Volunteering is Associated with Delayed Mortality in Older People: Analysis of the Longitudinal Study of Aging

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Abstract

The Longitudinal Study of Aging (LSOA) assessed the health and social functioning of a representative sample of 7527 American community-dwelling older people (> 70 years). We tested the hypothesis that frequent volunteering is associated with less mortality risk when the effects of socio-demographics, medical status, physical activity and social integration are controlled. We used Cox proportional hazards analyses to assess the unadjusted and adjusted associations between frequency of volunteering and time-to-death (96-month follow-up). Death occurred in 38.3 percent of the sample. After adjusting for covariates, frequent volunteers had significantly reduced mortality compared to non-volunteers. This association was greatest for those who frequently visited with friends or attended religious services.

Keywords

Cox proportional hazards regression, mortality, older individuals, social support, volunteerism

VOLUNTEERING may benefit the volunteers themselves as well as the organizations and individuals they serve. Several mechanisms have been hypothesized linking volunteering to improved well-being, health and longevity. For example, volunteering provides increased opportunities for social contacts and facilitates access to salutary social resources, such as emotional, cognitive or material support and health-related information (Luoh & Herzog, 2002). Several studies have found that volunteering is associated with greater social integration (Midlarsky & Kahana, 1994) and more social connections (Oman, Thoresen, & McMahon, 1999). Theory and evidence linking social contact and support to health (see House, Landes, & Umbertson, 1988) make plausible the link from volunteering to health and longevity through the paths of social contact and support.

Volunteering may also be linked to improved well-being and health through increased physical activity and other health behaviors (Chambré, 1987). Many volunteering roles require some level of physical activity. The benefits of even moderate physical activity in older adults is well established (US Department of Health and Human Services, 1996). In terms of other health behaviors, volunteers appear to be less likely to smoke and to have more moderate alcohol use than non-volunteers (Musick, Herzog, & House, 1999; Oman et al., 1999). It is unclear if volunteering influences the adoption of healthy behaviors or if individuals who have these behaviors are more likely to volunteer.

Also, it has been hypothesized that volunteering might benefit health and well-being by providing meaningful social roles (Moen, Dempster-McClain, & Williams, 1992; Musick et al., 1999), as well as promoting positive beliefs about self-worth, personal motivations and agency. Furthermore, well-being and positive affect might mediate the link between volunteering and physical health including longevity. Oman and Thoresen (2000) suggested volunteering may increase social integration and support, reduce self-absorption, commitment to developmentally appropriate goals and increase self-efficacy and self-esteem, and thereby serve to increase the depth and frequency of positive emotions (e.g. happiness, calmness, sense of meaning and purpose). Positive emotions may reduce the burden of psychological and physiological stress and thereby beneficially impact health-related physiological processes (e.g. Fredrickson & Levenson, 1998).

Previous empirical research

Until recently, research examining the effects of volunteering on older adults has focused mostly on mental health and well-being outcomes. Evidence from both cross-sectional (Jirovec & Hyduk, 1998; Krause, Herzog, & Baker, 1992; Young & Glasgow, 1998) and prospective studies (Morrow-Howell, Hinterlong, Rozario, & Tang, 2003; Thoits & Hewitt, 2001; van Willigen, 2000) suggests that volunteering is associated with greater well-being and psychological functioning, even after controlling for relevant covariates. The findings imply that volunteering is not simply a proxy for other factors that are known to affect well-being, such as medical status, physical activity or social engagement.

However, relatively little is known about the physical health benefits of volunteerism in older adults. To date, four prospective studies (Luoh & Herzog, 2002; Musick et al., 1999; Oman et al., 1999; Shmotkin, Blumstein, & Modan, 2003) have examined the effect of volunteering on mortality risk in elderly samples, controlling in various degrees for socio-demographics, physical health, health behaviors, social integration and psychological functioning. Another study (Sabin, 1993), while not specifically focused on the effects of volunteering on mortality, reported a significant protective effect of volunteering on the four-year mortality of an older sample. Table 1 summarizes the relevant details of these five studies.

Overall, the evidence from these studies suggests that volunteering may be associated with delayed mortality. Furthermore, volunteering appears to be an independent predictor of mortality above and beyond several control variables including demographic characteristics, measures of social support and involvement, health behaviors and medical health status. In other words, volunteering is not solely a proxy for these constructs. However, the addition of these constructs into statistical models tended to reduce the magnitude of the volunteering—mortality association, suggesting proxy, moderating or mediating relationships are operating.

Table 1. Summary of five prospective studies of the effects of volunteering on mortality

Study	*Sample characteristics*	*1. Volunteering predictors* *2. Mortality outcome*	*Controls*	*Conclusions and issues raised*
Sabin (1993)	7502 people aged ≥70 years. Nationally representative. LSOA data set 15.7% volunteers	1. Volunteering in last year (y/n) 2. Fact of death, 4-year follow-up	Demographics Health status Limitations in activities of daily living (ADL)	This study did not specifically focus on the volunteering/mortality association. A significant association was reported between volunteering and lower 4-year mortality for those in good health and no limitations in ADLs, but not for those in fair health or 1+ limitation in ADLs. The magnitude of the relationship is not reported. No exploration of volunteering/mortality moderators
Oman, Thoresen, & McMahon (1999)	1972 residents of Marin County California aged ≥55 years. Marin County dataset 31% volunteers	1. Number of organizations (0, 1, <2) and number of hours per year volunteering 2. Time to death, avg. 4.9-year follow-up	Demographics Health status Health behaviors Social integration Psych. functioning	In the adjusted model, volunteering for 2 or more groups reduced mortality risk 40% compared to no volunteering. Volunteering was more protective for those with high religious involvement and social support but low social activity. A monotonic 'dose-response' relationship was observed when hours/week was used instead of number of organizations as the main predictor
Musick, Herzog, & House (1999)	1211 people aged ≥65 years. Nationally representative. American's Changing Lives data set. 35% volunteers	1. Number of organizations (0, 1, ≥2) and number of hours per year volunteering (<40 hours, >40 hours) 2. Time to death, avg. 7.5-year follow-up	Demographics Health status Health behaviors Social integration	In the adjusted model, volunteering for 1 organization reduced mortality risk 44% compared to no volunteering. Volunteering for >1 organization was not linked to reduced mortality risk. A curvilinear relationship between hours of volunteering and mortality was found. The protective effect of moderate volunteering was most pronounced among those with the least social interaction. Contrary to expectations, the protective effect of moderate volunteering was marginally greater for those living with others

Continued

Table 1. Continued

Study	*Sample characteristics*	*1. Volunteering predictors* *2. Mortality outcome*	*Controls*	*Conclusions and issues raised*
Luoh & Herzog (2002)	4860 people aged ≥75 years. Nationally representative. AHEAD data set 12% volunteered >100 hrs/year	1. >100 hours of volunteering/year (y/n) 2. Tricotomized (e.g. good-to-excellent health, fair-to-poor health and dead)	Demographics Social integration Physical activity and health Psych. functioning	In the adjusted model, volunteering more than 100 hours annually reduced the odds ratio of death/excellent health by 62%. Volunteering more than 100 hours did not impart additional benefits. The categorization scheme in this study makes comparison with other studies difficult. For example, those volunteering less than 100 hours annually were grouped with people who did not volunteer
Shmotkin, Blumstein, & Modan (2003)	1343 people aged ≥75 years. Representative of 'old-old' Israeli Jewish population. CALAS data set 11% volunteers	1. Fact and frequency of volunteering 2. Time to death, avg. 7.9-year follow-up	Demographics Non-volunteering activity outlets Functional markers	In the adjusted model, volunteering > than once weekly reduced mortality risk 38%, and > than once monthly 40%, compared to no volunteering. Volunteering more rarely was not linked to mortality. Although there was some evidence that those with higher activity levels experienced more benefit, the search for moderators was largely unfruitful

The structure of explanatory models

A common approach to testing explanatory models using observational data is a unique variance strategy, that is attempting to 'explain away' the association between the construct of interest (in this case volunteering) and an outcome (in this case time-to-death) with 'control' variables known to be associated with both. For example, if a significant association between volunteering and mortality is reduced to non-significance after the addition of a measure of physical activity to the model, it is concluded that volunteering is not an independent predictor of mortality. The implied interpretation of this conclusion is that effects of volunteering are simply a proxy for or are reducible to the effects of physical activity, and therefore it is not very interesting. It is important to note that this statistical result (i.e. the erosion of the volunteering effect when physical activity is added) supports at least two causal models. As mentioned, the first model stipulates that people who are physically active tend to be involved in more activities including volunteering, and tend to be healthier and live longer. In other words physical activity causes both volunteering and longevity. However, the statistical results would also be consistent with a model wherein volunteering produces increased physical activity, resulting in improved health and longevity. In either case, baseline measures of volunteering and physical activity will be correlated and the association between volunteering and mortality will be eroded by the addition of physical activity in the model.

Some of the options for distinguishing between these models, such as mediational analysis of time structured data (Baron & Kenny, 1986) have data requirements that are almost never met in the context of Cox regression analysis of national health data (Allison, 1995; Singer & Willett, 2003). Specifically, the values of covariates must be known for every individual still at risk at each event time (Singer & Willet, 2003). Although the data used in the present study share this limitation and therefore will not be able to discriminate underlying mechanisms $A \rightarrow B \rightarrow C$ from $B \rightarrow A \rightarrow C$ from $A \leftrightarrow B \rightarrow C$, we encourage the reader to keep these possibilities in mind. We can conduct moderator analyses with survival data, that is determine for whom the observed effects, if any, are more pronounced.

Questions raised by the literature

This literature raises many questions: first, the operational definition of volunteering and the measurement of mortality varied substantially across studies, making it hard to directly compare the findings. Second, although these studies offered initial estimates of effect-sizes, the magnitude and functional form of the volunteering/mortality association are still unclear. Third, more research is needed to identify person and context factors that affect the strength of the associations between volunteering and mortality. The evidence on this point is sparse and mixed. For example, both of the studies summarized in Table 1 that examined the moderating effect of social integration and activity (Musick et al., 1999; Oman et al., 1999) found somewhat contradictory results.

The present study

In the present study, we build on the current literature exploring the following questions: (a) Is more frequent volunteering associated with less mortality risk even when the effects of socio-demographics, medical and physical activity status and social integration and support are controlled? This portion of the study was intended to replicate the primary findings of previous studies in another nationally representative sample of American older people, and to use comparable measures of volunteering frequency and mortality so that results might be compared. (b) What personal characteristics (moderators) influence the strength of the volunteering/mortality associations? Based on the results of Oman et al. (1999), we speculate that access to social resources and an underlying ability to profit from social contexts, tapped by measures of social integration, will interact with frequency of volunteering in predicting mortality risk. Specifically, we wonder if people with more social contact, support and integration will experience greater protective effects from volunteering than those who are less socially integrated. In contrast, one might

logically argue that volunteering provides opportunities to glean health-promoting information and social resources (House et al., 1988) that should be most valuable to individuals lacking these resource from other venues. By examining this issue, we attempt to improve our understanding of who does and does not benefit from volunteering.

In the present study, we examined data from the Longitudinal Study of Aging (LSOA; US Department of Health and Human Services & National Center for Health Statistics, 1993). Here we extend a previous study (Sabin, 1993) of the LSOA data by: (a) focusing primarily on volunteering instead of social relationships more generally; (b) using frequency of volunteering instead of a dichotomous measure of volunteering as a major predictor; (c) using time until death instead of the occurrence of death as the major outcome; (d) considering the entire 96-month follow-up period instead of only the first 48 months; and (e) using more extensive controls of physical health and activity factors.

Methods

Data

The LSOA assessed the health and social functioning of a nationally representative sample of community-dwelling older people. The initial survey was conducted in 1984 and included 7527 non-institutionalized people age 70 years or older. The interviews were conducted in the respondents' homes, with family members interviewed when participants were unable to answer themselves. Surviving participants or proxies were re-interviewed in 1986, 1988 and 1990. Other than mortality data, the present study only used information collected at baseline. Of the original 7527 respondents, data on volunteering were available on 7496 (99.6%).

Statistical analysis

Potential explanatory variables were retained for further analysis if they were significantly associated ($p < .10$) to mortality and volunteering in separate age and sex-adjusted regression models. Then, hierarchical Cox proportional hazards analyses (Allison, 1995; Singer & Willett, 2003) were used to assess unadjusted and adjusted associations between volunteering and mortality. Model 1 contained only frequency of volunteering as a predictor. In Model 2, the socio-demographic variables of sex, age, income and education were added as predictors. In Model 3 predictors related to health status and limitations were added. These first three models directly examine our question regarding the effect of volunteering on mortality controlling for demographic and health characteristics that are associated with both. In Model 4 predictors related to physical activity were added. Finally, social functioning and support variables were included as predictors in Model 5. This strategy of sequentially adding predictors allows us to identify the factors that explain part or all of the significant bivariate association between volunteering and mortality. To determine if a model was an improvement over the previous model, goodness-of-fit (–2 log-likelihood) and change-in-goodness-of-fit (Δ–2 log-likelihood) statistics were calculated and compared to a χ^2 distribution [17] (presented in Table 3).

Finally, we added interaction terms composed of level of volunteering and person/context variables of interest (e.g. level of volunteering X lives alone) to Model 5. In this manner, we sought to identify characteristics of individuals for which stronger or weaker links between volunteering and mortality existed.

The LSOA used a complex sampling strategy to produce national estimates of non-institutionalized (community-dwelling) people age 70 years or older at baseline. It has been demonstrated that the available statistical strategies to account for the disproportionately stratified multistage cluster sampling design of the LSOA have little effect on variance estimation in age and sex-adjusted multivariate models (Fitti & Kovar, 1987). Therefore, we used the unweighted data in the present study.

Measures

Mortality information (occurrence and date of death) was obtained from the National Death Index (NDI), a computerized compilation of all death certificates in the United States. The LOSA employed a complex, multistage process for establishing and verifying matches between participant identifiers (including social security numbers) and NDI data. This procedure is described elsewhere (US Department of Health and Human Services & National Center for

Health Statistics, 1993). Survival times to the nearest month were calculated for participants who died between January 1984 and December 1991 (n = 2866). The remaining participants were either verified or presumed to be alive at the end of the death certificate screening period (96 months).

Participants were asked if they presently did 'any volunteer work such as helping in charity work, working in a shop for a non-profit organization, working in a hospital or nursing home without pay, or doing community work without pay', as well as how often they participated in volunteerism during the previous 12 months (never, rarely, sometimes or frequently). We used the frequency measure as the primary predictor in these analyses.

We grouped covariates into four categories: (1) socio-demographics; (2) health; (3) physical activity; and (4) social functioning and support. Socio-demographic variables were included as they may be associated to both volunteering frequency and time-to-death. Health variables were included because volunteering might be a proxy for health status (only those of sufficient health can volunteer) and therefore must be controlled in our evaluation of the impact of volunteering on mortality. Physical activity variables and social support variables were included based on their previously discussed roles in hypothesized mechanisms linking volunteering to health and longevity. Continuous, count and ordinal variables were not transformed if their distributions were not severely skewed, in which case further grouping was conducted. Table 2 indicates which variables were transformed. All grouping and transformations were conducted prior to other analyses.

Socio-demographics variables included age group (70–74, 75–79, 80–84, 85+), sex, income (greater/less than $15,000/not reported), ethnic group (Not Caucasian/Caucasian), years of education, employment status (not working/working) and veteran status (no/yes). These are the variables assessed by LSOA that possibly correlated to both volunteering and age-of-death.

Health variables included self-reported health rated good or excellent (no/yes), no limitations on major or other activities (no/yes), Body Mass Index (BMI), difficulty walking a quarter mile without aid (no/yes). A medical conditions scale was constructed by screening medical history items to identify those associated ($p < .10$) with both volunteering and mortality in age and gender adjusted regression models. Seven items met this criterion: ever had broken hip; ever had hardening of the arteries; ever had hypertension; ever had coronary heart disease; ever had angina pectoris; ever had a stroke or cerebrovascular accident; had diabetes during the past 12 months. The medical condition scale was the sum of these no–yes items yielding a score between 0 and 7.

Physical activity variables included having a regular exercise routine (no/yes) and describing oneself as being a lot more active than peers (no/yes). Social integration variables included married (no/yes), living alone (no/yes), use of local senior center (no/yes), got together with friend/neighbors in the last 2 weeks (no/yes), got together with relatives in the last 2 weeks (no/yes), went to church or temple in the last 2 weeks (no/ yes) and went to movies, sporting events, etc. in the last two weeks (no/yes).

Results

Table 2 presents descriptive statistics for the predictors and covariates retained for analysis, as well as the correlations between these variables, volunteering and mortality. The mean of dichotomous variables is the proportion of people endorsing the item. For example, 38.2 percent of the sample died during the 96-month follow-up period. At baseline, 15.4 percent reported volunteering at least rarely (more than never) during the preceding 12 months. Among volunteers, 63.6 percent reported doing so frequently, 27.7 percent sometimes and 8.7 percent rarely. In terms of socio-demographic variables, 62.1 percent of the sample was female, the mean (SD) age was 76.8 (5.60) years, with an average of 10.1 years of formal education and 53.6 percent of the sample had an annual income of less than $15,000. In terms of health and disability, the average number of medical conditions was less than one, 64.1 percent reported no limitation of major or other activities, although 65.9 percent had difficulty walking a quarter mile unassisted. In terms of physical activity, 25.5 percent had a regular exercise routine and 26 percent rated themselves as a lot more active than their peers. In terms of social

Table 2. Descriptive statistics and correlations with volunteering and mortality ($N = 7496$)

Variable[a]	*Range*	*Mean*	*r with volunteering (Yes = 1)*	*r with mortality (No/Yes)*
Died	0–1	.382	–.13***	
Frequency of volunteering in last 12 months				
Never	0–1	.846		.13**
Rarely volunteers	0–1	.013		–.03**
Sometime volunteers	0–1	.043		–.05**
Frequently volunteers	0–1	.098		–.11***
Socio-demographics				
Female	0–1	.621	–.04***	–.13***
Age in years	70–99	76.800	–.12***	.27***
70–74 years	0–1	.446	.10***	–.19***
75–79 years	0–1	.306	.00	–.03**
80–84 years	0–1	.168	–.05***	.11***
85 years and older	0–1	.110	–.09***	.21***
Education (in years)	0–19	10.100	.21***	–.08***
Caucasian	0–1	.91	.05***	–.13***
Income <$15000	0–1	.536	–.07***	.04**
Income >$15000	0–1	.293	.12***	–.04**
Income unknown or refused	0–1	.172	–.05**	.01
Veteran	0–1	.100	.03*	–.04**
Health				
Number of chronic medical conditions	0–7	.911	–.07***	.18***
No limitations of major activities	0–1	.641	.12***	–.22***
Has difficult walking 0.25 mile	0–1	.659	–.17***	.25***
Self-reported health status very good or better	0–1	.354	.13***	–.14***
Physical activity				
Rates self a lot more active than peers	0–1	.261	.17***	–.11***
Has a regular exercise routine	0–1	.256	.10***	–.09***
Social functioning and support				
Married	0–1	.479	.04**	–.03***
Lives alone	0–1	.364	.03*	–.02*
Frequently uses senior center	0–1	.164	.18***	–.05***
Visited with friends or neighbors last 2 weeks	0–1	.313	.19***	–.12***
Visited with family last 2 weeks	0–1	.772	.03***	–.05***
Attended church or temple last 2 weeks	0–1	.507	.23***	–.18***
Movies, sporting events, etc. last 2 weeks	0–1	.244	.31***	–.15***

[a] Income, veteran: Has difficulty walking 0.25 mile, self-reported health status very good or better and rates self a lot more active than peers are dichotomized forms of variables that originally contained highly skewed distributions among more categories

*$p < .05$; **$p < .01$; ***$p < .001$

functioning, integration and support variables, 47.9 percent reported being married, 36.4 percent were living alone, 16.4 percent used a local senior center, 31.3 percent had visited with friend/neighbors during the past 2 weeks and over 50 percent attended church or temple in the past 2 weeks. The correlations between variables are as expected: in general, individuals who were in better health, were more active and had more social resources were more likely to volunteer and had less mortality risk.

Table 3 presents the results of the hierarchical Cox proportional hazards analyses. Note that hazard ratios can be interpreted as the risk

Table 3. Estimated net effects of amount of volunteering and other variables on mortality (Cox proportional hazards estimates; $N = 7496$) (All entries are hazard ratios and selected 95% confidence intervals)[a]

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Rarely volunteers (reference group: never volunteers)	.59* (.40, .86)	.75 (.51, 1.10)	.88 (.60, 1.30)	.90 (.61, 1.32)	1.01 (.69, 1.50)
Sometime volunteers	.58*** (.47, .72)	.66*** (.53, .82)	.75** (.61, .94)	.77* (.62, .95)	.71 (.89, 1.11)
Frequently volunteers	.47*** (.40, .55)	.55*** (.47, .65)	.67*** (.57, .79)	.69*** (.59, .82)	.81* (.68, .96)
Socio-demographics					
Female (reference group: Male)		.61***	.56***	.55***	.54 *** (.49, 59)
75–79 years (reference group: 70–74 years)		1.37***	1.37***	1.37***	1.35*** (1.22, 1.48)
80–84 years		2.24***	2.04***	2.05***	1.98*** (1.78, 2.20)
85 years and older		3.41***	2.87***	2.90***	2.70*** (2.39, 3.02)
Education in years		.99	1.00	1.00	1.00 (.99, 1.02)
Ethnicity (reference group non-Caucasian)		.96	.95	.93*	.94 (.97, 1.00)
Income > $15,000/year (reference group <$15,000/year)		.94	.95	.96	.98 (.90, 1.07)
Income unknown/refused		.90*	.95	.94	.94 (.84, 1.04)
Veteran		1.05	1.06	1.06	1.04 (.92, 1.19)
Health and physical activity					
Number of chronic conditions			1.17***	1.17***	1.17*** (1.13, 1.21)
No limitations of activities			.74***	.75***	.77*** (.71, .85)
Has difficult walking 0.25 mile			1.54***	1.49***	1.43*** (1.30, 1.55)
Self-reported health status very good or better			.79***	.82***	.82*** (.75, .90)
Has a regular exercise routine				.90*	.91 (.83, 1.00)
Rates self a lot more active than peers				.87**	.88** (.80, .97)

Continued

Table 3. Continued

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Social functioning and support					
Married					.83*** (.74, .92)
Lives alone					1.06 (1.00, 1.17)
Frequently uses senior center					1.00 (.90, 1.12)
Visited with friends or neighbors last 2 weeks					.96 (.89, 1.05)
Visited with family last 2 weeks					.96 (.88, 1.04)
Attended church or temple last 2 weeks					.76*** (.70, .83)
Movies, sporting events, etc. last 2 weeks					.80*** (.72, .89)
Model fit statistics					
χ^2/d.f.	120.9/3	877.2/12	1434.8/17	1448.3/19	1545.0/26
$\Delta\chi^2$/d.f.	140.0/3	756.3/9	557.6/5	13.5/2	99.7/7
p: $\Delta\chi^2$/d.f.	***	***	***	***	***

[a] A hazard rate is the instantaneous risk of a person experiencing death at each specified time. The proportional hazard assumption states that the relative hazards rate for two groups does not depend on time. In other words, the hazard of one group is a constant proportion of the hazard in the other. If hazards between groups are proportional, the effect of group membership can be summarized by a single quantity, the hazard ratio (HR). If the ratio r equals one, the hazards are equal and group membership has no effect on survival.

For variables with many categories, a hazard ratio is the ratio of hazard rates for people in a comparison group compared to people in a reference group. For example in Model 1, frequent volunteers have a hazard rate .47 times as large as the reference group (never volunteers). With continuous variables, such as years of education, the hazard ratio compares hazard rates at successive increments. For dichotomous variables, such as female or currently living w/spouse, the implied reference group is the opposite

*$p < .05$; **$p < .01$; ***$p < .001$

of death compared to the reference group, given the other variables in the model. In Model 1, in the absence of covariates, we found that, compared to individuals who never volunteered, those who rarely volunteered had a 41 percent reduction in mortality risk ($p < .05$), those who sometimes volunteered had a 42 percent reduction in risk ($p < .001$) and those who frequently volunteered had a 53 percent reduction in mortality risk ($p < .001$).

In Model 2, when sex, age and other socio-demographic variables are included, individuals who rarely volunteered no longer had a significant reduction in mortality risk, those who sometimes and frequently volunteered had a 34 percent and 45 percent reduction in risk respectively ($p < .001$).

In Model 3, when health and disability variables were accounted for, compared to people who never volunteered, those who rarely volunteered had no significant reduction in mortality risk, those who sometimes volunteered had a 25 percent reduction in risk ($p < .01$) and those who frequently volunteered had a 33 percent reduction in mortality ($p < .001$). In Model 4, when physical activity variables were accounted for, compared to people who never volunteered, those who rarely volunteered had no significant reduction in mortality risk, those who sometimes volunteered had a 23 percent reduction in risk ($p < .05$) and those who frequently volunteered had a 31 percent reduction in mortality ($p < .001$).

Finally, in Model 5 with the inclusion of social functioning and support variables, volunteering rarely or sometimes provided no significant reduction in mortality risk compared to never volunteering, but individuals who frequently volunteered had a 19 percent reduction in mortality risk (HR = .81, 95% CI: .68, .96; $p < .05$). Accordingly, frequent volunteering is significantly associated with survival times, in a way that is over and above what is accounted for by demographic, physical health and activity or social support and integration variables.

When added to Model 5, the interaction terms of sex by levels of volunteering were not significant, consistent with previous results (Oman et al., 1999). Having attended religious services in the past two weeks significantly interacted with level of volunteering ($p < .05$). Constructing the full model separately for religious service attenders and non-attenders we found dramatically different effects for volunteering on mortality risk. For attenders ($n = 3804$), frequent volunteering reduced mortality risk by 30 percent (HR = .70, 95% CI: .56, .86, $p < .001$) compared to non-volunteers. In non-attenders, there were no significant associations between volunteering frequency levels and mortality. This result is consistent with previous results (Oman et al., 1999) but of greater magnitude.

The interaction term of having visited with friends/neighbors during the past 2 weeks with level of volunteering was also significant ($p < .05$). Frequent volunteering had a protective effect only for those who had visited with friends/neighbors (HR = .81, 95% CI: .68, .98, $p < .05$). Terms for interactions between the level of volunteering and living alone, living with spouse, senior center, visiting with family and attending sporting or other events were not significant. However, the trend was consistently in the direction of greater benefit for people with more social contact.

Discussion

Main effects

We found that more frequent volunteering is associated with delayed mortality even when the effects of socio-demographics, medical and disability characteristics, self-ratings of physical activity and social integration and support are controlled. The effect of volunteering on mortality appears to be more than a proxy for the well-known effects of social support, health, age and other variables. However, the magnitude of the volunteering effect was eroded to near non-significance in the fully adjusted model, especially by the inclusion of the social support variables. This may have resulted from one or both of the following processes, although we cannot say in what proportion: (a) the volunteering/mortality relationship might be mediated by social support and physical activity; and/or (b) to some degree, volunteering might be a proxy for better health, activity level or demographic variables known to be associated with mortality. Given that the most influential social integration variables (married, religious service attendance and going to movies and sporting events) are not likely influenced by volunteering, we speculated that most of the

erosion of the volunteering/mortality link was due to the latter, rather than former, process.

The magnitude of the volunteering/mortality association appears to be smaller than that reported in previous studies using similar methodology (e.g. Musick et al., 1999; Oman et al., 1999). It is unknown to what extent these differences are the result of differences in how volunteering was operationalized or characteristics of the samples. The LSOA sample was somewhat older than the other samples. Only 15.7 percent of the LSOA sample reported volunteering during the previous year. This is a lower proportion of volunteers than shown in other studies of older US citizens (e.g. Musick et al., 1999; Oman et al., 1999) that reported volunteer rates of roughly double that in the present sample.

Moderators

It is reasonable to assume that individuals with lower social support and integration might have the most to gain from the social opportunities afforded through volunteering. We found the opposite to be true. Volunteers who visited with friends or attended religious services during the previous two weeks had greater reductions in mortality risk than volunteers with less social contact. The magnitude of the difference between religious service attenders and non-attenders was unexpected. However, this is not the first study to find that volunteering is more beneficial to those with more contact and support outside the volunteering context. Oman et al. (1999) found the protective effect of volunteering was strongest among those older volunteers who also had close intimate relationships or who frequently attended religious services. In a younger sample, Allen, Philliber, Herrling and Kuperminc (1997) found that volunteering in community service reduced unwanted pregnancy and other problem behaviors, but more so for adolescents who had other supports and resources, such as instruction and group discussions aimed at helping them cope with pressing developmental challenges.

Close personal relationships and religious service attendance may both be viewed as opportunities to access important cognitive and emotional resources. Especially for older people adjusting to declining physical functioning and closer proximity to death, religion and spirituality may provide especially salient coping resources (Pargament, 1997). Why should volunteers with access to cognitive and emotional resources outside the volunteering context benefit more from volunteering than others? Oman and Thoresen (2000) theorize that engagement with these resources may facilitate the development of and commitment to developmentally mature goals. In older people, contact with close friends and religious service attendance may facilitate developmentally mature goals such as sustained engagement with life or desire to become or remain generative. The person who approaches volunteering with these goals may find the experience more satisfying and may persist at it longer in the face of obstacles. As Oman and Thoresen (2000) also note, volunteering is a way of experientially enacting and solidifying these new goals, helping to reduce attachments to old goals (e.g. careerism). Reduced attachment to old goals and commitment to new goals may lead to more positive affect and commitment to health behaviors that in turn may influence health. From this perspective, close social relationships and religious service attendance act as scaffolds from which the volunteering experience is more developmentally significant and beneficial.

Limitations

In the present study, we did not have access to information regarding nature of volunteer work performed, the motivations for engaging (or not engaging) in such work, the actual and perceived costs and benefits of the volunteer experience or how characteristics of the person, such as social skills or meaning-making ability, interacted with volunteering work. It is important to note that self-rating of volunteering frequency may be imperfectly correlated with actual frequency of volunteering. It is possible that someone who rates participation in volunteer work as 'frequent' may in fact volunteer less than someone who rates their volunteer frequency as 'rarely'. It may be more accurate to say that we found an association between *perceived*, rather than actual, frequency of volunteer work and mortality.

Also, although the effect of more frequent volunteering remained significant ($p < .05$) after the addition of many control variables, it is possible that the addition of constructs not

assessed in LSOA such as personality, might eliminate the significance of these effects. Recent work on the effects of personality on mortality in old age (e.g. Wilson, Mendes de Leon, Bienias, Evans, & Bennett, 2004) has found that variables possibly associated with volunteering, such as low neuroticism and high conscientiousness, also predict delayed mortality. It is unknown if volunteering frequency would still predict delayed mortality if these factors were assessed and controlled.

Future directions

Many questions remain. The direction and magnitude of associations between volunteering frequency and other well-established mortality risk factors need to be clarified. Both well-controlled observational studies and randomized trials can further our knowledge in this area. Future observational research should include more detailed and frequent assessment of volunteering activities, volunteering motivations and perceived costs and benefits of volunteering, as well as more nuanced assessment of social integrating, coping and religious orientation and involvement. As noted in Okun and Schultz (2003), many motivations exist for engaging in volunteer work (e.g. career, understanding, enhancement, protective, making friends, social and values). Furthermore, their findings suggest significant variability in motivations between people of all ages. Knowing more about the relationships between volunteering motivations, access to social resources and health processes will greatly enhance our knowledge in this area.

However, no matter how careful or exhaustive researchers are to include all possible confounding variables, there is always the possibility that one or more key variables will be omitted. Therefore, to establish if the volunteering/mortality association is causal, or if volunteering is a proxy for other causal agents, the observational research conducted thus far can act as a foundation to design randomized trials of volunteering promotion interventions (Lawlor, Smith, Bruckdorfer, Kundu, & Ebrahim, 2004).

Although no volunteering interventions have been evaluated with respect to mortality risk, one recent trial found that physical activity, strength, the number of people one could turn to for help and cognitive activity increased significantly, and walking speed decreased significantly less in older adults randomized to volunteer in public elementary schools compared to controls at four to eight-month follow-up (Fried et al., 2004). Larger randomized trials with longer follow-up periods, that also track time to death, might shed considerable light on how and for whom volunteering reduces mortality risk. The observational studies conducted to date will provide important guidance to future randomized trials in this area in terms of identifying variable for which baseline equivalence must be checked, as well as possible moderators of intervention effects.

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