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Original Article

Longitudinal Associations Between Formal Volunteering and Cognitive Functioning

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Abstract

Objectives: The present study examines the association between formal volunteering and cognitive functioning over time. We also examine the moderating roles of race, sex, education, and time.

Method: Using 11,100 participants aged 51 years and older and nine waves of data from the Health and Retirement Survey, we simultaneously modeled the longitudinal associations between engaging in formal volunteering and changes in cognitive functioning using multilevel models.

Results: Formal volunteering was associated with higher levels of cognitive functioning over time, especially with aspects of cognitive functioning related to working memory and processing. This association was stronger for women than it was for men, and for those with below average levels of education. The positive association between formal volunteering and cognitive functioning weakened over time when cognitive functioning was conceptualized as memory, but strengthened over time when conceptualized as working memory and processing.

Discussion: Volunteering is a productive activity that is beneficial not just to society, but to volunteers' levels of cognitive functioning in older age. For women and those with lower levels of education, formal volunteering appears particularly beneficial to working memory and processing.

Keywords: Cognitive health, Longitudinal methods, Productive activity

Good cognitive functioning is critical to the definition of successful aging and to the ability of older adults to maintain an active, engaged lifestyle (Strawbridge, Cohen, Shema, & Kaplan, 1996). Cognitive functioning declines with age (James, Wilson, Barnes, & Bennett, 2011), but a significant amount of research has shown that one way older adults can maintain or increase cognitive functioning is via volunteering. Most of this literature focuses on formal volunteering, defined as participation in formal organizations in which the beneficiary is typically an unknown other (Li & Ferraro, 2005). In general, formal volunteering is found to be associated with positive outcomes for older adults, and even when accounting for the fact that more advantaged older adults select into volunteering, the beneficial effect of volunteering remains (e.g., Hao, 2008).

The literature on formal volunteering and its associations with physical health is robust, and longitudinal studies find that formal volunteering is associated with reduced mortality and increased self-rated health and physical function (Morrow-Howell, Hinterlong, Rozario, & Tang, 2003; Van Willigen, 2000). Less is known, however, about the association between formal volunteering and cognitive functioning. Models of older adult health promotion propose that volunteering increases physical activity, social engagement, and cognitive simulation (Fried et al., 2004)—all key components of successful aging that relate to better cognitive functioning

(Anderson et al., 2014). The purpose of this study is to determine the extent to which engaging in formal volunteering is associated with cognitive functioning over time in older adults.

Formal Volunteering and Cognitive Functioning

While the associations between formal volunteering and physical and mental health are well established, there is less evidence for the associations between volunteering and cognitive health. Because formal volunteering likely requires cognitive, social, and intellectual engagement, it might improve, maintain, or slow the decline of cognitive functioning. A study of over 2,500 older adults across 8 years showed that those who worked or volunteered were more likely to maintain cognitive functioning, whereas those who did not were more likely to decline cognitively over time (Yaffe et al., 2009). Infurna and colleagues (Infurna, Okun, & Grimm, 2016) examined the incidence of cognitive impairment over 14 years in respondents aged 60 years or older in the Health and Retirement Study (HRS), and found that those who were formally volunteering at baseline and those who maintained their volunteer role over time were at a reduced risk of becoming cognitively impaired over time. Taken together, these studies offer preliminary evidence that volunteering in older adulthood might prevent or slow the onset of cognitive impairment. However, the Yaffe et al. (2009) study did not isolate the effect of volunteering specifically, and Infurna and colleagues did not account for the amount of volunteering older adults were engaging in.

An example of the association between formal volunteering and cognitive functioning that does account for hours spent in the volunteer role comes from the Experience Corps program (Fried et al., 2004). The Experience Corps draws on a social model for health promotion and targets high-risk older adults in metropolitan areas to engage with school children in study designated schools. The tenets of a social model for health promotion suggest that engaging in generative volunteer work in older adulthood will increase physical activity, social engagement, and cognitive stimulation, which in turn will result in improved health outcomes, quality of life, and cognitive function. The Experience Corps program is highly structured and, in terms of time commitment, quite demanding (requiring participants to engage a minimum of 15 hr per week; see Fried et al., 2004). Comparisons of adults who engaged in the program and a wait-listed control group show that those in the intervention who had borderline to impaired executive functioning at baseline showed clinically meaningful improvements in executive functioning and memory performance after 8 months in the program (Carlson et al., 2008). These results are encouraging, suggesting that volunteering in the community could help slow or even reverse the progression of cognitive decline in older adults. However, this type of intensive engagement in formal volunteering is not the norm among older adult volunteers, many of whom average under 90 hr per year in formal volunteering roles (Anderson et al., 2014).

Formal volunteering might be beneficial to cognitive functioning because it allows older adults to engage in complex tasks, many of which might be new to them (Park et al., 2014), or because it allows older adults to engage socially and remain physically active (Fratiglioni, Wang, Ericsson, Maytan, & Winblad, 2000). The literature that does exist demonstrates that formal volunteering is associated with stable or less slowly declining cognitive functioning, but this literature is limited in that it draws on specific programs designed to intentionally benefit the health of volunteers (e.g., Experience Corps) or on operationalizations of volunteering that are dichotomous in nature or that combine volunteering with other potentially enhancing activities (i.e., paid employment). We draw on the scaffolding theory of aging and cognition-revised (STAC-R; Reuter-Lorenz & Park, 2014) to examine the association between formal volunteering at various levels of involvement and cognitive functioning over time in a large sample of adults in the United States, while also accounting for potential moderators of this association that have yet to be examined in the literature.

Theoretical Frameworks

The mechanisms that might link formal volunteering to cognitive functioning are addressed in the scaffolding theory of aging and cognition-revised (STAC-R; Reuter-Lorenz & Park, 2014). This model highlights the process of compensatory scaffolding, in which aging brains compensate for losses by relying on recruitment of brain regions whose function has not deteriorated, or at least not to the same degree. In this model, volunteering can be conceptualized as an intervention that engages the scaffolding process, in that volunteering might stimulate new learning, social engagement, or physical activity—the same beneficial processes highlighted by other theories that have been used to explain the benefits of volunteering later in life (e.g., social integration and activity theories).

The STAC-R model also emphasizes the neural resource environment—those factors that might enrich or deplete the environment that shapes age-related neural reorganization and cognitive response (Reuter-Lorenz & Park, 2014). The resource environment points to several variables that might moderate the association between formal volunteering and cognitive functioning. Several studies have found that higher levels of education are associated with an increased likelihood of engaging in volunteer roles, likely because higher levels of education provide both resources and opportunities to facilitate volunteering (e.g., Van Willigen, 2000). Drawing on the STAC-R model, Reuter-Lorenz and Park (2014) suggest that some enrichment factors, like high levels of education, might be protective of cognitive functioning by enabling enhanced scaffolding, and scholars have pointed to education as important moderating factor to consider in future work on volunteering and cognitive functioning (e.g., Infurna et al., 2016). Thus, those older adults with higher levels of education might be

better primed to engage in compensatory scaffolding, and they would then experience enhanced benefits from volunteering compared to their less educated counterparts.

Given the emphasis on the social aspects of volunteering as key to its beneficial impact, older adult men might be more likely to benefit from volunteering than are women. Results from the Experience Corps study showed that those engaged in the program experienced a significant increase in the number of people they could turn to for help (Fried et al., 2004). Thus, volunteering might be particularly beneficial to men, because women's social networks tend to be larger than men's throughout the life span (Cornwell, Schumm, Laumann, & Graber, 2009).

We also expect the associations between volunteering and mental health to differ for Black and White respondents. Several studies have found that the associations between volunteering and health are stronger for African Americans than Whites (e.g., Hinterlong, 2006; Tang, Copeland, & Wexler, 2012) although others have not (e.g., Tavares, Burr, & Mutchler, 2013). We propose that Black older adults might benefit cognitively from volunteering more than their White counterparts. Volunteer work might empower respondents who have accumulated more lifelong disadvantage (Tang et al., 2012). If, as Reuter-Lorenz and Park (2014) suggest in the STAC-R model, accumulated disadvantage relates to poorer brain health throughout the life course, volunteering may enable compensatory processes to mitigate some of these damages for Black older adults in particular.

Lastly, based on previous research that shows the benefits of volunteering increase with time (Van Willigen, 2000), we hypothesize that time since baseline interview will moderate the association between volunteering and cognitive functioning, such that the associations between formal volunteering and cognitive functioning will be stronger over time.

In sum, drawing on the STAC-R model (Reuter-Lorenz & Park, 2014), we hypothesize that formal volunteering will be associated with higher levels of cognitive functioning over time. We also hypothesize that the association between formal volunteering and cognitive functioning will be stronger for those with more education compared to those with less; for men than for women; for Blacks than for Whites; and that the association between formal volunteering and cognitive functioning will strengthen over time. We examine these associations while controlling for variables associated with cognitive performance in later life (e.g., income, health, age).

Methods

Participants

We used nine waves of the HRS (1998–2014). Each wave of data is collected roughly every 2 years. The HRS is a nationally representative study that oversamples Blacks, Hispanics, and residents of Florida. We used longitudinal data files (version P) from the (RAND HRS Data, Version P., 2016) and raw variables from the HRS for informal and formal volunteering.

In order to be included in this study, participants had to respond to the 1998 interview (i.e., baseline; excluded 16,111 respondents); be the primary HRS respondent (excluded 7,974 respondents); be aged 51 years or older in 1998 (excluded 86 respondents); report race as White or Black to facilitate tests of race as a moderator (excluded 479 respondents); respond to the 1998 interview without a proxy, because proxies do not complete the measure of cognitive functioning used here (excluded 1,024 respondents); have a sampling weight at baseline greater than zero (excluded 124 respondents); have no missing data at Level 2 (excluded 1 respondent); have at least one wave of complete data (excluded 559 respondents), and have a cognitive ability score of 7 or higher (Crimmins, Kim, Langa, & Weir, 2011; excluded 37 respondents). These criteria resulted in a final sample size of 11,100 individuals.

Measures

Dependent variables

Cognitive functioning in the HRS was assessed in respondents over the age of 50 with a 10 word immediate and delayed recall test of memory, a serial 7s subtraction test of working memory, and counting backwards to assess attention and processing speed (Ofstedal, Fisher, & Herzog, 2005). Scores on these items were summed to form a total cognition summary score, which ranges from 0 to 27, with higher scores indicating greater cognitive functioning.

Independent variables

Formal volunteering was based on number of hours volunteering in the past 12 months. Participants were asked if they had spent any time in the past 12 months doing volunteer work for religious, educational, health-related, or other charitable organizations. They were then asked to respond with how many hours they spent over the past 12 months doing volunteer work for such organizations. Dummy variables were created for this measure, with the reference group of no hours of volunteering: *1–99 hr volunteered*, *100–199 hr volunteered*, and *200+ hours volunteered*.

Depressive symptoms were assessed using the eight-item Center for Epidemiological Studies Depression (CES-D) scale (Radloff, 1977). Participants reported if they had felt each symptom "much of the time" during the past week (1 = *yes*, 0 = *no*). The eight items were summed, with higher scores indicating a greater number of depressive symptoms. *Informal volunteering* was based on the number of hours spent informal volunteering in the past 12 months. Participants were asked if they spent any time in the past 12 months helping friends, neighbors, or family who did not live with them and whom they did not receive compensation from for their help. They were then asked how many hours they spend informally volunteering in the past 12 months. Dummy variables were created for this measure, with the reference group of no hours of volunteering: *1–99 hr volunteered*, *100–199 hr volunteered*, and

200+ hours volunteered. Dummy variables were created for race (1 = *Black*, 0 = *White*), ethnicity (1 = *Hispanic*, 0 = *non-Hispanic*), sex (1 = *female*, 0 = *male*), and marital status (*married/partnered* as the reference group): *widowed*, *separated/divorced*, and *never married/unknown*. Age was centered by subtracting 50 from actual age for all waves. Education at baseline (0–17+) was centered on the sample baseline mean. Household income values were created by adding 250 to all household income values and then using natural log transformations to address non-normality. These transformed household income values were centered around the logged sample baseline mean of 10.22. Household wealth values were created by adding the lowest observed value plus 250 to each household wealth value and then taking the natural log transformation to address non-normality. These transformed household wealth values were centered around the logged sample baseline mean of 14.39. A time variable was also included that accounted for the number of years elapsed since the baseline interview.

Instrumental activities of daily living (IADL), hours worked per week, and self-rated health were also controlled. Individuals' IADLs were assessed by responding to whether or not respondents had some difficulty completing five tasks (1 = *some difficulty*, 0 = *no difficulty*): using the phone, managing money, taking medications, shopping for groceries, or preparing hot meals. Responses were summed to create an IADL scale (0–5 range; higher = *more limitations*). Self-rated health was assessed by asking participants, "Would you say your health is *excellent, very good, good, fair,* or, *poor*?" Responses were recoded so higher scores reflected better health (0–4 range). Participants reported the number of usual hours worked per week for both main and secondary jobs.

Data Analysis

Data were analyzed using multilevel modeling (MLM) with HLM 6.08 software. Multilevel modeling allows for the modeling of time invariant effects on time varying effects and the outcome variables. Level 1 variables (time-varying) included marital status, CES-D, cognitive functioning, self-rated health, formal volunteering, informal volunteering, household income, household wealth, IADLs, and number of hours worked per week. Level 2 (time invariant) variables included race, ethnicity, sex, education, and age. Analyses were weighted at Level 2 using person-level sampling weights.

This study utilized nested models. The baseline model consisted of formal volunteering along with the intercept and time slope, which were entered as fixed and random effects, respectively. The second model addressed the effects of the control variables on cognitive ability over time. The third model included interaction terms to address our moderation hypotheses.

Results

Table 1 presents the descriptive statistics (weighted and unweighted) for the sample at baseline. The majority of the participants were female, White, non-Hispanic, and married. The average age was about 66 years old, and average annual household income was $47,036. Average self-rated health was "good" and very few of the respondents had any IADL limitations.

At baseline, just over 30% of respondents were engaged in formal volunteering. This percentage was relatively stable throughout the study (with the highest percentage, 35.31%, volunteering in 2010). Chi-square analyses found that significantly more non-Hispanics and married individuals volunteered (results available upon request). Independent samples *t* tests found that volunteers were younger, had higher education, higher household income, higher household wealth, better self-rated health, fewer IADL limitations, lower depressive symptoms, worked

Table 1. Descriptive Statistics for Study Variables at Baseline (*N* = 11,100)

	Unweighted	Weighted[a]
	M (*SD*) or %	*M* (*SD*) or %
Cognitive ability (0–27; higher = better)	15.96 (4.27)	16.25 (0.05)
Formal volunteering		
1–99 hr	17.29%	17.75%
100–199 hr	6.60%	6.59%
200+ hours	7.89%	7.97%
Informal volunteering		
1–99 hr	40.32%	41.54%
100–199 hr	14.56%	15.28%
200+ hours	6.09%	6.49%
Depressive symptoms (0–8; lower = better)	1.59 (1.92)	1.53 (0.02)
Hispanic (1 = yes)	5.71%	4.67%
Black (1 = yes)	15.13%	10.19%
Female (1 = yes)	53.43%	51.97%
Education (years)	12.34 (3.10)	12.59 (0.03)
Household income (annual)	47,306 (81,357)	51,643 (912)
Household wealth	300,041 (11,050,00)	305,965 (9,797)
Age (years)	66.42 (10.12)	64.68 (0.12)
Marital status		
Married	56.81%	55.13%
Separated/divorced	14.85%	17.00%
Widowed	23.96%	22.84%
Never married	4.71%	5.29%
Hours of paid employment	15.63 (21.83)	18.54 (0.27)
Self-rated health (higher = better)	2.13 (1.16)	2.21 (0.01)
IADL limitations (some difficulty; 0–5)[b]	0.18 (0.57)	0.17 (0.01)

Note: [a]1998 person-level sampling weights. [b]IADL = Instrumental Activities of Daily Living.

more hours, and had higher cognitive functioning scores than nonvolunteers at baseline.

Table 2 presents multilevel modeling results for cognitive functioning over time. When accounting for control variables (Model 2), cognitive ability declined over time. Formal volunteering at any number of hours was associated with higher levels of cognitive functioning when compared to not formally volunteering. Education, race, sex, age, depression, household income, household wealth, widowed status, self-rated health, IADL limitations, hours employed, and informal volunteering were also significant predictors of cognitive functioning.

Our second hypothesis was that sex, race, education, and time since baseline interview would moderate the associations between formal volunteering and cognitive functioning. Two significant interactions emerged. Sex moderated the association between cognitive functioning and formal volunteering at 100–199 hr and 200 or more hours per year, such that the positive association between formal volunteering and cognitive functioning was stronger for women than for men. In addition, time since baseline interview moderated the association between formal volunteering at 100–199 hr and cognitive ability, such that the positive association between volunteering 100–199 hr per year and cognitive functioning decreased over time.

Table 2. Multilevel Model Results Predicting Total Cognitive Ability (N = 11,100)

	Cognitive ability		
	Model 1	Model 2	Model 3
Intercept	16.79**	18.18**	18.19**
Time (years since baseline)	−0.42**	−0.41**	−0.40**
Formal volunteering (1–99 hr)[a]	0.76**	0.36**	0.33*
Formal volunteering (100–199 hr)[a]	0.92**	0.46**	0.51**
Formal volunteering (200+ hours)[a]	1.02**	0.53**	0.47*
Informal volunteering (1–99 hr)[a]		0.25**	0.25**
Informal volunteering (100–199 hr)[a]		0.17**	0.17**
Informal volunteering (200+ hours)[a]		0.40**	0.39**
Hispanic (1 = yes; ref: non-Hispanic)		−0.28	−0.28
Black (1 = yes; ref: White)		−2.19**	−2.19**
Female (1 = yes; ref: male)		1.06**	0.97**
Education (years, centered)		0.37**	0.37**
Household income (annual, logged, centered)		0.17**	0.17**
Household wealth (logged, centered)		0.85**	0.86**
Age at baseline (centered)		−0.14**	−0.14**
Widowed (1 = yes; ref: married)		−0.24**	−0.25**
Separated or divorced (1 = yes; ref: married)		0.08	0.08
Never married (1 = yes; ref: married)		−0.26	−0.27
Hours of paid employment		0.00**	0.00**
Depressive symptoms (CES-D) (higher = worse)		−0.08**	−0.08**
Self-rated health (higher = better)		0.13**	0.13**
IADL limitations (some difficulty; 0–5)		−0.61**	−0.61**
Formal volunteering (1–99 hr) × Time			−0.00
Formal volunteering (100–199 hr) × Time			−0.03*
Formal volunteering (200+ hours) × Time			−0.02
Formal volunteering (1–99 hr) × Female			0.15
Formal volunteering (100–199 hr) × Female			0.34*
Formal volunteering (200+ hours) × Female			0.42*
Formal volunteering (1–99 hr) × Black			0.12
Formal volunteering (100–199 hr) × Black			0.13
Formal volunteering (200+ hours) × Black			−0.31
Formal volunteering (1–99 hr) × Education			−0.02
Formal volunteering (100–199 hr) × Education			−0.02
Formal volunteering (200+ hours) × Education			0.02
Estimated parameters	7	24	36
Deviance	376,621	368,610	368,575

Note: Robust standard errors with full maximum likelihood. CES-D = Center for Epidemiological Studies Depression scale; IADL = Instrumental Activities of Daily Living. Models are weighted. [a]Reference group = no volunteering.
*p < .05. **p < .01.

As a supplement to our primary analyses, we replicated our model using both the 20-item cognitive functioning scale from the HRS and a 7-item version. The 20-item version includes the 10 word immediate and delayed recall items, and in psychometric work conducted by the Ofstedal et al., (2005), was found to represent the memory component of cognitive functioning. The 7-item scale is a portion of the scale found to represent a mental status factor assessing working memory and processing speed that was administered to all HRS respondents, regardless of age. The pattern of associations between the control variables and the 20-item cognitive functioning scale was similar to the model reported above. Formal volunteering, however, was not significantly associated with the 20-item measure of cognitive functioning (results not shown), and only one interaction was significant—that between formal volunteering 100–199 hr per year and time since baseline ($\beta = .02$, $p = .03$), showing that the positive association between volunteering 100–199 hr per year and cognitive functioning decreased over time.

The pattern of significance between control variables and the 7-item mental status scale differed somewhat from that of the 27- and 20-item scales, in that with the 7-item scale, ethnicity and being female were negatively and significantly associated with cognitive functioning, but neither self-rated health nor hours of paid employment reached significance (Table 3). Formal volunteering for any number of hours was positively associated with the 7-item cognitive functioning scale (Model 2) compared to not volunteering, and at all levels of formal volunteering, significant interactions with time, education, and sex were found. Time since baseline interview moderated the association between formal volunteering and the 7-item cognitive ability scale: the positive association between volunteering and cognitive functioning increased over time, contrary to what was found with the 27- and 20-item scales. Sex moderated the association between cognitive functioning and formal volunteering, such that the positive association between formal volunteering and cognitive functioning was stronger for women than for men. Lastly, education moderated the association between formal volunteering and the 7-item cognition scale, with the cognitive benefits of formal volunteering being greatest for those with below-average levels of education.

Model Fit

Model comparison tests indicate better model fit at each step based on the results of log likelihood-ratio statistic ($p < .05$). The random effects for the intercept and time slope were statistically significant for all cognitive functioning models, indicating the existence of unexplained variance in the outcome. Significant parameters for the random effects also indicate that there is variability around the average fixed effects for the intercept (i.e., baseline status) and time slope (i.e., rate and direction of change over time).

Attrition Analyses

Attrition analyses tested for baseline differences between those who provided data for all waves ("completers;" $n = 1{,}525$) and those who were missing data for one or more waves. *T* tests and chi-square tests showed that completers, on average, had more education, were younger, had higher household incomes and wealth, and worked more hours. Completers reported fewer depressive symptoms and IADLs, better self-rated health, and had higher cognitive ability scores. We also found significant associations between completion status and ethnicity, race, sex, marital status, formal volunteering, and informal volunteering (results not shown).

Discussion

Recent research supports the beneficial effects of volunteering for adults, and active community engagement is theorized to be an integral part of successful aging (Rowe & Kahn, 1998). We found support for our first hypothesis that formal volunteering would be associated with greater cognitive functioning over time, after controlling for numerous factors known to be associated with cognitive functioning, but follow-up analyses suggests this result is driven by formal volunteering's association with the 7 items of the cognitive functioning scale that assess cognitive processing and working memory (e.g., counting backgrounds) and not memory (e.g., word recall). This positive association held for all three groups of hours volunteered per year, ranging from 1 to 200 or more hours. Thus, our findings add important evidence to the literature on formal volunteering and its benefit to the cognitive functioning of older adults by showing that the specific type of cognitive functioning that volunteering might most benefit is working memory and processing. Further, we found evidence for moderator effects in that education, sex, and time since baseline interview each moderated some of the associations between volunteering and cognitive functioning.

Social models for health promotion (Fried et al., 2004) and the STAC-R model (Reuter-Lorenz & Park, 2014) both point to volunteering as an activity that might stimulate new learning, social engagement, and or physical activity. In this way, volunteering can be viewed as intervention that engages the process of compensatory scaffolding, a form of positive plasticity that occurs with aging (Cramer et al., 2011). Further, this type of intervention is not only cost-effective, but estimates place the value of volunteer service at nearly $184 billion in 2014 (Corporation for National and Community Service: National Data Volunteering and Civic Engagement in the United States, 2014). Additional research is needed into the specific activities that are performed by older adult volunteers to better flesh out why volunteering benefits older adults' working memory and cognitive processing, but not memory as assessed by immediate and delayed recall tasks. The STAC-R would suggest that it is those volunteer activities that encourage learning

Table 3. Multilevel Model Results Predicting the 7-Item Cognitive Ability Scale (N = 11,100)

	7-item cognitive ability		
	Model 1	Model 2	Model 3
Intercept	5.65**	6.12**	6.17**
Time (years since baseline)	−0.04**	−0.04**	−0.05**
Formal volunteering (1–99 hr)[a]	0.18**	0.07**	−0.06
Formal volunteering (100–199 hr)[a]	0.25**	0.12**	−0.03
Formal volunteering (200+ hours)[a]	0.29**	0.14**	−0.01
Informal volunteering (1–99 hr)[a]		0.08**	0.07**
Informal volunteering (100–199 hr)[a]		0.06**	0.06**
Informal volunteering (200+ hours)[a]		0.08**	0.08**
Hispanic (1 = yes; ref: non-Hispanic)		−0.35**	−0.34**
Black (1 = yes; ref: White)		−1.17**	−1.16**
Female (1 = yes; ref: male)		−0.25**	−0.28**
Education (years, centered)		0.16**	0.16**
Household income (annual, logged, centered)		0.03**	0.03**
Household wealth (logged, centered)		0.24**	0.24**
Age at baseline (centered)		−0.01**	−0.01**
Widowed (1 = yes; ref: married)		−0.08**	−0.08**
Separated or divorced (1 = yes; ref: married)		−0.05	0.06
Never married (1 = yes; ref: married)		−0.09	−0.10
Hours of paid employment		−0.001	−0.001
Depressive symptoms (CES-D) (higher = worse)		−0.02**	−0.02**
Self-rated health (higher = better)		0.003	0.004
IADL limitations (some difficulty; 0–5)		−0.26**	−0.25**
Formal volunteering (1–99 hr) × Time			0.02**
Formal volunteering (100–199 hr) × Time			0.02**
Formal volunteering (200+ hours) × Time			0.02**
Formal volunteering (1–99 hr) × Female			0.09**
Formal volunteering (100–199 hr) × Female			0.11*
Formal volunteering (200+ hours) × Female			0.15**
Formal volunteering (1–99 hr) × Black			−0.09
Formal volunteering (100–199 hr) × Black			0.08
Formal volunteering (200+ hours) × Black			−0.06
Formal volunteering (1–99 hr) × Education			−0.01*
Formal volunteering (100–199 hr) × Education			−0.02**
Formal volunteering (200+ hours) × Education			−0.02*
Estimated parameters	7	24	36
Deviance	230,612	225,393	225,289

Note: Robust standard errors with full maximum likelihood. CES-D, CES-D = Center for Epidemiological Studies Depression scale; IADL = Instrumental Activities of Daily Living. Models are weighted. [a]Reference group = no volunteering.
*p < .05. **p < .01.

new skills, social and intellectual engagement, and physical activity that would be most helpful to compensatory scaffolding. It is possible that the tasks required of formal volunteering do not require or reinforce skills such as recall so much as they do working memory, attention, and processing speed. It is also possible that the parts of the brain activated by volunteering are most closely associated with skills such as processing speed. However, the limited amount of research on the links between volunteering and cognitive functioning rarely explores the tasks older adults are engaging in when they volunteer, or how those tasks vary based on organization type. Further research on this topic will help elucidate the primary mechanisms through which volunteering is associated with specific aspects of cognitive functioning.

The moderator analyses demonstrated some significant results that were opposite that which we hypothesized. First, while we hypothesized that the link between formal volunteering and cognitive functioning would be stronger for men, we found that it was stronger for women engaged in formal volunteering for 100 or more hours per year for the 27-item cognitive scale, and for all amounts of volunteering for the 7-item scale. The main effect for sex showed that women, on average, had higher total cognitive functioning

throughout the study, but lower scores on the items assessing processing speed and working memory. It is possible that women's better total cognitive functioning scores are due to older women's better ability for word recall than men, as has been found in other studies (Van Hooren et al., 2007). Regardless of these main effects, women benefited more from formal volunteering than did men. It is possible that the characteristics of volunteering are of particular importance for women's cognitive functioning—perhaps engaging in activities that are multifaceted (e.g., socially, physically, and intellectually stimulating as well as generative) is critical for women's cognitive health. The data presented here cannot answer that question, but future research should continue to explore the differential benefit of volunteering to men and women, and whether engagement in differing types of tasks might explain this differential benefit.

Time since baseline was a significant moderator of the association between volunteering and both total cognitive functioning and the 20-item scale assessing memory, but in the opposite direction as was hypothesized, such that the association between formal volunteering of 100–199 hr per year and total cognitive functioning decreased over time, although the size of this effect was small. While it is encouraging that formally volunteering might have some benefit for cognitive functioning, it is somewhat discouraging to find that this association decreases over time (at least for those volunteering roughly 2–3.5 hr/week and when considering the full or 20-item word recall cognitive functioning scales), even if small in magnitude. It is possible that while volunteering might help slow the normative decline in memory initially, at some point normative aging processes—and the normative decline in word recall—is too robust a process for formal volunteering to stall. Future research could further elucidate these processes by focusing on age of initiation of volunteer work, tasks involved in volunteer work, and competing explanations, such as stress exposure.

We were encouraged, however, that the moderating role of time was in the expected direction and for all levels of volunteering when we examined the association between formal volunteering and the 7-item scale of cognitive functioning—that is, the association between formal volunteering and the 7 items assessing working memory and processing increased over time. The STAC-R suggests that the benefit of productive engagement such as volunteering is via the cognitive, social, and physical enhancement it provides, which then promotes cognitive scaffolding. It is possible that this type of enhancement primarily benefits the components of cognitive functioning related to working memory and processing, and less so to factors such as word recall. If this is the case, then optimal volunteer experiences might require continuous changes and challenges in activities, such as learning new skills or engaging in increasingly complex tasks or interactions, to maintain this enhancement and its benefits. Future research should explore this possibility, which will need to be balanced against the aspects of volunteering that keep volunteers engaged, such as generativity (Carlson et al., 2008).

Contrary to our hypotheses, race did not significantly moderate the association between volunteering and any of the cognitive functioning scales, although it was directly associated with all scales of cognitive functioning, with Blacks having lower levels. We hypothesized that the accumulated disadvantage likely experienced by Black adults across the life course would make volunteering an especially beneficial activity, in that it would potentially compensate for some of this disadvantage. One possible reason for a lack of significance for race is that Blacks constituted less than 11% of the sample, and perhaps a larger sample would find significant moderation. Future research should look to replicate or refute these results to enhance our understanding of whether there are demographic characteristics that might influence the association between formal volunteering and cognitive health.

Although we did not find that education was a moderator of the association between formal volunteering and total cognitive functioning scores, it was a moderator in the model considering the 7-item scale, with those with the lowest level of education benefitting the most from volunteering. The main effect of education clearly shows that those with more education have higher levels of cognitive functioning, no matter which scale is used, and this fact is well established in the literature. Based on the STAC-R (Reuter-Lorenz & Park, 2014), we had hypothesized that higher education might offer an environment that primes the brain for efficient compensatory scaffolding in the presence of productive engagement such as volunteering. We found the reverse, which suggests that volunteering might partially compensate for the effect of lower levels of education (it is worth noting that in this sample, the lowest levels of education were those who had the equivalent of less than ten years of education). Thus, if practitioners begin to look at volunteering as an intervention to help slow the normative decline in cognitive functioning that occurs as we age, targeting older adults with low levels of education might be a particularly worthwhile endeavor.

To date, much of the literature on the association between volunteering and health outcomes suggests that those who are most vulnerable are most likely to experience positive health benefits from volunteering (Anderson et al., 2014). At least as it relates to education, we also find partial support for this regarding cognitive functioning. But more research is needed to better understand the constellation of risk and protective factors older adults have, especially if neural resource enrichment, characterized by factors such as intellectual engagement, education, higher ability, and fitness, is critical in the brain's ability to engage in compensatory scaffolding (Reuter-Lorenz & Park, 2014) and thus slow normative decline in cognitive functioning. Future research assessing multiple components of the STAC-R model will be necessary to better understand

differential patterns of benefit from productive activities such as volunteer work.

Limitations

One strength of the current study was the use of a large national data set over many waves of data and the use of a scale of cognitive functioning that could be broken down into its component parts. This enabled us to show that formal volunteering in later life might be differentially associated with various components of cognitive functioning over time. Another strength was our investigation of potential moderators, which showed that formally volunteering is more strongly associated with cognitive functioning for women than for men and, when considering aspects of working memory and processing, for those with lower levels of education. The use of longitudinal secondary datasets to study volunteer behavior and outcomes, however, is not without its limitations. One methodological issue plaguing research on volunteering is that of selection effects. Participation in a research study is by itself a type of volunteering, so selection bias is likely to be present. It is also probable that those who volunteer self-select into the volunteer role, which might maximize the benefits of volunteering (Li & Ferraro, 2005). In addition, older adult volunteers might already be resource rich compared to their nonvolunteering counterparts—research shows that they are younger, more educated, have higher incomes, and are healthier than nonvolunteering older adults (Anderson et al., 2014). How older adults become volunteers is also unknown, and the benefits of volunteering might vary based on the processes through which one becomes a volunteer (e.g., via a direct request from a clergy member versus a coercion from one's spouse). While the repeated measurement of volunteer involvement is a significant benefit of these data, little is known about the nature of the volunteer work—information that would provide more rigorous tests of theory and likely lead to increased knowledge about which specific aspects of volunteer work are beneficial (or not) for older adults. The wave spacing (every 2 years) of the HRS also does not allow assessment of the waxing and waning in volunteer work that might occur in later adulthood (Morrow-Howell, 2010). In addition, as with other large, secondary datasets, attrition is selective, with the most advantaged and most likely to volunteer being more likely to remain in the data set and contribute more waves of data. Thus, while datasets such as the HRS provide detailed and repeated information on a wide variety of important measures, work remains to be done on the aspects of volunteering that provide the benefits documented in this and other studies.

Conclusions

Overall, these results suggest that formally volunteering in mid and later life is positively associated with cognitive functioning, more so for women than for men, and more so to working memory and processing than to recall/memory. We wish to highlight the importance of further study of the characteristics of volunteering activities (and volunteers) in later life. Such an emphasis will allow a better understanding of which aspects of volunteering are associated with which aspects of cognitive functioning and how to maximize those beneficial components of the volunteer role. Doing so holds the promise of not only the continued direct economic benefit of volunteering, but the potential benefit of additional years of the life span with good cognitive health.

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Conflict of Interest

None reported.

Author Contributions

C. M. Proulx planned the study, supervised analysis, and wrote all parts of the paper except methods. A. L. Curl assisted in planning the study, conducted analyses, and edited paper drafts. A. E. Ermer wrote the methods section and tables, edited paper drafts, and assisted with the reference section.

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