Volunteering is associated with increased survival in able-bodied participants of the English Longitudinal Study of Ageing.

Nina Trivedy Rogers[1*], Panayotes Demakakos[1], Mark Steven Taylor[2,3], Andrew Steptoe[1], Mark Hamer[1] and Aparna Shankar[1]

[1] Department of Epidemiology and Public Health, University College London, London, WC1E 7HB, UK

[2] Department of Public Health, Fakulta Zdravotnictva a Socialnej Prace, University of Trnava, Trnava, Slovakia.

[3] Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine, London, WC1E 7HT, UK

*Corresponding Author: Nina Rogers, Tel: +44 207 6798318.

Email address: n.rogers@ucl.ac.uk

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ABSTRACT

Background: Volunteering has been linked to reduced mortality in older adults but the mechanisms explaining this effect remain unclear. This study investigated whether volunteering is associated with increased survival in participants of the English Longitudinal Study of Ageing and whether differences in survival are modified by functional disabilities.

Methods: A multivariate Cox Proportional Hazards model was used to estimate the association of volunteering with survival over a period of 10.9 years in 10,324 participants, whilst controlling for selected confounders. To investigate effect modification by disability, the analyses were repeated in participants with and without self-reported functional disabilities.

Results: Volunteering was associated with a reduced probability of death from all-causes in univariate analyses (HR = 0.65, CI 0.58-0.73, P < 0.0001), but adjustment for covariates rendered this association non-significant (HR = 0.90, CI 0.79–1.01, P = 0.07). Able-bodied volunteers had significantly increased survival compared to able-bodied non-volunteers (HR = 0.81, 95% CI: 0.69 – 0.95, P = 0.009). There was no significant survival advantage among disabled volunteers, compared to disabled non-volunteers (HR = 1.06, CI 0.88–1.29, P = 0.53).

Conclusion: Volunteering is associated with reduced mortality in older adults in England, but this effect appears to be limited to volunteers who report no disabilities.

INTRODUCTION

Volunteering is widely regarded as a purely altruistic act, but a substantial and growing body of research has suggested that the practice is beneficial to the volunteer in terms of improved wellbeing[1–3], health[4–7] and survival[8–12]. Studies of volunteering have commonly focused on later adult life[8,11,12], largely because of a perception that during a time that can be associated with significant life transitions such as retirement and bereavement, volunteering is one way in which people may choose to rectify feelings of loss and control[13]. A biological mechanism by which volunteering might influence survival has yet to be demonstrated and discrepant results of previous studies have led to questions over whether such an effect truly exists[14]. Indeed, some studies have shown that volunteering does not independently predict survival once key covariates are controlled for[10,15,16]; leading some to conclude that volunteering is likely to be a proxy measure for other beneficial factors that influence survival.

Two opposing hypotheses are postulated with regard to who might benefit the most from volunteering. The "compensatory hypothesis" posits that the association between volunteering and risk of death increases as levels of resource (i.e. human and social capital) decrease[17]. It can be inferred from this model that the benefits obtained from volunteering might compensate for the loss of resources in those with disabilities and lead to improvements in survival[16] and wellbeing[13]. Indeed, a study by Okun and colleagues[16] concluded that volunteering significantly reduced the risk of death in those with functional limitations, but had no effect on the able-bodied. Alternatively, the premise of the "complementary hypothesis" is that as the levels of resource increase, so does the association between volunteering and survival(12). This model reasons that when resources are low, volunteering further taxes a person's already limited coping skills and becomes burdensome. Studies in support of this model have shown that volunteers who also have high levels of social contact or attend religious services survive

for longer than volunteers with less social contact or attendance of fewer religious services[9,12]. Moreover, Sabin and colleagues[18] presented data that suggested that volunteering only reduced the risk of death in participants who were in good health and without disability. Those who suffered from disability or poor health did not benefit from volunteering in terms of survival benefit.

Most studies examining the effects of volunteering on health and survival have done so using data from cohort studies from the USA[10–12,16,18]. In order to investigate the association between volunteering and survival in older English people, we used data from the English Longitudinal Study of Ageing (ELSA); a panel study of ageing among the English population that includes a nationally representative sample of women and men aged 50 and over[19]. The primary goal of this study was to determine if volunteering increases survival in older adults and if that association is modified by the presence of self-report disabilities. Due to the large sample size of the ELSA cohort and the long period of follow-up, a key strength of this study was increased statistical power. Confounders were taken into account in an attempt to reveal any independent protection from death by volunteering[8,9,11]; potential mediators were also included in the survival model to ascertain potential mechanisms through which volunteering might impact on mortality.

METHODS

Participants

Baseline data on volunteering status and other confounders and covariates were collected at wave one (2002/2003) of ELSA. The sample consisted of 10,324 participants who had complete data at this wave. Further details on the ELSA sample and data collection are available elsewhere[19].

Exposure

Frequency of volunteering was determined by the question *"How often do you do voluntary work?"* The response options were *"twice a month or more"*, *"about once a month"*, *"every few months"*, *"about once or twice a year"*, *"less than once a year"* or *"never"*. Those participants who volunteered at least once a month were classified as volunteers.

Confounding variables

Well described factors affecting survival were included as covariates or possible mediators in the analysis. These included age in years; gender; total non-pension wealth (quintiles); highest educational qualification (none, O-levels or A-levels, degree/higher or equivalent) and living arrangements (living with a partner or spouse/ living alone). Adjustment of covariates relating to health and behaviour included current smoking status; tertiles of global cognitive function (combined standardized scores on verbal fluency, immediate recall and delayed recall tests)[20]; most vigorous level of physical activity undertaken on a weekly basis (none, mild, moderate, vigorous); cardiovascular disease (CVD), which includes myocardial infarction, congestive heart failure, angina, hypercholesterolemia, stroke, heart murmur or abnormal heart rhythm; chronic lung disease (CLD) which includes emphysema or chronic bronchitis; previous cancer diagnosis (all types); depression (score ≥ 4 on the 8-item version of the Centre for

Epidemiologic Studies Disease scale (CES-D)[21,22] and functional disability. Functional disability was calculated using the Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (iADL) scales[23]. For each item on the scales, participants were asked if they were able to carry out the activity without help or if they required assistance. The six-item ADL list included dressing, walking across a room, bathing or showering, eating, getting in or out of bed and using the toilet. The seven-item iADL list included using a map to navigate an unfamiliar place, preparing a hot meal, shopping for groceries, making telephone calls, taking medications, doing work around the house or garden and managing money. Previous studies have demonstrated that a disability scale based on combining items from both ADL and iADL scales is an effective method for representing functional disability [24,25]. It has also been shown that ADLs and iADLs do not have a rigid hierarchy in terms of severity of disability, but rather there is a good degree of overlap between iADL and ADL items [25]. As most participants in ELSA did not require help with any of the thirteen items on the combined ADL/iADL list, we classified any individual requiring assistance with any one or more items on the combined 13-item list as having a functional disability [26].

Outcome

Mortality data were retrieved for those participants who consented to linkage to official records from the NHS central register. Survival was described in months from the date of the wave one interview. Month of death was recorded up until February 2013 when the study was censored. Mean follow-up time was 112.2 months (SD = 30.3).

Statistical analysis

Baseline differences on covariates between volunteers and non-volunteers were assessed using Pearson's chi-square test. Age differences between the 2 groups were tested using a t-test for

independent samples. Cox proportional hazards regression models were used to test the association between volunteering and survival in the full sample, whilst controlling for selected covariates. The interaction between volunteering status and presence of disability was examined, following which sub-group analysis was performed on those with (n=2917) and those without (n = 7403) disabilities.

Time-dependent covariate terms were used in the Cox models to test for violation to the proportional hazards assumption. To rule out potential reverse causation, sensitivity analysis was carried out by excluding deaths that occurred in the first two years of follow-up. All statistical analysis was performed in STATA 13.

RESULTS

Table 1 shows the baseline characteristics of respondents by volunteering status. Eighteen point nine percent of participants volunteered at least once each month, 5.7% volunteered more than once each year but less frequently than once each month, 2.2% volunteered less than one time each year and 73.2% never volunteered. Participants who volunteered at least once a month were classified as volunteers for the purpose of these analyses. A higher proportion of volunteers were female, better educated, wealthier, living with a spouse or partner and had higher levels of cognitive function. In addition, volunteers were healthier than non-volunteers, being less likely to suffer from CVD or CLD, to have a disability or to experience depression. Volunteers were however more likely to have a previous cancer diagnosis. Non-volunteers were almost 3 times more likely to lead a completely sedentary lifestyle and were nearly twice as likely to be current smokers when compared with volunteers. There were no significant differences in the age distribution of volunteers and non-volunteers.

Table 1: Baseline characteristics of ELSA sample by volunteer status

Known Risk Factors	Non-volunteers (n=8367)	Volunteers (n=1957)	P value
Age –mean (SD)	65.07 (10.5)	64.84 (9.3)	0.39
Male – N (%)	3884 (46.4%)	829 (42.4%)	0.001
Living with partner/spouse – N (%)	5703 (68.2%)	1389 (71.0%)	0.016
Wealth (lowest quintile) – N (%)	1756 (21.0%)	191 (9.8%)	<0.0001
No educational qualifications– N (%)	3990 (46.6%)	454 (23.2%)	<0.0001
Cancer [a]– N (%)	286 (3.4%)	86 (4.4%)	0.037
Cardiovascular Disease [a]– N (%)	1031 (12.3%)	205 (10.5%)	0.023
Chronic Lung Disease [a]– N (%)	527 (6.3%)	81 (4.1%)	<0.0001
Depressive Symptoms [b] – N (%)	1476 (17.6%)	190 (9.7%)	<0.0001
Cognitive function (lowest tertile) [c]– N (%)	3027 (36.2%)	427 (21.8%)	<0.0001
Current smoker – N (%)	1640 (19.6%)	196 (10.0%)	<0.0001
Functional disability (≥1 ADL/iADL) – N (%)	2529 (30.2%)	390 (19.9%)	<0.0001
Sedentary lifestyle– N (%)	973 (11.6%)	78 (4.0%)	<0.0001

[a] Previous diagnosis of specified disease
[b] Centre for Epidemiologic Studies Depression scale (CES-D) score of ≥ 4
[c] Combined standardized score on verbal fluency, immediate recall and delayed recall

Table 2 shows the number of participants requiring assistance to carry out specific tasks on the ADL and iADL measures. Within each of the ADL and iADL scales, the proportion of participants reporting that they required assistance to carry out certain activities varied greatly and depended on the activity type. Statistically significant differences in ADL prevalence between volunteers and non-volunteers were observed in every item on both scales. Dressing oneself (9.9% volunteers, 14.3% non-volunteers) and bathing (6.2% volunteers, 13.5% non-volunteers) were the two most commons activities within the ADL scale that participants reported needing assistance with. Working around the home and garden (9.4% volunteers, 17.6% non-volunteers) was the most common iADL with which participants experienced difficulty.

Table 2: Number and percentage of volunteers and non-volunteers requiring assistance for iADL and iADL items

Functional disability	Total sample	Volunteers	Non-Volunteers	Chi^2	P value
ADL:					
Dressing	1373 (13.3)	178 (9.9)	1195 (14.3)	37.0	<0.0001
Walking across a room	327 (3.2)	21 (1.1)	306 (3.7)	34.5	<0.0001
Bathing or showering	1252 (12.13)	121 (6.2)	1131 (13.5)	80.1	<0.0001
Eating	179 (1.73)	13 (0.7)	166 (2.0)	16.2	<0.0001
Getting in/out of bed	679 (6.58)	75 (3.8)	604 (7.2)	29.6	<0.0001
Using the toilet	366 (3.55)	43 (1.1)	323 (3.7)	12.8	<0.0001
iADL					
Using a map to get around	546 (5.29)	46 (2.4)	500 (6.0)	41.6	<0.0001
Preparing a hot meal	445 (4.31)	29 (1.5)	416 (4.9)	46.8	<0.0001
Shopping for groceries	954 (9.24)	60 (3.1)	894 (10.7)	109.8	<0.0001
Making telephone calls	175 (1.70)	18 (0.9)	157 (1.9)	8.7	0.003
Taking medications	152 (1.47)	13 (0.7)	139 (1.7)	10.9	0.001
Doing work around the home and garden	1653 (16.01)	183 (9.4)	1470 (17.6)	79.7	<0.0001
Managing money	238 (2.31)	18 (0.9)	220 (2.6)	20.6	<0.0001

At baseline there were 10,324 participants, of whom 2,412 (23.4%) died over the follow-up period. Three hundred and twenty seven volunteers (16.7%) and 2,085 non-volunteers (24.9%) died during the follow-up period. Mean time to death or censoring for the whole sample was 112.2 months (SD 30.3). In volunteers and non-volunteers mean time to death or censoring was respectively 117.1 months (SD: 24.7) and 111.1 months (SD 31.4).

In an unadjusted model, volunteering was associated with increased survival (HR 0.64, 95% CI 0.57-0.71). Adjustment for age and sex (Table 3) had a very small effect on the HR for mortality (model 1: HR 0.65, 95% CI 0.58 – 0.74). This association was reduced more substantially when wealth, education and living arrangements were included in the model (model 2: HR 0.73, 95% CI 0.65-0.83). Likewise inclusion of health conditions and disability further attenuated the effect of volunteering (model 3: HR 0.78, 95% CI: 0.69 – 0.88). The inclusion of factors that could be acting as both confounders and mediators between volunteering and mortality also reduced much of the relationship; controlling for cognitive function and depression (model 4: HR 0.82, 95% CI 0.73-0.93) followed by physical activity and smoking (model 5: HR 0.90, 95% CI 0.79 – 1.01) attenuated the association to non-significance and volunteering was shown to have no significant impact on survival in the total population. In sensitivity analysis, the exclusion of participants that died in the first 24 months of follow-up had a negligible effect on the association between volunteering and mortality.

Following this, the interaction between volunteering status and disability was examined to see if the effect of volunteering on mortality varied by disability status. This interaction was found to be significant (HR: 1.31, 95% CI 1.03 – 1.68) and sub group analysis by disability status was subsequently performed.

Table 3: Hazard ratios (HR) of survival in the total population.

	Model 1 HR (95% CI)	Model 2 HR (95% CI)	Model 3 HR (95% CI)	Model 4 HR (95% CI)	Model 5 HR (95% CI)
Volunteer	0.65 (0.58 – 0.74)	0.73 (0.65 – 0.83)	0.78 (0.69 – 0.88)	0.82 (0.73 – 0.93)	0.90 (0.79 – 1.01)
Age (in years)	1.09 (1.08 – 1.10)	1.08 (1.08 – 1.09)	1.07 (1.06 – 1.08)	1.07 (1.06 – 1.08)	1.06 (1.06 – 1.07)
Sex (Male)	1.58 (1.46 – 1.71)	1.69 (1.56 – 1.84)	1.71 (1.57 – 1.86)	1.68 (1.55 – 1.83)	1.71 (1.57 – 1.87)
No qualifications		1.04 (0.88 – 1.25)	1.06 (0.89 – 1.26)	0.95 (0.80 – 1.13)	0.93 (0.85 – 1.10)
Lowest wealth quintile		1.75 (1.51 – 2.03)	1.62 (1.39 – 1.87)	1.49 (1.28 – 1.73)	1.30 (1.12 – 1.51)
Living with a partner		0.91 (0.83 – 1.00)	0.91 (0.83 – 1.00)	0.92 (0.84 – 1.00)	0.93 (0.85 – 1.02)
CVD[a]			1.18 (1.07 – 1.31)	1.19 (1.07 – 1.32)	1.17 (1.06 – 1.30)
Cancer[a]			3.19 (2.31 – 4.42)	3.24 (2.33 – 4.48)	3.38 (2.44 – 4.68)
Chronic Lung Disease[a]			1.61 (1.42 – 1.83)	1.64 (1.44 – 1.87)	1.52 (1.34 – 1.74)
Disability[b]			2.09 (1.74 – 2.51)	1.60 (1.46 – 1.74)	1.42 (1.29 – 1.55)
Depressive symptoms[c]				1.09 (0.99 – 1.21)	1.02 (0.92 – 1.13)
Cognitive function[d]				0.87 (0.84 – 0.89)	0.88 (0.86 – 0.91)
Current smoker					1.71 (1.53 – 1.90)
Less than weekly physical activity					3.44 (2.56 – 4.63)

[a] Previous diagnosis of specified disease

[b] Activity of daily living (ADL) or instrumental activity of daily living (iADL), score of ≥ 1

[c] Centre for Epidemiologic Studies Depression scale (CES-D) score of ≥ 4

[d] Combined standardized score on verbal fluency, immediate recall and delayed recall

Volunteering, mortality and disability status

Able-bodied volunteers had a significant survival advantage over able-bodied non-volunteers (HR: 0.81 95% CI: 0.69 - 0.95) under the fully-adjusted model described above (Table 4A). Independent predictors of survival were similar in both the able-bodied and total population, except that having no educational qualifications or cohabiting with a partner or spouse were both found to have significant associations with altered survival in the able-bodied but not the total population. Depression was not associated with altered survival in this group. In sensitivity analysis, excluding participants who died in the first 24 months had a negligible effect on the association between volunteering and mortality for both the non-disabled and disabled groups.

In the disabled (Table 4B), volunteering had no significant and independent association with altered survival (HR: 1.06, 95% CI: 0.88 – 1.29). As before, depression was not significant but surprisingly neither being in the lowest wealth quintile, nor lacking educational qualifications, nor living with a spouse/partner appeared to have any association with altered survival in those with self-reported disabilities. We repeated this analysis using each of the 6-item ADL and the 7-item iADL scales in place of the combined (13-item) ADL/iADL lists. There were negligible differences between the association test results from the 13 item, 6 item or 7 item measures (data not shown).

Table 4: Survival in the A) able-bodied and B) disabled ELSA respondents

	A) Able-bodied (n=7403)		B) Disabled (n=2917)	
	HR (95% CI)	P value	HR (95% CI)	P value
Volunteer	0.81 (0.69 – 0.95)	0.01	1.07 (0.88 – 1.29)	0.51
Age (in years)	1.08 (1.07 – 1.10)	<0.0001	1.05 (1.04 – 1.06)	<0.0001
Sex (Male)	1.72 (1.53 – 1.95)	<0.0001	1.70 (1.50 – 1.92)	<0.0001
No qualifications	0.75 (0.59 – 0.95)	0.014	1.12 (0.84 – 1.50)	0.424
Lowest wealth quintile	1.40 (1.14 – 1.73)	0.001	1.09 (0.88 – 1.36)	0.428
Living with a spouse	0.71 (0.53 – 0.94)	0.016	0.89 (0.79 – 1.02)	0.085
Cardiovascular disease[a]	1.24 (1.06 – 1.45)	0.007	1.16 (1.01 – 1.33)	0.034
Cancer[a]	3.23 (2.00 – 5.24)	<0.0001	3.67 (2.34 – 5.75)	<0.0001
Chronic Lung Disease[a]	1.65 (1.31 – 2.07)	<0.0001	1.46 (1.24 – 1.70)	<0.0001
Depressive symptoms[b]	1.14 (0.95 – 1.36)	0.16	0.98 (0.86 – 1.11)	0.699
Higher cognitive function[c] (highest tertile)	0.88 (0.85 – 0.92)	<0.0001	0.88 (0.85 – 0.92)	<0.0001
Current smoker	1.90 (1.65 – 2.20)	<0.0001	1.48 (1.26 – 1.74)	<0.0001
No physical activity on a weekly basis	1.58(1.25 – 2.00)	<0.0001	4.19 (2.66 – 6.60)	<0.0001

[a] Previous diagnosis of specified disease
[b] Centre for Epidemiologic Studies Depression scale (CES-D) score of ≥ 4
[c] Verbal fluency, immediate recall and delayed recall

DISCUSSION

The purpose of this study was to determine whether participation in volunteering activities is associated with improved survival rates in a nationally representative community sample of older adults in England.

Volunteers in ELSA had a number of characteristics that would be described as beneficial to survival including better health and higher socioeconomic status. We observed that volunteers in the English population do have a survival advantage over non-volunteers (HR 0.64, CI 0.57-0.71) but that this became non-significant when the model was adjusted for a number of confounders and mediators. One interpretation of this finding is that volunteering does not directly influence survival; rather it is the type of person who volunteers that has favourable characteristics that promote survival. It is a proxy marker for a number of behaviours and characteristics that actually mediate the survival increase. Previous studies have shown that volunteers exhibit stronger salutary behaviours and are healthier and wealthier than non-volunteers[9,12,27] and it is possible that this selection effect is the underlying reason why volunteers are often observed to have a higher life expectancy compared with non-volunteers. On the other hand, volunteering might lead to the adoption of healthy behaviours[28] or impact positively on other outcomes[4,29] that are downstream and promote survival. The notion that any benefits of volunteering are a result of both selection and functional consequence of volunteering have been substantiated in previous reports[30,31] and are consistent with the results from this study. Our results indicate that whilst healthier people are more likely to volunteer, it is also possible that the beneficial effects of volunteering are mediated through factors that promote survival, such as physical activity. We conclude that it is probably a survival advantage to volunteer, but that the effect in the general population is quite small and

that volunteering behaviour is highly correlated with and potentially inextricable from a number of other well-described beneficial characteristics.

Subgroup analysis allowed us to explore whether volunteering was more advantageous in terms of survival only in those reporting no disabilities. To the best of our knowledge only two studies have examined this relationship and they have reported contradictory results [16,18]. The results of our study appear to support the *complementary hypothesis* and suggest that volunteering is advantageous to those who are not limited by the presence of disabilities. Furthermore, in those respondents who report at least one ADL or iADL, there appears to be no advantage to survival if they volunteer.

Factors such as self-perceived competency and feelings of usefulness have been reported to sculpt health trajectories and longevity [32]. Activities that require higher levels of commitment or which place greater physical demands on a person may bring more meaning to those who volunteer, but it may be harder for people with functional disabilities to take part in such activities. Functionally disabled volunteers may instead have to choose from a limited number of activities where they feel neither competent nor valued by others in the community. This disparity in the psychological rewards of volunteering might provide one explanation for the differential outcomes of volunteering between able and less-able bodied persons. Motivations for volunteering might also be a key factor, as volunteering for self-orientated (i.e. escaping from one's troubles or making one feel better about oneself) rather than altruistic reasons may be more common in those with functional disabilities, but has been reported to offer no survival benefit [10].

The diversity of roles that can be included under the umbrella of volunteering activity makes it difficult to disentangle which aspects of an activity might lead to beneficial effects to health

and survival. In this study we could not differentiate between different types of volunteering activities and within the context of ELSA we cannot explore the possibility that specific types of volunteering have more penetrant effects on the survival than others. The true effects of volunteering on mortality can therefore only be fully investigated with data that captures the different dimensions of volunteering. Differentiating between the physically active or more socially orientated activities will potentially be important, as will consideration of both motivation and satisfaction. Whilst the reporting of volunteering activity type might provide some insight into most beneficial activities for health and survival, even homogenous activities can differ with regards to the effort, value and motivation a person puts into the activity. Future studies should be designed that are able to address these issues directly.

The data were limited by the use of self-reported measures. ELSA includes only limited information about the frequency and intensity of volunteering and no information exists on type of activity. As we did not have a continuous measure, the optimal dose of volunteering could not be estimated.

Volunteering represents one avenue through which healthy older adults may be able to substantially improve their survival. However, more needs to be done to understand factors leading to improved health and longevity among older adults who already suffer from disability.

AUTHOR CONTRIBUTIONS

N.T. Rogers had full access to the data, and takes responsibility for the integrity and accuracy of the results. All authors contributed to the concept and design of study, drafting and critical revision of the manuscript.

COMPETING INTERESTS:

None declared

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"What this paper adds"

What is already known on this subject

- Evidence suggests that volunteering in older age is associated with increased survival
- Most studies have taken place in the USA
- The mechanisms through which volunteering affects health and survival are not known
- Few studies have examined how the benefits of volunteering differ according to disability status

What this study adds

- This is the first study to examine volunteering and survival in older people in the UK.
- In the overall population, there was no advantage through volunteering, after taking into account inter-individual differences in health status, cognitive function and health behaviours.
- Able-bodied volunteers had a survival advantage over able-bodied non-volunteers. Disabled volunteers had no survival advantage over disabled non-volunteers.

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