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Informal Helping and Subsequent Health and Well-Being in Older U.S. Adults

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Abstract

Background Growing evidence suggests that informal helping (unpaid volunteering not coordinated by an organization or institution) is associated with improved health and well-being outcomes. However, studies have not investigated whether *changes* in informal helping are associated with subsequent health and well-being.

Methods This study evaluated if changes in informal helping (between t_0;2006/2008 and t_1;2010/2012) were associated with 35 indicators of physical, behavioral, and psychosocial health and well-being (at t_2;2014/2016) using data from 12,998 participants in the Health and Retirement study — a national cohort of US adults aged > 50.

Results Over the four-year follow-up period, informal helping ≥ 100 (versus 0) hours/year was associated with a 32% lower mortality risk (95% CI [0.54, 0.86]), and improved physical health (e.g., 20% reduced risk of stroke (95% CI [0.65, 0.98])), health behaviors (e.g., 11% increased likelihood of frequent physical activity (95% CI [1.04, 1.20])), and psychosocial outcomes (e.g., higher purpose in life (β = 0.15, 95% CI [0.07, 0.22])). However, there was little evidence of associations with various other outcomes. In secondary analyses, this study adjusted for formal volunteering and a variety of social factors (e.g., social network factors, receiving social support, and social participation) and results were largely unchanged.

Conclusions Encouraging informal helping may improve various aspects of individuals' health and well-being and also promote societal well-being.

Keywords Informal helping · Physical health · Health behaviors · Psychosocial factors · Older adults · Outcome-wide approach

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Introduction

Prosocial behaviors are a key building block of society at the micro- (e.g., individual origins of prosociality), meso- (e.g., helper-recipient dyads), and macro- (e.g., volunteering in the context of groups and large organizations) levels [1]. While there is a large and growing body of evidence around the health and well-being benefits of formal volunteering [2, 3], less is known about the downstream benefits of the most common type of prosocial behavior: informal helping. Informal helping (i.e., informal volunteering) is defined as, "unpaid volunteering not coordinated by an organization or institution" (e.g., babysitting, cooking meals, providing transportation, etc.) directed toward helping people outside of one's household [4]. Three partially overlapping perspectives offer insight into why people participate in informal helping: 1) social capital (helping establish networks, norms, and trust that facilitates cooperation among people), 2) social network theory (reciprocity for helping others within one's social network), and 3) evolutionary biology (informal

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helping is present in all human societies, and evolutionary biologists consider it an important aspect of our evolution as social animals) [4]. Further, there may be altruistic, spiritual, and/or moral reasons for engaging in informal helping behaviors. Yet, little is known about how informal helping is associated with downstream health and well-being. Indeed, despite growing attention to the topic, compared with related constructs, informal helping continues to be "ignored or understudied within research and policy" [5].

Four factors converge to underscore the importance of studying informal helping in older adults. First, populations are rapidly aging in many countries throughout the world [6]. With rapid population aging, researchers and policymakers are increasingly interested in health assets that enhance our society's health and well-being [7, 8], and informal helping may be a promising health asset to consider. Second, informal helping is often more accessible than formal volunteering for various subgroups of people [4, 9]. For example, it is difficult for many in lower socioeconomic situations to formally volunteer because for people who work labor-intensive jobs and/or multiple jobs, there is little energy and time to formally volunteer [9]. Further, for older adults constrained by physical health conditions (e.g., wheelchair bound people in nursing homes) who want to act on their intrinsic prosocial desire, informal helping may be an accessible outlet. Third, there are also economic benefits to informal helping. Though work assigning monetary value to informal helping is rare, prior work has found that informal helping contributes more to the economy than formal volunteering [4]. Fourth, informal helping is more common than formal volunteering, and people in many countries (e.g., the United States, United Kingdom, and France) spend more time informally helping than formally volunteering [4]. Because many people are already engaging in informal helping, from a public health perspective, it is important to understand the downstream health and well-being consequences of these common informal helping behaviors (e.g., if increased informal helping is associated with increased depressive symptoms because it is perceived as stressful or overwhelming, it would be important to know this). Informal helping has been linked with improved: physical health (e.g., a reduced risk of mortality and cardiovascular disease [10–12]), psychological well-being (e.g., higher positive affect and life satisfaction [13–16]), and psychological distress (e.g., lower depression and depressive symptoms [14, 17]), though findings are mixed [13, 18].

These past observational studies helped break exciting new ground. However, there is relatively little prior research evaluating associations between informal helping and health and well-being outcomes and many of these studies have limitations that this study aims to improve upon. First, while an increasing number of studies are longitudinal, many are cross-sectional, making it difficult to assess the direction of causality [4]. Does informal helping protect against depression, or are depressed people less likely to informally help? Cross-sectional data cannot provide evidence concerning this question. However, an outcome-wide approach can help us assess if changes in informal helping are associated with subsequent health and well-being outcomes (e.g., if informal helping protects against depression). Second, many studies have not yet evaluated a wide range of outcomes that holistically assess healthy aging (e.g., across physical, behavioral, and psychosocial domains). Third, most studies do not adjust for prior informal helping, or prior outcomes, in the pre-baseline wave. Pre-baseline adjustment for informal helping helps readers evaluate how *changes* in informal helping are associated with health and well-being.

This study asked the question, if informal helping were increased, what improvements to health and well-being outcomes might we observe within a relatively short time frame (i.e., a 4-year follow up period)? To begin addressing this question, this study used the new *outcome-wide* analytic approach which is described further in the *Statistical Analysis* section [19, 20]. Using this approach, this study examined if changes in informal helping were associated with better subsequent health and well-being across 35 separate outcomes, including indicators of physical health, health behaviors, and psychosocial factors. Outcome-wide analyses are a hypothesis-generating, data-driven approach aimed at discovering promising health and well-being outcomes associated with various exposures, such as increased informal helping, which may then undergo further investigation in future studies. These outcomes were chosen because they are frequently included in the conceptualization of seminal gerontological models that characterize the antecedents, processes, and outcomes that foster people's ability to age well [21–25]. We generally expected that increases in informal helping would be associated with better subsequent health and well-being.

Methods

Design and Sample

Data were from the Health and Retirement Study (HRS), a national sample of adults aged > 50 in the United States. Approximately 50% of HRS respondents were randomly selected for an enhanced face-to-face (EFTF; see HRS materials for more information [26]) interview in 2006, and the other half of respondents were assessed in 2008. After the EFTF interview, participants completed a psychosocial questionnaire which they mailed to the University of Michigan upon completion (88% response rate in 2006 and 84% response rate in 2008; see HRS documentation for more information about the self-administered questionnaire,

which was left with participants for their completion and return by mail [27]). These sub-cohorts alternate reporting of psychosocial factors: each participant reports psychosocial data every 4 years (2006/2010/2014 for Cohort A and 2008/2012/2016 for Cohort B). To increase sample size and statistical power, data from 2006 and 2008 were combined. Participants were excluded if they did not report psychosocial data at baseline because over half of the study outcomes were included in this assessment, resulting in a final sample of 12,998 participants.

This study used data from three timepoints: 1) covariates were assessed in the pre-baseline wave (t_0;2006/2008), 2) the exposure (informal helping) was assessed in the baseline wave (t_1;2010/2012), and 3) outcomes were assessed in the outcome wave (t_2;2014/2016). Further details about this study can be found on the HRS website (http://hrsonline.isr.umich.edu/). This study was exempt from additional review by the Institutional Review Board at the University of British Columbia because data were publicly available and de-identified.

Measures

Informal Helping

In the pre-baseline and baseline waves, respondents were asked: "Have you spent any time in the past 12 months helping friends, neighbors, or relatives who did not live with you and did not pay you for the help?" If they answered yes to this question, respondents were asked how many hours they spent helping: 1−49 h, 50−99 h, 100−199 h, or ≥ 200 h. Based on past research suggesting that approximately 100 h/year of formal volunteering may be an inflection point for improved health and well-being, the top 2 informal helping groups were collapsed in the main analyses to increase statistical power [28]. Thus, informal helping was split into categories of: 0 h, 1–49 h, 50–99 h, and ≥ 100 h/year.

Covariates

This study adjusted for a wide range of covariates in the pre-baseline wave (t_0;2006/2008). Covariates included: sociodemographic factors (age (continuous), gender (male/female), race/ethnicity (White, African-American, Hispanic, Other), marital status (married/not married), income (< $50,000, $50,000–$74,999, $75,000–$99,999, ≥ $100,000), total wealth (based on quintiles of the score distribution for total wealth in this sample), educational attainment (no degree, GED/high school diploma, ≥ college degree), employment status (yes/no), health insurance (yes/no), geographic region (Northeast, Midwest, South, West), religious service attendance (none, < 1x/week, ≥ 1x/week), personality (openness, conscientiousness, extraversion, agreeableness, neuroticism; continuous), and childhood abuse (yes/no)). This study also adjusted for informal helping and all outcome variables in the pre-baseline wave.

Outcomes

This study evaluated 35 outcomes in the outcome wave (t_2;2014/2016). These included measures of: physical health (all-cause mortality, number of chronic conditions, diabetes, hypertension, stroke, cancer, heart disease, lung disease, arthritis, overweight/obesity, physical functioning limitations, cognitive impairment, chronic pain, self-rated health), health behaviors (heavy drinking, smoking, physical activity, sleep problems), psychological well-being (positive affect, life satisfaction, optimism, purpose in life, mastery, health mastery, financial mastery), psychological distress (depression, depressive symptoms, hopelessness, negative affect, perceived constraints), and social factors (loneliness, living with a spouse/partner, frequency of contact with 1) children, 2) other family, and 3) friends). Electronic Supplementary Material Text 1 and HRS materials provide further details (e.g., reliabilities of scales) about each of these variables [27, 29, 30].

Statistical Analysis

The outcome-wide analytic approach uses several analytic decisions not widely implemented outside of biostatistics and causal inference, thus these decisions are summarized here [19]. First, it is difficult to discern whether covariates are confounders or mediators if the covariate measurements used in analyses are assessed at the same timepoint as the exposure (t_1;2010/2012) [19]. Thus, to reduce this concern and allow for a comprehensive set of covariates to address confounding, covariates were adjusted for in the pre-baseline wave (t_0;2006/2008). Second, all outcome variables in the pre-baseline wave (t_0) were adjusted for to reduce the likelihood of reverse causality. Third, to evaluate "*changes*" in informal helping, this study adjusted for informal helping in the pre-baseline wave (t_0). This helps "hold constant" pre-baseline levels of informal helping. Data from all participants, irrespective of how their informal helping changed from the pre-baseline to baseline waves, was incorporated into the overall estimate. For example, participants who start in the ≥ 100-h informal helping group in the pre-baseline wave (t_0) and remain there in the baseline wave (t_1) contribute to the final estimate. However, this estimate also corresponds to participants who start in the 0-h informal helping group in the pre-baseline wave and move to the ≥ 100-h group in the baseline wave. The model effectively assumes that there is no interaction between past and current informal helping (i.e., the ≥ 100-h group coefficient is constant across

past informal helping levels). Thus, it is possible to evaluate how *changes* in informal helping (between t_0 and t_1) are associated with later health and well-being outcomes in the outcome wave (at t_2: see Electronic Supplementary Material Text 2). Adjusting for pre-baseline informal helping (t_0) has several other advantages. First, it reduces risk of reverse causality by "removing" the potential accumulating effects that informal helping might have had on health and well-being outcomes in the past (prevalent exposure). Second, it allows us to focus on how *changes* in informal helping (incident exposure) affect outcomes. Therefore, there is a focus on how changes in informal helping are associated with short-term changes in health and well-being outcomes.

This study used an outcome-wide approach [19] and ran separate models for each outcome. Depending on the nature of the outcome, 3 different models were used: 1) logistic regression for each binary outcome with a prevalence < 10%, 2) generalized linear models (with a log link and Poisson distribution) for each binary outcome with a prevalence ≥ 10%, and 3) linear regression for each continuous outcome. All continuous outcomes were standardized (mean = 0, standard deviation = 1) so their effect sizes can be interpreted as a standard deviation change in the outcome variable and multiple p-value cutoffs were marked in our tables (including those making Bonferroni correction) because practices for multiple testing vary widely and are continuously evolving [31, 32]. All analyses were conducted in Stata (Version 17.0).

Additional Analyses

Several additional analyses were conducted. 1) E-value analyses were conducted. E-values allow us to evaluate the robustness of our results to unmeasured confounding by assessing the minimum strength that unmeasured confounder(s) would have to have on the risk ratio scale (with both informal helping and the outcome) to entirely explain away the association between informal helping and the outcome [33]. All models were re-analyzed: 2) using a reduced list of conventional covariates (only sociodemographic factors) in the pre-baseline wave. This approach (i.e., not adjusting for prior informal helping) might crudely assess the potential cumulative effects that the whole history of informal helping has on outcomes, 3) after removing people with a history of a given physical condition at baseline, 4) using only complete cases to assess the impact of multiple imputation on results, 5) after additionally adjusting for formal volunteering at baseline, to evaluate the effects of informal helping above and beyond formal volunteering, 6) after additionally adjusting for other social factors (including social network, social support, and social participation), 7) after additionally adjusting for formal volunteering and other social factors in the same analyses (see Electronic Supplementary Material Text 1 for descriptions of formal volunteering and other social factors).

Multiple Imputation

When conducting complete-case analyses we had missing data for the exposure (0.26%), covariates (up to 23.73%), and outcomes (up to 38.40%), which ultimately led to a 34.74% to 57.10% drop in sample size when complete-case analyses were conducted, depending on the outcome being evaluated. All missing exposures, covariates, and outcomes were imputed using imputation by chained equations, and 5 datasets were created. This method generally provides a more flexible approach than other methods of handling missing data and addresses problems that arise from attrition [34].

Results

In the pre-baseline wave (t_0;2006/2008), participants were on average 65 years old (*SD* = 10), predominantly women (59%) and married (67%). Table 1 provides the distribution of covariates by informal helping, and Electronic Supplementary Material Table 1 shows the changes in informal helping from the pre-baseline wave (t_0) to the baseline wave (t_1).

Over the 4-year follow-up period, participants engaging in informal helping ≥ 100 h/year (versus 0 h/year), conditional on prior informal helping, had a 32% reduced risk of mortality (95% CI [0.54, 0.86]; Electronic Supplementary Material Text 3), 20% reduced risk of stroke (95% CI [0.65, 0.98]), 22% reduced risk of physical functioning limitations (95% CI [0.68, 0.89]), 21% reduced risk of cognitive impairment (95% CI [0.68, 0.93]), and higher self-rated health (β = 0.10, 95% CI [0.05, 0.16]; Table 2). There was less evidence of associations between informal helping and other physical health outcomes, including number of chronic conditions and risk of: diabetes, hypertension, cancer, heart disease, lung disease, arthritis, overweight/obesity, and chronic pain.

Among health behaviors, participants engaging in informal helping ≥ 100 h/year (versus 0 h/year), conditional on prior informal helping, had an 11% increased likelihood of engaging in frequent physical activity (95% CI [1.04, 1.20]) four years later. There was little evidence of associations between informal helping and heavy drinking, smoking, or sleep problems.

Amongst psychological factors, for psychological well-being, participants engaging in informal helping ≥ 100 h/year (versus 0 h/year), conditional on prior informal helping, had higher positive affect (β = 0.11, 95% CI [0.03, 0.18]), optimism (β = 0.11, 95% CI [0.05, 0.17]), purpose in life (β = 0.15, 95% CI [0.07, 0.22]), mastery (β = 0.11, 95% CI [0.02, 0.19]), and health mastery (β = 0.09, 95% CI [0.02, 0.15]). Among psychological distress factors,

Table 1 Characteristics of Health and Retirement Study Participants at Pre-Baseline by Baseline Categories of Informal Helping (N = 12,964)[a,b,c]

Participant Characteristics	0 h (n = 6,050)		1–49 h (n = 3,594)		50–99 h (n = 1,649)		≥ 100 h (n = 1,671)	
	No. (%)	Mean (SD)	No. (%)	Mean (SD)	No. (%)	Mean (SD)	No. (%)	Mean (SD)
Sociodemographic factors								
Age (yr; range: 46–96)		67.5 (10.3)		63.3 (9.2)		63.2 (9.2)		62.6 (8.4)
Female (%)	3873 (64.0)		1840 (51.2)		895 (54.3)		1012 (60.6)	
Race/Ethnicity (%)								
White	4148 (68.6)		2721 (75.7)		1342 (81.4)		1348 (80.7)	
Black	953 (15.8)		523 (14.6)		173 (10.5)		195 (11.7)	
Hispanic	796 (13.2)		259 (7.2)		92 (5.6)		80 (4.8)	
Other	151 (2.5)		90 (2.5)		42 (2.6)		47 (2.8)	
Married (%)	3283 (62.0)		2100 (71.2)		971 (71.0)		987 (70.7)	
Annual Household Income (%)								
< $50,000	3443 (65.2)		1445 (49.2)		616 (45.2)		629 (45.4)	
$50,000-$74,999	762 (14.4)		526 (17.9)		239 (17.6)		256 (18.5)	
$75,000–$99,999	433 (8.2)		333 (11.3)		168 (12.3)		166 (12.0)	
≥ $100,000	640 (12.1)		635 (21.6)		339 (24.9)		335 (24.2)	
Total Wealth (%)								
1st Quintile	1357 (25.7)		483 (16.4)		191 (14.0)		174 (12.6)	
2nd Quintile	1143 (21.7)		583 (19.8)		235 (17.3)		225 (16.2)	
3rd Quintile	987 (18.7)		617 (21.0)		269 (19.8)		317 (22.9)	
4th Quintile	955 (18.1)		608 (20.7)		315 (23.1)		315 (22.7)	
5th Quintile	836 (15.8)		648 (22.1)		352 (25.8)		355 (25.6)	
Education (%)								
< High School	1517 (25.1)		381 (10.7)		140 (8.5)		128 (7.7)	
High School	3220 (53.3)		1999 (55.9)		912 (55.6)		923 (55.4)	
≥ College	1300 (21.5)		1198 (33.5)		589 (35.9)		614 (36.9)	
Employed (%)	1748 (33.2)		1470 (50.0)		685 (50.3)		686 (49.5)	
Health Insurance (%)	5010 (95.0)		2783 (94.7)		1306 (95.9)		1313 (94.7)	
Geographic Region (%)								
Northeast	827 (15.3)		422 (14.0)		202 (14.4)		230 (16.0)	
Midwest	1336 (24.7)		838 (27.8)		435 (31.0)		411 (28.6)	
South	2262 (41.8)		1191 (39.5)		490 (35.0)		505 (35.2)	
West	993 (18.3)		564 (18.7)		275 (19.6)		289 (20.1)	
Childhood Abuse (%)	303 (6.3)		181 (6.7)		94 (7.6)		106 (8.4)	
Physical Health								
Number of chronic conditions (range: 0–8)		2.6 (1.4)		2.3 (1.4)		2.3 (1.3)		2.3 (1.3)
Diabetes (%)	1111 (21.1)		458 (15.6)		191 (14.0)		165 (11.9)	
Hypertension (%)	3048 (57.8)		1486 (50.6)		661 (48.6)		663 (47.9)	
Stroke (%)	393 (7.5)		115 (3.9)		67 (4.9)		57 (4.1)	
Cancer (%)	744 (14.1)		390 (13.3)		164 (12.1)		163 (11.8)	
Heart disease (%)	1196 (22.7)		559 (19.0)		228 (16.8)		233 (16.8)	
Lung disease (%)	496 (9.4)		184 (6.3)		81 (6.0)		76 (5.5)	
Arthritis (%)	3247 (61.6)		1563 (53.2)		719 (52.9)		756 (54.6)	
Overweight/obesity (%)	3720 (71.6)		2109 (72.6)		966 (71.5)		1010 (73.6)	
Physical functioning limitations (%)	1383 (26.2)		416 (14.2)		168 (12.3)		149 (10.8)	
Cognitive impairment (%)	1050 (20.2)		283 (9.8)		96 (7.2)		90 (6.6)	

Table 1 (continued)

Participant Characteristics	0 h (n = 6,050)		1–49 h (n = 3,594)		50–99 h (n = 1,649)		≥ 100 h (n = 1,671)	
	No. (%)	Mean (SD)	No. (%)	Mean (SD)	No. (%)	Mean (SD)	No. (%)	Mean (SD)
Chronic pain (%)	1913 (36.3)		919 (31.3)		395 (29.0)		422 (30.5)	
Self-rated health (range: 1–5)		3.1 (1.1)		3.5 (1.0)		3.5 (0.9)		3.6 (1.0)
Health Behaviors								
Heavy drinking (%)	307 (7.1)		206 (8.6)		76 (6.9)		79 (7.2)	
Smoking (%)	710 (13.6)		365 (12.5)		140 (10.4)		158 (11.5)	
Frequent physical activity (%)	3577 (67.8)		2424 (82.6)		1182 (86.9)		1195 (86.3)	
Sleep problems (%)	1185 (42.7)		667 (40.6)		282 (37.1)		321 (38.3)	
Religious Service Attendance (%)								
Never	1402 (26.6)		678 (23.1)		273 (20.0)		268 (19.3)	
< 1x/week	1638 (31.1)		958 (32.6)		450 (33.0)		511 (36.9)	
≥ 1x/week	2230 (42.3)		1302 (44.3)		639 (46.9)		607 (43.8)	
Psychological Well-Being								
Positive affect (range: 1–5)		3.5 (0.8)		3.7 (0.7)		3.7 (0.7)		3.7 (0.7)
Life satisfaction (range: 1–7)		5.0 (1.5)		5.2 (1.4)		5.3 (1.3)		5.3 (1.4)
Optimism (range: 1–6)		4.4 (1.0)		4.6 (0.9)		4.7 (0.9)		4.7 (0.9)
Purpose in life (range: 1–6)		4.5 (0.9)		4.8 (0.9)		4.8 (0.9)		4.9 (0.8)
Mastery (range: 1–6)		4.7 (1.1)		4.9 (1.0)		5.0 (1.0)		4.9 (1.0)
Health mastery (range: 0–10)		7.2 (2.4)		7.5 (2.1)		7.6 (2.0)		7.6 (2.1)
Financial mastery (range: 0–10)		7.4 (2.7)		7.4 (2.4)		7.6 (2.3)		7.4 (2.4)
Psychological Distress								
Depression (%)	819 (15.8)		275 (9.5)		109 (8.2)		119 (8.7)	
Depressive symptoms (range: 0–8)		1.5 (2.0)		1.1 (1.7)		1.0 (1.6)		1.0 (1.7)
Hopelessness (range: 1–6)		2.5 (1.3)		2.1 (1.1)		2.0 (1.1)		2.0 (1.1)
Negative affect (range: 1–5)		1.7 (0.7)		1.6 (0.6)		1.6 (0.5)		1.6 (0.6)
Perceived constraints (range: 1–6)		2.3 (1.2)		2.0 (1.0)		1.9 (1.0)		1.9 (1.0)
Social Factors								
Loneliness (range: 1–3)		1.5 (0.6)		1.4 (0.5)		1.4 (0.5)		1.4 (0.5)
Living with a spouse/partner (%)	3082 (65.3)		2026 (75.2)		906 (74.1)		937 (75.1)	
Contact children ≥ 1x/week (%)	3519 (74.3)		1997 (74.6)		942 (77.3)		985 (78.5)	
Contact other family ≥ 1x/week (%)	2420 (51.0)		1380 (51.0)		668 (53.8)		718 (56.8)	
Contact friends ≥ 1x/week (%)	2913 (61.0)		1863 (68.8)		892 (71.5)		907 (71.6)	
Personality								
Openness (range: 1–4)		2.9 (0.6)		3.0 (0.5)		3.1 (0.5)		3.1 (0.5)
Conscientiousness (range: 1–4)		3.3 (0.5)		3.4 (0.4)		3.5 (0.4)		3.5 (0.4)
Extraversion (range: 1–4)		3.1 (0.6)		3.3 (0.5)		3.3 (0.5)		3.3 (0.5)
Agreeableness (range: 1–4)		3.5 (0.5)		3.5 (0.4)		3.6 (0.4)		3.6 (0.4)
Neuroticism (range: 1–4)		2.1 (0.6)		2.0 (0.6)		2.0 (0.6)		2.0 (0.6)

[a]This table was created based on non-imputed data

[b]All variables in Table 1 were used as covariates, and assessed in the pre-baseline wave (t_0;2006/2008)

[c]The percentages in some sections may not add up to 100% due to rounding

participants engaging in informal helping ≥ 100 h/year (versus 0 h/year) had lower constraints (β = -0.06, 95% CI [-0.11, -0.01]). However, there was little evidence of associations between informal helping and life satisfaction, financial mastery, depression, depressive symptoms, hopelessness, and negative affect.

Finally, amongst social factors, participants engaging in informal helping ≥ 100 h/year (versus 0 h/year), conditional on prior informal helping, had a 13% increased likelihood of frequent contact with friends (95% CI [1.05, 1.23]). However, there was little evidence of associations between informal helping and loneliness, living with a spouse or partner,

Table 2 Informal Helping and Subsequent Health and Well-being (Health and Retirement Study [HRS]: N = 12,998)[a,b,c,d]

Outcomes	Informal Helping			
	0 h (n = 6,066) (Reference)	1–49 h (n = 3,603) RR/OR/β (95% CI)	50–99 h (n = 1,653) RR/OR/β (95% CI)	≥ 100 h (n = 1,676) RR/OR/β (95% CI)
Physical Health				
All-cause mortality	1.00	0.69 (0.59, 0.81)***	0.73 (0.59, 0.90)**	0.68 (0.54, 0.86)**
Number of chronic conditions	0.00	-0.04 (-0.07, -0.01)**	-0.03 (-0.08, 0.01)	-0.01 (-0.05, 0.03)
Diabetes	1.00	0.97 (0.89, 1.06)	0.98 (0.86, 1.11)	0.99 (0.88, 1.12)
Hypertension	1.00	0.98 (0.93, 1.04)	0.98 (0.91, 1.05)	1.01 (0.94, 1.09)
Stroke	1.00	0.87 (0.76, 1.01)	0.88 (0.73, 1.07)	0.80 (0.65, 0.98)*
Cancer	1.00	0.94 (0.85, 1.04)	0.89 (0.78, 1.03)	0.92 (0.80, 1.06)
Heart disease	1.00	0.97 (0.90, 1.05)	0.99 (0.89, 1.11)	0.97 (0.86, 1.09)
Lung disease	1.00	0.96 (0.84, 1.09)	1.02 (0.86, 1.21)	0.93 (0.78, 1.12)
Arthritis	1.00	1.00 (0.94, 1.06)	1.01 (0.94, 1.09)	1.03 (0.96, 1.11)
Overweight/obesity	1.00	1.01 (0.96, 1.07)	1.01 (0.94, 1.09)	1.03 (0.96, 1.11)
Physical functioning limitations	1.00	0.86 (0.78, 0.94)***	0.76 (0.66, 0.87)***	0.78 (0.68, 0.89)***
Cognitive impairment	1.00	0.93 (0.85, 1.03)	0.77 (0.67, 0.90)***	0.79 (0.68, 0.93)**
Chronic pain	1.00	1.00 (0.93, 1.08)	0.99 (0.90, 1.09)	0.99 (0.89, 1.09)
Self-rated health	0.00	0.08 (0.04, 0.12)***	0.10 (0.04, 0.15)**	0.10 (0.05, 0.16)***
Health Behaviors				
Heavy drinking	1.00	1.02 (0.77, 1.33)	1.04 (0.76, 1.42)	1.18 (0.85, 1.63)
Smoking	1.00	1.07 (0.91, 1.26)	1.11 (0.91, 1.35)	1.19 (0.98, 1.44)
Frequent physical activity	1.00	1.09 (1.02, 1.15)**	1.12 (1.04, 1.20)**	1.11 (1.04, 1.20)**
Sleep problems	1.00	0.99 (0.92, 1.07)	0.95 (0.86, 1.05)	1.01 (0.91, 1.12)
Psychological Well-Being				
Positive affect	0.00	0.08 (0.03, 0.12)***	0.10 (0.05, 0.16)***	0.11 (0.03, 0.18)**
Life satisfaction	0.00	0.05 (0.00, 0.11)	0.06 (0.00, 0.12)	0.04 (-0.05, 0.14)
Optimism	0.00	0.05 (0.01, 0.09)*	0.05 (0.01, 0.10)	0.11 (0.05, 0.17)***
Purpose in life	0.00	0.09 (0.04, 0.14)**	0.11 (0.06, 0.17)***	0.15 (0.07, 0.22)**
Mastery	0.00	0.06 (0.01, 0.11)*	0.07 (0.01, 0.13)*	0.11 (0.02, 0.19)*
Health mastery	0.00	0.05 (0.00, 0.10)*	0.05 (-0.01, 0.12)	0.09 (0.02, 0.15)**
Financial mastery	0.00	0.05 (0.01, 0.09)*	0.04 (-0.02, 0.10)	0.06 (-0.02, 0.14)
Psychological Distress				
Depression	1.00	0.98 (0.85, 1.13)	1.05 (0.86, 1.28)	0.97 (0.78, 1.21)
Depressive symptoms	0.00	-0.04 (-0.08, 0.00)	-0.04 (-0.10, 0.01)	-0.02 (-0.08, 0.05)
Hopelessness	0.00	-0.06 (-0.10, -0.02)**	-0.06 (-0.12, 0.00)	-0.07 (-0.13, 0.00)
Negative affect	0.00	0.01 (-0.05, 0.07)	0.02 (-0.03, 0.07)	0.04 (-0.03, 0.12)
Perceived constraints	0.00	-0.07 (-0.11, -0.02)**	-0.07 (-0.13, -0.01)*	-0.06 (-0.11, -0.01)*
Social Factors				
Loneliness	0.00	-0.03 (-0.09, 0.03)	-0.07 (-0.14, -0.01)*	-0.03 (-0.11, 0.04)
Living with a spouse/partner	1.00	1.01 (0.95, 1.07)	1.01 (0.94, 1.10)	0.99 (0.91, 1.08)
Contact children ≥ 1x/week	1.00	1.03 (0.98, 1.09)	1.03 (0.96, 1.11)	1.06 (0.99, 1.14)
Contact other family ≥ 1x/week	1.00	1.04 (0.97, 1.11)	1.02 (0.93, 1.12)	1.04 (0.94, 1.15)
Contact friends ≥ 1x/week	1.00	1.10 (1.03, 1.17)**	1.15 (1.06, 1.24)***	1.13 (1.05, 1.23)**

CI confidence interval, *OR* odds ratio, *RR* risk ratio

*$p < 0.05$ before Bonferroni correction; **$p < 0.01$ before Bonferroni correction; ***$p < 0.05$ after Bonferroni correction (the p-value cutoff for Bonferroni correction is $p = 0.05/35$ outcomes: $p < 0.001$)

[a]If the reference value is "1," the effect estimate is OR or RR; if the reference value is "0," the effect estimate is β

[b]The analytic sample was restricted to those who had participated in the baseline wave (t_1;2010/2012). Multiple imputation was performed to impute missing data on the exposure, covariates, and outcomes. All models adjusted for: sociodemographic characteristics (age, sex, race/ethnicity, marital status, annual household income, total wealth, level of education, employment status, health insurance, geographic region), child-

Table 2 (continued)

hood abuse, religious service attendance, prior values of the outcome variables (diabetes, hypertension, stroke, cancer, heart disease, lung disease, arthritis, overweight/obesity, physical functioning limitations, cognitive impairment, chronic pain, self-rated health, heavy drinking, current smoking status, physical activity, sleep problems, positive affect, life satisfaction, optimism, purpose in life, mastery, health mastery, financial mastery, depressive symptoms, hopelessness, negative affect, perceived constraints, loneliness, living with spouse/partner, contact children ≥ 1x/week, contact other family ≥ 1x/week, contact friends ≥ 1x/week), personality factors (openness, conscientiousness, extraversion, agreeableness, neuroticism), and prior informal helping, each of which was assessed in the pre-baseline wave (t_0;2006/2008)

[c]An outcome-wide analytic approach was used, and a separate model for each outcome was run. A different type of model was run depending on the nature of the outcome: 1) for each binary outcome with a prevalence of ≥ 10%, a generalized linear model (with a log link and Poisson distribution) was used to estimate a RR; 2) for each binary outcome with a prevalence of < 10%, a logistic regression model was used to estimate an OR; and 3) for each continuous outcome, a linear regression model was used to estimate a β

[d]All continuous outcomes were standardized (mean = 0; standard deviation = 1), and β was the standardized effect size

or contact with children or other family. For associations between informal helping at other amounts (e.g., 1–49 and 50–99 h/year vs. 0 h/year) and subsequent health and well-being outcomes, see Table 2.

Additional Analyses

Concerning the additional analyses, first, E-values suggested that many of the observed associations were moderately robust to unmeasured confounding (Table 3). For example, for mortality, an unmeasured confounder associated with both informal helping and mortality by risk ratios of 2.29 each (above and beyond the covariates already adjusted for) could explain away the association, but weaker joint confounder associations could not. Further, to shift the CI to include the null, an unmeasured confounder that was associated with both informal helping and mortality by risk ratios of 1.60 each could suffice, but weaker joint confounder associations could not. Second, adjustment for conventional covariates showed mostly larger estimates than found in the fully adjusted models (Electronic Supplementary Material Table 2). Third, after removing anyone with a history of a given physical condition at baseline, estimates were generally similar (Electronic Supplementary Material Table 2). Fourth, complete-case analyses showed similar results to results from the main imputed analyses (Electronic Supplementary Material Table 3). Fifth, results from analyses that additionally adjusted for formal volunteering at baseline (Electronic Supplementary Material Table 4), social factors (social network factors, social support, and social participation; Electronic Supplementary Material Table 5), and combined covariates from Supplemental Tables 4 and 5 (volunteering and all social factors; Electronic Supplementary Material Table 6), showed similar results to the main imputed analyses (with the exception of stroke and some psychosocial factors), suggesting that informal helping is associated with improved subsequent health and well-being above and beyond the effects of formal volunteering and other social factors.

Discussion

In a large, longitudinal, and national sample of US adults aged > 50, informal helping ≥ 100 h/year (versus 0 h/year) was associated with improved physical health (e.g., decreased risk of: mortality, stroke, physical functioning limitations, cognitive impairment; higher self-rated health), health behaviors (e.g., increased physical activity), psychological well-being (e.g., increased: positive affect, optimism, purpose in life, mastery, and health mastery), psychological distress (e.g., decreased constraints) and social outcomes (e.g., more frequent contact with friends). However, informal helping showed little evidence of associations with other physical health factors (e.g., number of chronic conditions, diabetes, hypertension, cancer, heart disease, lung disease, arthritis, overweight/obesity, and chronic pain), health behaviors (e.g., heavy drinking, smoking, and sleep problems), psychological well-being (e.g., life satisfaction, financial mastery), psychological distress (e.g., depression, depressive symptoms, hopelessness, and negative affect), and social factors (e.g., loneliness, living with a spouse or partner, contact with children and other family). The findings from this study converge with findings from some prior studies (e.g., associations between informal helping and mortality, positive affect, and null associations with depression; [11, 13, 18]) and diverge from other studies (e.g., associations between informal helping and cardiovascular disease, hypertension; [3]). Findings may have diverged for many reasons, including: 1) different measurements to assess the exposure and outcomes, 2) differences in sample composition, 3) this study adjusted for an extensive set of covariates while most other studies used a more limited set of covariates (e.g., sociodemographics only), 4) many previous studies were cross-sectional, and most did not adjust for pre-baseline informal helping and outcomes. In the case of depression and depressive symptoms, for example, the null results here using longitudinal data, may indicate that prior cross-sectional studies found a protective association, not necessarily because informal helping protects

Table 3 Robustness to Unmeasured Confounding (E-Values) for the Associations Between Informal Helping (≥ 100 h vs. 0 h) and Subsequent Health and Well-Being (N = 12,998)[a]

	Effect Estimate[b]	Confidence Interval Limit[c]
Physical Health		
All-cause mortality	2.29	1.60
Number of chronic conditions	1.09	1.00
Diabetes	1.10	1.00
Hypertension	1.11	1.00
Stroke	1.82	1.17
Cancer	1.40	1.00
Heart disease	1.21	1.00
Lung disease	1.36	1.00
Arthritis	1.22	1.00
Overweight/obesity	1.22	1.00
Physical functioning limitations	1.88	1.49
Cognitive impairment	1.84	1.37
Chronic pain	1.13	1.00
Self-rated health	1.43	1.28
Health Behaviors		
Heavy drinking	1.64	1.00
Smoking	1.66	1.00
Frequent physical activity	1.47	1.23
Sleep problems	1.12	1.00
Psychological Well-being		
Positive affect	1.43	1.23
Life satisfaction	1.25	1.00
Optimism	1.44	1.27
Purpose in life	1.54	1.35
Mastery	1.43	1.19
Health mastery	1.38	1.17
Financial mastery	1.31	1.00
Psychological Distress		
Depression	1.20	1.00
Depressive symptoms	1.13	1.00
Hopelessness	1.32	1.03
Negative Affect	1.24	1.00
Constraints	1.30	1.08
Social Factors		
Loneliness	1.21	1.00
Living with spouse/partner	1.08	1.00
Contact children ≥ 1x/week	1.33	1.00
Contact other family ≥ 1x/week	1.25	1.00
Contact friends ≥ 1x/week	1.52	1.26

[a]See VanderWeele and Ding (2017) for the formula for calculating E-values

[b]The E-values for effect estimates are the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome to fully explain away the observed association between the exposure and outcome, conditional on the measured covariates

[c]The E-values for the limit of the 95% confidence interval (CI) closest to the null denote the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome to shift the confidence interval to include the null value, conditional on the measured covariates

against depression, but because depressed people are less likely to provide help to others.

Conceptual disagreement remains about the specific boundaries that separate various constructs related to social support, and definitions of social relationships are often broad [35–37]. Just as many researchers believe the distinction between some aspects of social support (e.g., formal volunteering and informal helping) is important to assess as these two topics are meaningfully distinct and have different contextual factors [38], our intention was to distinguish between informal helping and other related social support factors. While many studies have demonstrated that general measures of social support (e.g., Sarason et al.'s highly cited measure [39, 40]) are indeed associated with well-being, scholars are increasingly trying to demonstrate which aspects of social support are most efficacious in improving well-being for different groups of people at different stages of life or life contexts (e.g., some cannot formally volunteer, but they can offer informal help that is separate from caregiving for family). Informal helping may fall under the broad umbrella of social support provision, but not all social support provision would be classified as informal helping (and vice versa). Informal helping may be conceptually distinct from other aspects of social support in several ways (e.g., perceptions of recipients (informal helping may be done without the recipients' knowledge (e.g., a neighbor knows someone has moved their trash bins for them but doesn't know who)), and acts of informal helping may also not be directed at a specific recipient (e.g., "informal political participation, informal religious activity, and membership in informal mutual assistance groups" [4]); however, social support is provided to known recipients). Relatedly, our findings suggest that associations between informal helping and health and well-being outcomes in this study are not explained by other prosocial behaviors (e.g., volunteering) or other social factors (e.g., social support, social network, or social participation).

While much of the prior literature on prosociality and health in older adults has focused on formal volunteering [3], we focused on the unique associations of informal helping – an understudied prosocial behavior in older adults but a behavior that is more common – with subsequent health and well-being outcomes. While informal helping may appear to be a similar construct to formal volunteering, informal helping is differentially associated with (and conceptually distinct from) formal volunteering [2]. For instance, informal helping likely has more reciprocity and obligation engineered into the exchanges. Here, a few key differences observed between informal helping and formal volunteering are commented on. For instance, compared with findings that were also based on HRS data [2], informal helping was associated with improvements in a greater number of psychological well-being factors than formal volunteering, while formal volunteering was associated with improvements in more

psychological distress outcomes. Perhaps when informally helping people that one knows, helpers receive more consistently positive feedback than that they might receive from formally volunteering to serve strangers (who may give mixed or no reactions). In regard to social factors, formal volunteering was associated with lower loneliness, while informal helping was not. Informal helping (e.g., picking up groceries for a neighbor) might provide less opportunity to form new relationships than formal volunteering, though associations are observed between informal helping and increased objective contact with friends. If people are trying to decrease loneliness and increase social contact, formal volunteering might be a more intentional way of doing this, though there are avenues of informal helping that appear to increase the frequency of contact with others in one's existing social network. Though some differences between informal helping and formal volunteering are apparent, some key similarities (e.g., decreased risks of mortality, increased likelihood of engaging in physical activity, etc.) suggest that there may be common systems and mechanisms linking prosocial acts more generally with health and well-being. For example, the caregiving system model, which provides neurophysiological mechanistic explanations for how helping others affects physical health and longevity, suggests that helping others triggers the release of hormones that downregulate the harmful effects of stress (e.g., inflammation and the immune response [3]). Further, helping close others has been shown to buffer against the harmful effects of stress, and there are several plausible psychosocial mechanisms explaining this finding (e.g., increased: sense of meaning or mattering, social well-being, and opportunities for generativity [41]).

In supplementary analyses, formal volunteering and social factors were further adjusted for to isolate the effects of informal helping, and the results with health and well-being outcomes were largely maintained (with the exception of some outcomes, e.g., stroke, contact with friends). It is possible that some other social factors (e.g., one's social participation/social network) may have accounted for associations between informal helping and stroke. The cascading social process model [42] may explain this finding. According to this model, social network characteristics (e.g., size/density of relationships) facilitate social mechanisms (e.g., contact with friends and helping friends/neighbors/relatives), which may flow through specific pathways (e.g., health behaviors) to influence health and well-being outcomes (e.g., stroke). Thus, it is possible that informal helping does not provide benefits to some physical health outcomes (e.g., stroke) above and beyond the effects of other social factors. Regarding social outcomes, after adjusting for formal volunteering and other social factors, there was no longer notable evidence of associations with informal helping. Perhaps, other social factors (e.g., social support, social participation) are more direct routes to increasing contact with friends, while informal helping behaviors (e.g., purchasing groceries for a neighbor), do not necessarily increase social contact.

These findings should be considered in the context of their limitations, which inspire many important future directions. First, nearly all of the physical health outcomes and health behaviors used in the current study were self-reported, and thus may be susceptible to self-report bias. Future studies should measure these outcomes objectively. However, study participants were blind to this study's hypotheses and reported informal helping before this study was conducted. Second, there is the potential for confounding by third variables. However, this concern was reduced by implementing a longitudinal study design, adjusting for a large number of covariates, and conducting E-value analyses. Third, the type and quality (e.g., providing an instrumental service such as transportation or warm, caring emotional support [37, 41, 43]), recipient (close friend or distant neighbor/relative), and motivation (e.g., doing voluntary acts of kindness or involuntary chores for a sick relative) of the informal helping done is not known based on the informal helping item used in HRS. These may have different implications for health and well-being. For example, assessing a singular instance of informal helping done toward a stranger (from which nothing can be expected in return) may better capture a truly prosocial intent behind that instance of informal helping than social support provision (e.g., emotional support) directed toward a friend in a mutual relationship. We encourage the development of survey items that would more directly assess some issues that ours could not address (e.g., informal helping done in the context of mutual relationships vs. toward strangers): "Have you spent any time in the past 12 months helping strangers without expecting or receiving anything in return?" These will be important distinctions to parse out in future research. Fourth, *how* informal helping influences health is not known. Some of the associations observed in this study may act as mechanistic pathways and should be evaluated using formal mediation methods. For example, perhaps with more informal helping, people experience fewer (subjective) physical functioning limitations because helping someone else helps oneself feel more capable (e.g., through an increased sense of mastery). Alternatively, informal helping may increase physical activity (perhaps one is acquiring increased physical activity through running errands/doing chores), and as a result might influence objective physical functioning. Fifth, it is not known for whom informal helping is the most influential for health outcomes. Future studies may benefit from assessing important candidate moderators (e.g., age, socioeconomic status, personality) that influence associations between informal helping and health and well-being outcomes. Informal helping, if associated with improved health and well-being in traditionally marginalized populations, may be a route to helping others (and experiencing the health benefits of doing

so) despite an inability to formally volunteer. In fact, informal helping in some studies is more common among lower SES populations [4]. Sixth, the study waves are spaced four years apart in HRS. To assess the potential outcomes of an intervention over a shorter time period, and to reduce the potential amount of change in the covariates from the pre-baseline to baseline wave, future studies may benefit from a shorter time period between the pre-baseline and baseline waves. The current study had several notable strengths. This study used a large and national sample aged > 50. Further, this study simultaneously assessed a large number of outcomes using a longitudinal study design that allows for a direct comparison of effect sizes between outcomes.

Conclusion

Research that reveals how to encourage more acts of prosociality is valuable for its own sake and could be deployed to identify pathways for more timely and complete recovery from the stressors associated with COVID-19. Informal helping is a historically understudied, but a potentially powerful driver of health and well-being in older adults. Informal helping behaviors, as opposed to formal volunteering, are open for wider segments of the population to engage in and may have positive effects on subsequent health and well-being that rival or exceed the more commonly studied formal volunteering. Prosocial activities can also be increased through intervention (e.g., community courses improving compassion and social trust [16]) and these findings highlight the effects that might be observed if informal helping interventions and/or policies were implemented at scale. Interventions to promote compassion might also be understood as building the capacity to love others. A focus on the fundamental dignity of everyone as a human person, and promoting teachings and practices of love of neighbor, common to many religious traditions, might also foster informal helping, formal volunteering, and prosociality more generally. In addition to interventions, policies that encourage social participation and engagement (such as the World Health Organization development of age-friendly communities [44, 45]) provide opportunities for older adults to act as active contributors to the community. This may promote increased informal helping and subsequently result in enhanced health and well-being outcomes. In line with calls to consider "the variety of ways in which prosocial behavior can be manifested" [1], with further evidence, these findings suggest the benefits of encouraging more micro-moments of kindness into the lives of many. Promoting informal helping may be a double-pronged approach to: 1) improving the health of the helpers on an individual level, and 2) improving society as a whole.

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Data Availability The authors do not have permission to share data but the source data is publicly available from the HRS upon request.

Declarations

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was exempt from review by the Institutional Review Board at the University of British Columbia because data were publicly available and de-identified.

Informed Consent Informed consent was obtained by the Health and Retirement Study from all individual participants included in the study.

Conflicts of Interest Tyler J. VanderWeele reports receiving personal fees from Flerish Inc. and Flourishing Metrics. Julia S. Nakamura, Matthew T. Lee, and Eric S. Kim have no competing interests to declare that are relevant to the content of this article.

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