, 0.77)***	0.76(0.69, 0.83)***
Persons					
None	26 892	1.00	1.00	1.00	1.00
1–19 hours	837	0.45(0.42, 0.48)***	0.49(0.46, 0.52)***	0.54(0.50, 0.58)***	0.67(0.62, 0.71)***
20–49 hours	400	0.62(0.56, 0.69)***	0.69(0.62, 0.76)***	0.69(0.62, 0.76)***	0.75(0.68, 0.83)***
50 and over	1206	0.67(0.64, 0.71)***	0.78(0.74, 0.83)***	0.74(0.69, 0.78)***	0.76(0.72, 0.81)***

^aLongstanding illness, general health and chronic conditions.

****P*-value = 0.000; ***P* < 0.001; **P* < 0.01.

1.15, respectively]. The association between caregiving and physical ability is less clear: even among those with the heaviest caregiving commitments, the likelihood of reporting mobility or dexterity problems is less than for non-caregivers (OR = 0.94; 95% CI = 0.92, 0.96), though the prevalence of limiting long-term illness is slightly higher (OR = 1.06; 95% CI = 1.04, 1.08).

The cohort experienced a total of 29 335 deaths between the Census in March 2011 and the end of 2013, with 2443 of these to caregivers. Caregiving, taken as a categorical variable, was associated with a lower mortality risk [hazard ratio (HR) = 0.57; 95% CIs = 0.55, 0.60 and HR = 0.72; 95% CI = 0.69, 0.75 after adjustment for respectively age and sex, and in the fully adjusted model. Table 3 shows the risks of death according to intensity of caregiving input. Tests for interaction suggested that the relationship between caregiving and mortality risk in adjusted models did not vary by gender (*P* = 0.095) but results are presented for males and females as well as for all persons, as is customary. In models adjusted for age, caregivers providing 20 or more hours caregiving per week were approximately 35% less likely as non-caregivers to die during the follow-up period. This was attenuated by further adjustment for variation in marital status, ethnicity, socioeconomic status and health status at baseline. This attenuation were most pronounced for caregivers providing less than 20 hours per week, though even in the fully adjusted model, people providing 50 or more hours per week were still about 24% less likely to die than non-caregivers (HR = 0.76; 95% CI = 0.72, 0.81).

A non-significant test for interaction (*P* = 0.129) suggested that there was no variation in reduced mortality risk of caregivers according to age. There was also no evidence that the relationship between caregiving and mortality risk varied by marital status for either men or women (test for interaction *P* = 0.779 and *P* = 0.824, respectively) and the reduction in mortality risk for married caregivers was generally of similar magnitude as for non-married caregivers: for example HR = 0.72; 95% CI = 0.66, 0.78 and HR = 0.74; 95% CI = 0.55, 0.99 for married and for never-married people providing 50 or more hours of caregiving per week compared with their non-caregiving peers (full analysis available on request).

Table 4 compares mortality risks by caregiving commitment in models stratified by the selected chronic conditions (though even in this large dataset the number of caregivers recording chronic conditions is small, resulting in wide confidence intervals). Nevertheless, the effect sizes are generally all less than 1 and of the same order as for all-cause mortality. It is noteworthy, given the concerns about caregiver stress, that the mortality risk associated with caregivers with chronic mental, emotional or psychological conditions still tend to be less than those of non-caregivers, though the reduction in effects sizes for those providing 50 or more hours caregiving per week were more modest (HR = 0.86; 95% CI = 0.71, 1.04). Caregiving was also associated with a reduced mortality risk among the 40% of caregivers who recorded no chronic conditions.

Table 5 shows the variation of cause-specific mortality associated with different levels of caregiving,

Table 4. Mortality risk of caregiving for carers recording specific self-reported health problems. Each row represents hazard ratios from separate Cox proportional hazards analyses (95% CIs), adjusted for those demographic, socioeconomic, area-level and health factors listed in Table 1 (with non-caregivers as reference group)

Chronic condition	Non-caregivers with condition	Caregivers with condition	Caregiving input		
			1–19 hours	20–49 hours	50 hours and over
Men					
Mental health problem	31 260	4426	0.79 (0.56, 1.12)	0.69 (0.43, 1.12)	0.81 (0.61, 1.08)
Mobility and dexterity	67 466	9502	0.64 (0.55, 0.75)***	0.73 (0.60, 0.88)**	0.71(0.64, 0.79)***
Long-term pain	59 706	10 379	0.62 (0.50, 0.76)***	0.89 (0.72, 1.11)	0.77 (0.67, 0.88)***
Breathing difficulties	43 353	6899	0.77 (0.64, 0.94)*	0.92 (0.72, 1.16)	0.74 (0.64, 0.86)***
No chronic conditions	177 585	31 111	0.66 (0.60, 0.74)***	0.79 (0.69, 0.91)**	0.73 (0.67, 0.79)***
Women					
Mental health problem	43 750	9293	0.57 (0.38, 0.86)**	0.45 (0.25, 0.79)**	0.93 (0.72, 1.20)
Mobility and dexterity	91 805	13 157	0.61 (0.52, 0.72)***	0.63 (0.49, 0.79)***	0.65 (0.57, 0.74)***
Long-term pain	82 176	15 514	0.59 (0.48, 0.73)***	0.60 (0.46, 0.80)***	0.73 (0.63, 0.85)***
Breathing difficulties	53 326	9991	0.64 (0.50, 0.81)***	0.74 (0.55, 1.00)	0.60 (0.50, 0.73)***
No chronic conditions	200 155	41 581	0.60 (0.53, 0.68)***	0.57 (0.47, 0.69)***	0.72 (0.65, 0.79)***
Persons					
Mental health problem	75 010	13 719	0.68 (0.52, 0.89)**	0.56 (0.39, 0.80)**	0.86 (0.71, 1.04)
Mobility and dexterity	159 271	22 659	0.63 (0.56, 0.70)***	0.69 (0.59, 0.80)***	0.68 (0.63, 0.74)***
Long-term pain	141 882	25 893	0.61 (0.53, 0.70)***	0.76 (0.64, 0.90)**	0.75 (0.68, 0.83)***
Breathing difficulties	96 679	16 890	0.71 (0.61, 0.83)***	0.85 (0.70, 1.02)	0.69 (0.61, 0.77)***
No chronic conditions	377 740	726 92	0.64 (0.59, 0.69)***	0.70 (0.62, 0.78)***	0.72 (0.68, 0.77)***

All models adjusted for age, ethnicity, marital status, housing tenure and house value, car availability, presence of chronic disability, general health level and urban-rural residence.

*** $P = 0.000$; ** $P < 0.001$; * $P < 0.01$.

after full adjustment for demographic, socioeconomic, area and health-related variables recorded at baseline. About 28% of deaths in the cohort were due to cardiovascular disease (of which 51% were due to ischaemic heart disease) and 34% due to cancer. The effect sizes for most causes of death were less than 1, indicating lower risks among caregivers, even for the less frequent causes. The risk of death from ischaemic heart disease for caregivers providing 50 or more hours of caregiving was about 29% lower compared with non-caregivers (HR = 0.71; 95% CI = 0.60, 0.83). The reductions in mortality risk due to cancer and respiratory disease were of a similar magnitude to that for all cardiovascular disease, whereas the reductions associated with external causes and alcohol-related deaths tended to be lower, especially for male caregivers, though in females the number of deaths was small and the confidence intervals crossed unity. Although the number of registered deaths from suicide over the 33 months was relatively small, the hazard ratios suggest that caregivers, including those providing 50 or more hours caring per week, are at lower risk than non-caregivers (though the associated confidence intervals were wide and crossed unity).

Discussion

This study confirms that caregiving is associated with lower rather than higher mortality risk. Even those with a caregiving commitment of 50 or more hours per week experience a short-term mortality risk about 25% lower than non-caregiving peers. This reduction is evident across gender and age and is of similar magnitude among those with chronic health conditions and those with no reported chronic health conditions. The study also shows that the morbidity of caregivers (compared with non-caregivers) is not straightforward. This is not surprising, as there is likely to be at least three competing influences operating. First, a degree of health selection might be expected, at least in terms of the physical capability needed to maintain a significant caregiving role,³⁰ and the relatively lower likelihood of chronic mobility and dexterity problems in caregivers might be evidence for this. Second, even if caregiving showed no direct causative impact on caregiver health, it might still be expected they have worse health than non-caregivers because of spousal concordance (homogamy bias) arising from phenotypic assortative mating and social homogamy, so that when the health of one partner fails to the extent that they need care there is a high likelihood that the other partner might also be in poor

Table 5. Cause-specific mortality by number of hours spent caring, compared with non-caregivers. Data represent hazard ratios (95% CIs) in models fully adjusted for the covariates listed in Table 1

Cause of death	Number of deaths ^b	Caregiver (number of hours per week)		
		1–19	20–49	50 or more
Men				
All cardiovascular	4 232	0.77 (0.65, 0.91)**	0.83 (0.66, 1.05)	0.78 (0.68, 0.90)**
Ischaemic heart disease	2 548	0.86 (0.70, 1.05)	0.96 (0.72, 1.27)	0.73 (0.60, 0.88)**
Stroke	819	0.73 (0.49, 1.09)	0.83 (0.48, 1.44)	0.86 (0.64, 1.17)
Respiratory disease	1 937	0.59 (0.43, 0.81)**	0.92 (0.64, 1.31)	0.82 (0.67, 1.01)
All cancer	5 250	0.70 (0.61, 0.81)**	0.87 (0.71, 1.06)	0.82 (0.73, 0.93)**
Alcohol-related	356	1.21 (0.76, 1.91)	0.37 (0.12, 1.16)	0.41 (0.18, 0.91)*
All external causes	665	0.70 (0.47, 1.02)	0.57 (0.29, 1.10)	0.56 (0.35, 0.91)*
All accidents	357	0.56 (0.31, 1.03)	0.90 (0.42, 1.91)	0.46 (0.23, 0.94)*
Suicide	298	0.85(0.52, 1.40)	0.26 (0.65, 1.05)	0.67 (0.33, 1.36)
Women				
All cardiovascular	4 005	0.63 (0.51, 0.79)**	0.77 (0.57, 1.05)	0.72 (0.60, 0.87)**
Ischaemic heart disease	1 690	0.52 (0.36, 0.76)**	0.66 (0.39, 1.09)	0.69 (0.51, 0.92)*
Stroke	1 192	0.60 (0.39, 0.91)*	0.97 (0.58, 1.62)	0.88 (0.64, 1.21)
Respiratory disease	2 015	0.39 (0.26, 0.61)**	0.47 (0.26, 0.83)**	0.54 (0.40, 0.74)**
All cancer	4 779	0.71 (0.61, 0.82)**	0.66 (0.52, 0.84)**	0.90 (0.79, 1.03)
Alcohol-related	189	0.13 (0.03, 0.54)**	0.60 (0.22, 1.62)	0.83 (0.45, 1.53)
All external causes	433	0.28 (0.13, 0.59)**	0.95 (0.49, 1.84)	0.76 (0.46, 1.25)
All accidents	328	0.32 (0.13, 0.78)*	1.21 (0.57, 2.57)	0.87 (0.49, 1.53)
Suicide	98	0.22 (0.05, 0.92)*	0.27 (0.04, 1.97)	0.47 (0.15, 1.48)
Persons^a				
All cardiovascular	8 237	0.70 (0.62, 0.81)**	0.80 (0.66, 0.97)*	0.75 (0.67, 0.84)**
Ischaemic heart disease	4 238	0.74 (0.62, 0.89)**	0.86 (0.67, 1.10)	0.71 (0.60, 0.83)**
Stroke	2 011	0.66 (0.49, 0.88)**	0.90 (0.62, 1.31)	0.87 (0.70, 1.08)
Respiratory disease	3 952	0.51 (0.39, 0.66)**	0.73 (0.54, 0.98)*	0.71 (0.60, 0.85)**
All cancer	10 029	0.71 (0.64, 0.79)**	0.78 (0.67, 0.91)**	0.86 (0.79, 0.94)**
Alcohol-related	545	0.72 (0.47, 1.11)	0.48 (0.23, 1.02)	0.61 (0.38, 0.99)*
All external causes	1 098	0.53 (0.37, 0.74)**	0.70 (0.44, 1.12)	0.63 (0.44, 0.89)**
All accidents	685	0.45 (0.27, 0.74)**	1.01 (0.60, 1.73)	0.64 (0.41, 0.99)*
Suicide	396	0.66 (0.41, 1.05)	0.27 (0.08, 0.84)*	0.61 (0.33, 1.11)

All models adjusted for: age group; ethnicity; marital status; car access; rateable value; settlement band; long-term limiting illness & general health

^aThe persons analysis also adjusted for gender.

^bNumber of deaths = all deaths from the associated cause; this includes deaths occurring to non-carers.

*** $P = 0.000$; ** $P < 0.001$; * $P < 0.01$.

health. This might explain the higher levels of long-term pain and breathing difficulties among caregivers. Finally, whereas there is clear evidence that caregiving is associated with an increased prevalence and incidence of poor mental health,^{3,26,27,31,32} a unique twins study by Vitaliano *et al.*³³ suggests that the relationship between caregiving and psychological distress may be determined by a vulnerability largely shaped by genetic and early-life factors.

In recent years there is an increasing consensus that the mortality risk associated with caregiving as a whole tends to be lower than that of their non-caregiving peers. A number of relatively small studies have found an elevated risk among select sub-populations of carers,^{4–7} but such studies have been criticized because they usually contrast the most stressed caregivers with the healthiest non-caregivers, and

Fredman *et al.*²⁰ have shown (at least amongst elderly female caregivers) that it is high stress rather than caregiving *per se* that is associated with increased mortality risk. Indeed, as Brown *et al.*¹⁷ state, 'It may be difficult to separate caregiving (the amount of time and effort involved in active help) from the other aspects of caregiving such as watching the decline in a loved one or the stress of anticipatory bereavement'. The lower mortality risks from both cardiovascular disease and among people with chronic mental health problems in this study argue that the beneficial effects of caregiving outweigh any impacts arising from attendant stress.³⁴

The evidence on potentially salutogenic effects of caregiving has also increased over recent years (see Roth *et al.*¹⁶ for an excellent recent review). It is generally

acknowledged that a higher proportion of caregivers find their role satisfying and rewarding than complain about stress or strain and that for many it enhances their relationship with the care recipient.^{35,36} For some, such altruistic behaviour may improve well-being and reduce mortality,³⁷ though it should be noted that for many caregivers (such as spousal or family members) their role would be deemed less than optional. Caregivers are generally more active than non-caregivers,³⁷ and this activity may offset some of the other associated adverse cardiovascular risk factors^{12,13} as well as helping to delay the natural age-related decline in physical and mental functioning. Fredman *et al.*³⁹ showed that physical functioning at 2 years follow-up remained higher in high-intensity female caregivers (defined as performing either six or more instrumental activities of daily living (IADL) or two or more activities of daily living (ADL)) than in low-intensity (0–5 IADL and 0–1 ADL) or non-caregivers,³⁸ and a later cross-sectional analysis of the same cohort showed that continuous caregivers, despite their higher levels of perceived stress, had better cognitive functioning than continuous non-caregivers.⁴⁰ However, the protective effect of caregiving among those with chronic dexterity and mobility problems in the current study suggests that mechanisms other than increased physical activity may be of importance. Perhaps one of the most important facets of caregiving is the increased sense of purpose it brings. Older adults who feel more useful have been shown to have lower mortality rates,⁴¹ and that having a purpose in life buffers against mortality risk at most adult age groups and is independent of other markers of psychological or affective well-being.⁴²

This study has significant strengths and limitations. Its strengths are that it relates to the entire population of caregivers rather than subgroups selected according to relationship or condition, and that cause of death is derived from validated records. The enhanced measures of self-reported health in the 2011 Northern Ireland Census, and especially the inclusion of specific causes of chronic morbidity, greatly extend previous census-based studies. Its caveats concern the information limitations of the census. There were no measures of caregiver stress or about the care recipient or nature of caregiving provided, though the inclusion of the 50 or more hours of caregiving category enabled an exploration of a greater level of intensity of caregiving than most other previous studies. Because deaths are available only to the end of 2013, the study was limited to examining the effects of caregiving on relatively short-term mortality, though further analysis with longer follow-up is planned as data become available. However, this means that there was less potential for confounding from the effects of bereavement or of hospitalization or admission of the care recipient to a formal nursing

establishment, all of which may be associated with an increased mortality risk amongst caregivers.^{43,44} A major concern, and one almost impossible to dismiss, is that the people who undertake and persist with a caregiving role may be healthier than those who do not.³⁰ However, the relatively small change in the hazard ratios after adjustment for a detailed array of indicators of health status at baseline and the beneficial effects of caregiving even among people with specific health problems, is strongly suggestive that these effects are not due to health selection effects.

It is likely that the association between caregiving and mortality is not straightforward and may be confounded by the relationship between the caregiver and recipient, the needs of the recipient and the social context of the caregiving.⁴⁵ It is also evident that caregiving generates a mixture of positive and negative responses which may be highly context-specific.^{46,47} However, this study clearly demonstrates that overall and for the majority of caregivers, the act of caregiving is associated with a lower rather than a higher risk of death. This indicates the need for a re-appraisal of the impact of caregiving on health, as others before us have also suggested.⁴⁸ The study does not rule out the possibility of higher risk among certain sub-groups of caregivers and does not obviate the need to identify those most at risk of the stresses of caregiving and the need to identify effective ways to alleviate this stress.

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