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ORIGINAL ARTICLE

A randomized controlled trial and pragmatic analysis of the effects of volunteering on the health and well-being of older people

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Abstract

Background Volunteering among older people has the potential to deliver health benefits to the individual, along with economic and social benefits to society. However, it is not clear whether healthier people are more likely to engage in volunteering, whether volunteering improves health, or the extent to which the relationship may be reciprocal. There is an identified need for longitudinal work, especially in the form of randomized controlled trials, to establish causality.

Aims To assess the effects of commencing volunteering among older non-volunteers utilizing a randomized controlled trial approach involving per-protocol and pragmatic analyses.

Methods Of the 445 Australians aged 60 + years who participated in the study, 201 were assigned to an intervention arm that required them to participate in a minimum of 1 h/week of formal volunteering in a position of their choice. The remaining participants were assigned to a control condition and asked to continue their lives as usual, but were not discouraged from commencing volunteering.

Results Across the assessed physical, psychological, and social variables, a significant difference in sit-to-stand scores was found in both the per-protocol and pragmatic analyses, and a further significant difference in the fast pace walk was identified in the pragmatic analyses.

Conclusion The results provide some support for policies and programs designed to encourage older people to engage in volunteering to maintain or improve their health.

Trial registration Australian and New Zealand Clinical Trials Registry ACTRN12615000091505.

Keywords Volunteering · Health promotion · Exercise

Introduction

Healthy aging is characterized by individuals maintaining high levels of functionality, independence, and the ability to contribute to society in later life [1, 2]. Achieving healthy aging is important for individuals' quality of life and is becoming increasingly critical at the societal level due to

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rapid population aging and the potential implications for the viability of health systems and economies [1].

The effective promotion and facilitation of healthy aging requires the identification and promotion of lifestyle behaviors that are protective of health in later life [3]. These behaviors include those relating to specific consumption acts (e.g., eating a healthy diet and avoiding tobacco and excessive alcohol consumption) and broader categories of action (e.g., regular engagement in physical, mental, and social activities) [4–8]. Evidence suggests that healthy aging interventions that encompass multiple behavioral domains can be more effective than those targeting single domains [9].

Volunteering is understood to be a potential healthy aging intervention that has substantial individual and societal-level benefits across multiple domains [10–14]. Formal volunteering has been defined as the provision of labor via an affiliation with an official organization [15, 16]. This differs from informal volunteering or caring activities that occur outside of formal organizational structures and typically involve assistance provided to friends and family members [17]. Engagement in formal volunteering has been associated with favorable physical and mental health outcomes for older people [12], with these outcomes proposed to result from complex interactions between the physical, psychological, and social aspects of volunteering activity [10]. However, despite these benefits, only a minority of older people volunteer. In Australia, the context of the present study, 20% of those aged 65 + years reported volunteering in the year prior to the 2016 census [18].

An important precursor to large-scale investments in health interventions is sound evidence relating to the likely benefits of initiatives to guide allocation of constrained budgets [3]. To date, most evidence relating to the potential health outcomes of volunteering among older people is limited to cross-sectional studies (and to a lesser extent prospective cohort studies) that demonstrate favorable associations between engagement in volunteering and a range of physical and mental health outcomes [10, 12, 19]. Examples of favorable physical health outcomes include higher levels of physical activity [20], greater functionality [13, 21], lower prevalence of hypertension [22], higher cognitive functioning [23, 24], less time in hospital [14], higher self-rated health [21, 25, 26], and reduced mortality [25]. In terms of mental health, engaging in volunteering has been associated with lower rates of depression [21, 27], higher levels of life satisfaction and subjective well-being [25, 28, 29], higher self-esteem [30], greater social connectedness [11, 30], and reduced loneliness [31].

Although the available evidence for the beneficial health effects of volunteering is promising, it is not clear whether healthier people are more likely to engage in volunteering, whether volunteering improves health, or the extent to which the relationship may be reciprocal. There is an identified need for longitudinal work, especially in the form of randomized controlled trials, to establish causality [10, 12, 30]. To date, the very few randomized controlled trials investigating the health and well-being effects of volunteering among seniors relate specifically to intergenerational or fostering programs designed to provide opportunities for older people to interact with children [20, 32–34]. In these studies, the samples comprised older people who had expressed interest in either teaching or fostering children, and as such are unlikely to be representative of the broader population of seniors. Significant differences in physical activity and/or cognitive and social outcomes were found between intervention and control groups, suggesting that the volunteering activities conferred benefits to the intervention groups. Further randomized controlled trials are required to provide greater insight into the nature and extent of relationships between participation in a wider range of volunteering activities (i.e., beyond just those involving children) and a more comprehensive range of health outcomes across physical, psychological, and social domains. Finally, as most prior work in this field has been conducted in the US, it has been noted that research is needed in other geographical contexts to provide a broader understanding of relevant factors [12, 19].

To address these research gaps, the present study constituted a randomized controlled trial involving non-volunteers aged 60 + years residing in the general community who had no known interest in volunteering. The aim was to identify any relationships between commencing volunteering and changes in various physical, psychological, and social outcomes over time. Engagement in volunteering was prescribed to those in the intervention condition, although they were able to select their preferred type of formal volunteering. This arrangement reflects the real-world situation where individuals choose their volunteer vocation according to personal preferences. Randomly assigning participants who had not expressed any interest in volunteering to the intervention condition is similar to the phenomenon of 'voluntolding' that occurs when individuals are forced to volunteer to access social benefit payments or fulfill community service obligations [35]. If the benefits could be demonstrated, this approach could also be used in the form of medical practitioners prescribing volunteering as a health intervention for older people.

Based on existing literature, it was hypothesized that commencement of formal volunteering among non-volunteers aged 60 + years would improve physical, psychological, and social outcomes relative to those observed in a control group. Given the acknowledged substantial real-world constraints of volunteering research [12], in particular the inability to prevent those in the control condition from commencing volunteering over the study period, pragmatic

analyses was conducted in addition to the per-protocol analyses [36]. This involved assessing outcomes for all participants engaging in formal volunteering over the study period, regardless of assigned condition.

Methods

The study protocol received approval from the Curtin University Human Research Ethics Committee and was registered with the Australian and New Zealand Clinical Trial Registry (ACTRN12615000091505). Full details of the study protocol are reported in Pettigrew, Jongenelis, Newton, Warburton, and Jackson [37]. The completed CONSORT checklist is provided in the supplementary materials.

Design

Using a parallel-group design, eligible individuals were randomly assigned to either the intervention or control arms of the trial. A simple randomization method was adopted, with a researcher independent to the study using a computer-generated randomization script to determine the allocation sequence. Participants were allocated to condition based on sequence by author MJ as they were recruited into the study. Participants and members of the study team assessing physical health outcomes were blinded to assignment (i.e., those in the intervention condition were not advised that there was a parallel condition in the study that did not involve volunteering, and those in the control condition were not advised that there was an intervention condition that involved volunteering).

The total planned sample size was $n = 400$, with 200 allocated to the intervention arm and 200 to the control arm. This sample size was determined according to the requirement for power of 0.80 to detect a main effect or interaction at an alpha level of 0.01 and a conservative effect size of 0.1. Participants in the intervention arm were asked to undertake a minimum of 60 min of formal volunteering per week during the 6-month study. Participants in the control arm were not required to engage in formal volunteering, however, due to the potential health benefits of this activity, they were not required to refrain from volunteering during the study period as per ethics approval requirements.

Participants

Community-dwelling Australians aged 60 years and over were recruited into a study on 'healthy aging' via a wide range of communication strategies including radio announcements, notices in newspapers, flyers in retirement villages and government offices, and approaches made in shopping centers and seniors' venues. The study was conducted in Perth, Western Australia, and participants were limited to those who could attend one of two university campuses in the metropolitan area (one in the north and one in the south of the city), thus effectively confining participation to those who lived in the metropolitan area and had adequate mobility to travel to and around a large campus.

At the time of recruitment, individuals were assessed for eligibility. Criteria were being 60 + years of age, being fully retired, and no participation in formal volunteering during the previous 12 months. Eligible individuals were advised that involvement in the study would require them to (1) complete surveys, (2) attend two data collection sessions at a university campus 6 months apart, (3) wear a step count device, and (4) document their daily activity levels. AUD$200 remuneration was offered to compensate participants for their effort, travel time to and from the university campus, and associated transport and parking costs. All participants provided signed informed consent at their first on-campus visit.

Due to lower participation rates among those allocated to the volunteering condition, additional recruitment was undertaken using the same randomization procedure, resulting in a total sample of 445 (201 in the intervention condition, 244 in the control condition). Table 1 provides the final sample composition in total and by condition allocation. The CONSORT flow diagram of the progress through the phases of the randomized trial is presented in Fig. 1.

Measures

Reviews of previous studies on the outcomes of volunteering for healthy aging have emphasized the need for inclusion of objective measures to provide a more rigorous assessment of study outcomes [6, 10]. The objective and subjective measures used in the present study to assess a diverse range of outcome variables are described below.

Sociodemographic measures

Participants were asked to report personal attributes such as gender, age, highest level of education, country of birth, and postcode. Reported postcodes were used to calculate the socio-economic status (SES) of the area in which participants resided according to the Australian Bureau of Statistics' Socioeconomic Index for Areas [38].

Physical measures

To assess objective health, participants were asked to report any diagnoses of chronic diseases, with the total number of diseases reported used as a variable in analyses. In addition, objective measures of height and weight were collected by trained research assistants using a

Table 1 Sample profile by condition allocation

	Total sample at T1 $n=445$		Total sample at T2 $n=370$		Volunteer condition at T2 $n=148$		Control condition at T2 $n=222$	
	n	%	*n*	%	*n*	%	*n*	%
Gender								
Male	196	44	169	46	57[a]	39	112	51
Female	249	56	201	54	91	61	110	49
Age (years)								
60–69	216	49	172	47	64	43	108	49
70–79	193	43	168	45	72	49	96	43
80 +	36	8	30	8	12	8	18	8
Mean (*SD*)	70.39 (6.08)		70.67 (5.94)		70.83 (5.73)		70.56 (6.08)	
SES[b]								
Low	66	15	49	13	19	13	30	14
Mid	203	46	171	46	62	42	109	49
High	176	39	150	41	66	45	83	37
Objective health								
Mean (SD)	2.55 (1.61)		2.40 (1.57)		2.47 (1.68)		2.36 (1.50)	

Missing values ($n=2$ on self-rated health variable, $n=2$ on objective health variable) treated listwise. Figures represent information collected at the time point noted in the column header (with the exception of objective health which was not re-assessed at T2)

[a]Significantly different from those in the control condition at $p<.05$

[b]Based on postcode using the Australian Bureau of Statistics' Socio-Economic Index For Areas *Index of Relative Disadvantage* [38]

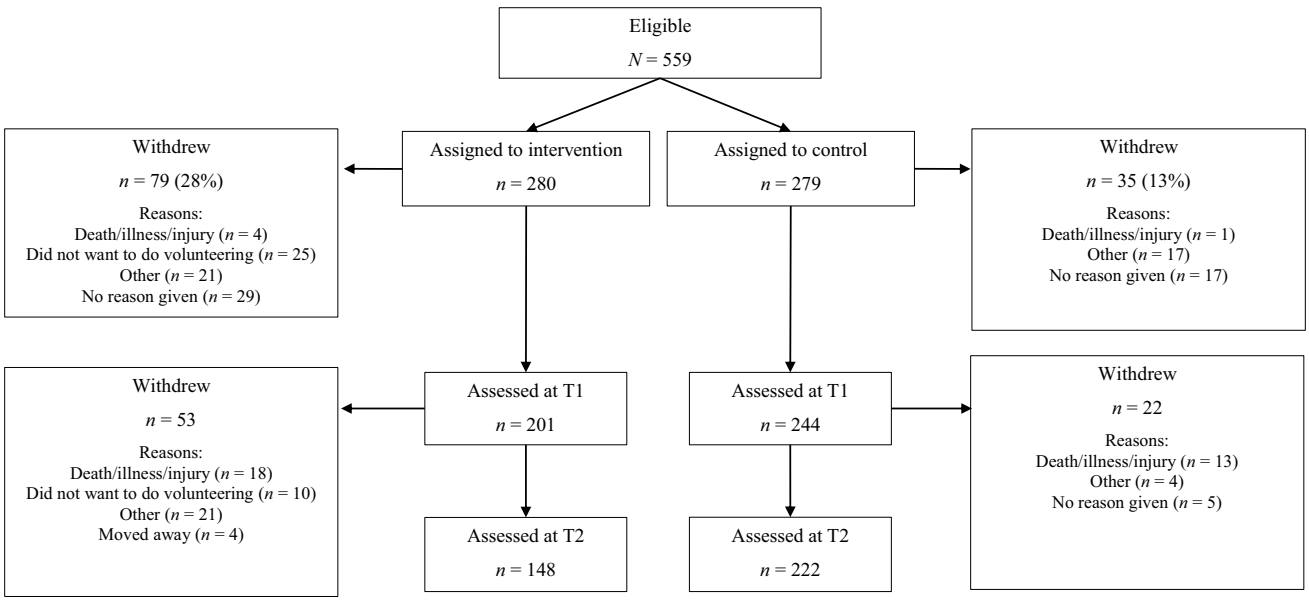

Fig. 1 CONSORT flow diagram

calibrated stadiometer and scales. Results were used to calculate participants' body mass index (BMI). Waist girth was assessed twice, with the average of these two measurements used if they differed by no more than 2 mm. If a difference > 2 mm was observed, a third reading was taken and the average of all three measurements was used in analyses. Three consecutive readings of participants' resting heart rate were taken at 1-min intervals with the average of the second and third readings used.

Two tests of gait speed (an important global indicator of physical functioning and frailty status; [39]) were conducted: (1) a 6 m 'normal' pace test in which participants were instructed to walk at a pace similar to when undertaking their daily activities and (2) a 6 m 'fast' pace test in which participants were instructed to walk as fast as possible without running. Dynamic balance was assessed using the 6 m backwards walking test in which participants were instructed to walk backwards placing one foot directly behind the heel of the other. All walking tests were completed three times by participants (using light gates), with intervening recovery times. The fastest time recorded across the three attempts for each test was used in analyses. To test walking endurance, participants were instructed to walk 400 m (10 laps out and back over a 20 m course) as fast as they could at a pace they could maintain [40]. Time taken (measured by stopwatch in seconds) to complete this walk was used in analyses.

Lower limb strength was assessed using the five repetition sit-to-stand test. Participants were seated in a hard-backed chair with their arms folded across their chest and instructed to rise as fast as possible to a full standing position then return to a full sitting position five times. The fastest time recorded (measured by stopwatch) across three attempts was used in analyses.

To assess muscle strength, participants completed three exercises: chest press, leg extension, and seated row. A warm-up set of six repetitions of each exercise was performed at 60% of perceived one-repetition maximum strength (1RM). After a 2-min rest interval, a set of three repetitions of each exercise was performed at 80% perceived 1RM. After another 2-min rest interval, 1–5 trials to determine the maximum weight that could be lifted once successfully and with correct technique were performed with 2–3-min rest intervals between trials. Maximum weight successfully lifted was recorded and used in analyses.

Daily engagement in moderate-to-vigorous physical activity (MVPA) and daily step counts were assessed objectively using GT3X accelerometers (ActiGraph, Pensacola, Florida). Participants were instructed to wear the device attached to a belt on their hip over a 24-h period for 7 consecutive days, removing it only for water-based activities. Periods of continuous zeros lasting more than 90 min were considered non-wear time [41]. Average minutes of MVPA per week were calculated using vector-magnitude cut-points that have been established in older adults ($\geq$ 2752 counts/min [42]).

Psychological measures

Participants completed nine psychological scales: the Warwick–Edinburgh Mental Well-Being Scale [43], the Center for Epidemiological Studies Depression Scale [44], the Global Quality of Life Scale [45], the Rosenberg Self-Esteem Scale [46], the General Self-Efficacy Scale [47], and the Purpose in Life and Personal Growth subscales of Ryff's Psychological Well-Being Scales [48]. In addition, satisfaction with life was assessed on a single-item scale of 1 (Very good) to 5 (Very bad), with responses reverse-scored for analysis purposes.

Social measures

The Social Provisions Scale [49] was used to assess participants' perceptions of the support they receive from other people across the six domains of nurturance, reassurance of worth, social integration, reliable alliance, and guidance.

Volunteering measures

Participants in both conditions reported whether they engaged in formal volunteering at the beginning of the study (asked verbally upon recruitment for eligibility determination) and at the end of the study via a survey. The survey items asked participants to report whether they had undertaken formal volunteering in the previous 6 months (yes/no response options), with those responding in the affirmative asked to report the average number of hours per week and the number of organizations for which they had volunteered. A definition of formal volunteering (work activities that are unpaid, non-compulsory, and unrelated to family obligations) was provided at both time points to minimize response error (e.g., participants perceiving informal volunteering or caring duties as formal volunteering).

Protocol

Participants initially completed a survey (either in hard copy or online) that contained demographic and health history items and the psychological and social provisions scales. They then attended one of two university campuses (located in the north or south of the city) where they undertook their Time 1 (T1) physical assessments and were given an accelerometer to wear over the following 7 days. Participants allocated to the intervention condition received assistance in identifying volunteering positions of interest to them. This involved a research assistant accessing an online volunteering resource and entering the participant's postcode to generate a list of activities in their local area and discussing potential positions with them. Alternatively, participants could nominate a particular interest (e.g., planting trees) and an online search was conducted by the research assistant to locate possible volunteering options relating to this preference. Participants were responsible for then using this information to attain a volunteering position. Other than the provision of assistance to source volunteering opportunities, this protocol was repeated after 6 months (Time 2: T2).

Data collection commenced December 2014 and occurred progressively until February 2017.

Analysis

Paired samples *t* tests were used to assess changes between T1 and T2 within groups and two-way repeated measures ANOVAs were conducted to compare differences over time between the groups. The dependent variables were the measures listed above, with the exception of sociodemographic characteristics. To assess the intervention effects, a per-protocol approach was initially adopted that involved excluding data from participants who provided baseline data but did not complete the T2 assessments. Pragmatic analyses were then conducted to identify any relationships between commencing volunteering and changes in various physical, psychological, and social outcomes over time irrespective of condition allocation. These analyses were identical to the per-protocol analyses, with the exception that actual volunteering status (i.e., did or did not volunteer) was entered as the between-groups factor rather than condition allocation. Only participants in both conditions who reported volunteering for at least one organization were classified as volunteers in the pragmatic analyses.

Further sensitivity analyses were conducted according to the intention-to-treat principle whereby all participants who provided baseline data were retained irrespective of study completion. Baseline scores for those who did not complete the study were used for these participants at T2. Results from these analyses are presented in the online supplementary materials (Table S1).

Results

Attrition analyses

Of the 445 participants assessed at T1, 370 were successfully followed-up at T2, representing an overall attrition rate of 17%. This figure was lower than the 25% attrition rate anticipated on the basis of previous research [37]. The attrition rates by group were 26% in the intervention condition and 9% in the control condition. A logistic regression revealed that attrition in the study population was equal for gender and age but not for condition allocation, health status, and SES. The odds of completing the study were greater among those assigned to the control condition ($B = 1.24$, SE = 0.29, OR = 3.45, 95% CI 1.96, 6.06, $p < .001$), those with fewer chronic diseases ($B = -0.28$, SE = 0.08, OR = 0.75, 95% CI 0.64, 0.89, $p < .001$), and those residing in higher SES suburbs ($B = 0.01$, SE = 0.00, OR = 1.01, 95% CI 1.00, 1.01, $p = .038$).

Sociodemographic group differences

A greater proportion of females responded to the recruitment strategies, resulting in females representing 61% of those initially agreeing to participate. In addition, as a simple rather than stratified randomization procedure was adopted, a gender imbalance was observed by condition assignment. This was particularly pronounced among those in the intervention condition (intervention: 68% females vs. 32% males; control: 54% females vs. 46% males). This gender imbalance was observed through all phases of the study and, as such, gender was controlled for in all analyses. Analyses conducted to determine the presence of any other demographic or health differences (age, SES, objective health status) by condition (intervention vs. control) did not reveal any significant differences.

Volunteering compliance

Thirty-three participants in the intervention arm did no formal volunteering and 32 participants in the control arm engaged in formal volunteering during the study period. The average amount of time spent per week in volunteering activities for all those reporting volunteering (i.e., across both conditions) was 216 min (range 30–1680 min).

Outcomes by allocated condition

Table 2 presents T1 and T2 scores from the per-protocol analyses for the physical, psychological, and social measures under investigation, stratified by condition. One significant group × time interaction with a moderate effect size was observed between the groups: those who complied with the intervention condition demonstrated significant improvements in their sit-to-stand test scores from T1 to T2 relative to those who complied with the control condition. No harms associated with participation in the study were detected.

Outcomes by actual volunteering status

Table 3 presents T1 and T2 scores stratified by actual volunteering status (i.e., irrespective of allocated condition). Significant group × time interactions were observed in these pragmatic analyses for two variables: sit-to-stand and fast pace walk. Those who volunteered demonstrated significant improvements in their sit-to-stand test scores from T1 to T2, and performed significantly better on this test at T2 than the non-volunteers. Fast pace walk times deteriorated among non-volunteers between T1 and T2, but remained stable among the volunteers.

Table 2 Outcomes by allocated condition ($n = 284$): per-protocol analyses

Measures	Volunteer condition: compliant ($n = 106$)						Control condition: compliant ($n = 178$)						Group × time interaction
	T1		T2		Δ	*d*	T1		T2		Δ	*d*	
	M	SD	*M*	SD			*M*	SD	*M*	SD			
Physical													
BMI	28.08	4.64	27.95	4.66	−0.13	−0.13	27.54	5.02	27.43	5.17	−0.10	−0.08	$F(1, 277) = 0.01$, $p = .920$
Waist girth	95.14	12.97	94.92	13.84	−0.22	−0.04	95.87	13.33	95.88	13.63	0.01	0.00	$F(1, 274) = 0.14$, $p = .713$
Resting HR	72.16	14.63	69.82	10.54	−2.34	−0.19	70.58	11.53	68.40	10.89	−2.18***	−0.30	$F(1, 277) = 0.01$, $p = .943$
6 m Backwards	23.93	12.25	20.66	8.64	−3.26**	−0.32	22.97	10.08	19.86	9.18	−3.12***	−0.35	$F(1, 264) = 0.02$, $p = .885$
6 m Normal pace	4.73	0.68	4.70	0.74	−0.03	−0.05	4.79	0.77	4.80	0.87	0.01	0.01	$F(1, 267) = 0.52$, $p = .473$
6 m Fast pace	3.60	0.51	3.61	0.62	0.01	0.02	3.56	0.59	3.65	0.62	0.09**	0.20	$F(1, 267) = 3.12$, $p = .079$
Sit-to-stand	12.64	3.05	11.69	2.99	−0.94***	−0.40	12.54	2.88	12.25	2.83	−0.29	−0.13	$\boldsymbol{F}(1, 261) = 4.49$, $\boldsymbol{p} = .035$
Chest press	27.56	14.36	28.65	15.49	1.09	0.16	32.46	15.20	33.19	14.38	0.73	0.12	$F(1, 236) = 0.20$, $p = .653$
Leg extension	47.19	17.29	49.53	17.80	2.34**	0.28	48.12	17.06	51.62	18.08	3.50***	0.34	$F(1, 233) = 0.42$, $p = .516$
Seated row	50.89	18.29	53.25	18.89	2.35*	0.25	56.52	18.84	58.48	17.55	1.97**	0.27	$F(1, 246) = 0.11$, $p = .737$
400 m Walk	286.41	43.96	285.39	42.74	−1.02	−0.03	286.72	51.78	282.36	50.54	−4.36	−0.11	$F(1, 258) = 0.43$, $p = .515$
Weekly MVPA	209.10	155.56	176.69	158.25	−32.41*	−0.26	230.85	198.33	207.86	169.50	−22.99*	−0.18	$F(1, 265) = 0.85$, $p = .357$
Daily step count	6712.13	2707.36	6142.90	2943.64	−569.23**	−0.27	7014.83	3585.35	6782.05	3061.64	−232.78	−0.12	$F(1, 265) = 2.77$, $p = .097$
Psychological													
Psychological well-being	55.31	8.25	56.13	8.24	0.81	0.13	53.79	8.78	54.19	8.50	0.40	0.06	$F(1, 274) = 0.51$, $p = .477$
Depression	8.12	6.93	7.08	6.19	−1.04	−0.17	9.00	8.88	7.92	7.77	−1.08*	−0.15	$F(1, 271) = 0.06$, $p = .800$
Self-efficacy	32.85	3.97	33.48	4.18	0.62*	0.21	31.90	4.43	32.87	4.45	0.97***	0.31	$F(1, 274) = 1.05$, $p = .306$
Quality of life	79.41	12.05	80.88	13.56	1.47	0.13	77.51	12.95	79.17	12.45	1.66*	0.16	$F(1, 274) = 0.01$, $p = .932$
Purpose in life	66.24	12.30	69.16	10.49	2.92***	0.36	65.14	12.38	66.40	12.01	1.27	0.15	$F(1, 273) = 2.19$, $p = .140$
Personal growth	69.52	10.21	71.54	9.14	2.02*	0.23	67.56	9.79	68.22	10.39	0.65	0.08	$F(1, 275) = 1.07$, $p = .302$
Self-esteem	23.40	4.76	24.68	4.77	1.29***	0.38	23.19	5.36	24.62	5.03	1.43***	0.36	$F(1, 273) = 0.01$, $p = .943$
Life satisfaction	4.07	0.76	4.11	0.79	0.04	0.07	4.03	0.84	4.02	0.91	−0.01	−0.01	$F(1, 276) = 0.21$, $p = .650$
Social													
Social provisions	79.56	10.19	82.41	10.15	2.85***	0.42	78.07	9.95	79.86	10.19	1.79**	0.23	$F(1, 270) = 1.07$, $p = .303$

Those who attended their T2 assessment but did not provide data relating to one or more of the outcome variables were treated listwise. Significant group x time interactions shown in bold text

BMI body mass index, *HR* heart rate, *MVPA* moderate-to-vigorous physical activity

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

Table 3 Outcomes by volunteering status, irrespective of allocated condition ($n = 349$[a]): Pragmatic analyses

Measures	Volunteered between T1 and T2 ($n = 138$)						Did not volunteer between T1 and T2 ($n = 211$)						Group × time interaction
	T1		T2		Δ	*d*	T1		T2		Δ	*d*	
	M	SD	*M*	SD			*M*	SD	*M*	SD			
Physical													
BMI	28.36	5.39	28.39	5.36	0.02	0.01	27.54	4.85	27.47	4.96	−0.08	−0.06	$F(1, 346) = 0.55$, $p = .460$
Waist girth	96.20	14.79	96.25	15.11	0.06	0.01	95.95	13.08	96.03	13.30	0.08	0.02	$F(1, 343) = 0.00$, $p = .996$
Resting HR	71.10	13.68	69.76	10.59	−1.34	−0.12	70.37	11.90	68.22	10.85	−2.15***	−0.28	$F(1, 345) = 0.70$, $p = .402$
6 m Backwards	23.20	12.26	20.40	8.81	−2.80**	−0.28	22.92	10.28	19.87	9.45	−3.05***	−0.33	$F(1, 331) = 0.09$, $p = .765$
6 m Normal pace	4.80	0.75	4.72	0.81	−0.07	−0.10	4.78	0.75	4.80	0.84	0.02	0.03	$F(1, 333) = 1.96$, $p = .162$
6 m Fast pace	3.59	0.54	3.59	0.65	0.00	0.00	3.55	0.57	3.66	0.62	0.11**	0.23	$\boldsymbol{F}(1, 334) = 5.65$, $\boldsymbol{p} = .018$
Sit-to-stand	12.85	3.56	11.74	2.97	−1.11***	−0.40	12.67	3.00	12.46	2.95	−0.20	−0.08	$\boldsymbol{F}(1, 327) = 8.94$, $\boldsymbol{p} = .003$
Chest press	28.59	14.98	29.29	16.06	0.71	0.11	31.73	15.05	32.35	14.68	0.62	0.10	$F(1, 292) = 0.05$, $p = .830$
Leg extension	47.53	18.09	49.71	18. 67	2.18**	0.26	48.16	17.86	52.02	18.80	3.86***	0.37	$F(1, 288) = 1.73$, $p = .190$
Seated row	51.92	18.98	54.02	19.45	2.10*	0.21	56.05	19.13	58.21	18.03	2.16***	0.29	$F(1, 302) = 0.00$, $p = .987$
400 m Walk	286.02	49.84	281.05	47.32	−4.97	−0.12	285.01	48.84	281.98	47.72	−3.03	−0.08	$F(1, 322) = 0.21$, $p = .646$
Weekly MVPA	208.37	169.21	179.24	166.79	−29.14*	−0.22	229.35	191.53	205.39	167.43	−23.97*	−0.19	$F(1, 328) = 0.36$, $p = .547$
Daily step count	6591.61	2769.55	6199.17	2994.07	−392.44*	−0.18	7061.53	3510.24	6747.73	2991.76	−313.81*	−0.15	$F(1, 328) = 0.36$, $p = .552$
Psychological													
Psychological well-being	54.99	8.67	56.03	9.31	1.04*	0.17	54.06	8.68	54.52	8.28	0.47	0.08	$F(1, 342) = 1.04$, $p = .308$
Depression	8.39	7.34	7.47	6.89	−0.92	−0.16	8.74	8.42	7.90	7.43	−0.84	−0.12	$F(1, 340) = 0.00$, $p = .958$
Self-efficacy	32.73	4.10	33.22	4.45	0.49	0.16	32.11	4.40	32.90	4.38	0.80***	0.26	$F(1, 343) = 1.13$, $p = .288$
Quality of life	79.13	13.71	80.36	14.24	1.23	0.11	77.91	13.05	79.57	13.18	1.66*	0.16	$F(1, 343) = 0.10$, $p = .753$
Purpose in life	66.33	12.33	68.55	10.97	2.22**	0.28	65.60	12.14	66.93	11.67	1.33*	0.15	$F(1, 342) = 0.64$, $p = .424$
Personal growth	69.84	9.94	71.30	9.15	1.46*	0.18	67.89	9.99	68.36	10.35	0.47	0.06	$F(1, 344) = 0.76$, $p = .384$
Self-esteem	23.21	5.09	24.61	5.12	1.40***	0.40	23. 45	5.26	24.74	4.89	1.29***	0.33	$F(1, 340) = 0.15$, $p = .696$
Life satisfaction	4.03	0.82	4.06	0.88	0.03	0.04	4.05	0.81	4.06	0.88	0.01	0.01	$F(1, 345) = 0.03$, $p = .859$
Social													
Social provisions	78.97	10.55	82.04	10.77	3.07***	0.43	78.65	9.86	80.36	9.99	1.71**	0.23	$F(1, 334) = 2.53$, $p = .113$

Those who attended their T2 assessment but did not provide data relating to one or more of the outcome variables were treated listwise. Gender treated as a covariate. Significant group x time interactions shown in bold text

BMI body mass index, *HR* heart rate, *MVPA* moderate-to-vigorous physical activity

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

[a]Volunteering status was unable to be determined for 21 participants (excluded from analyses)

Discussion

The present study appears to be the first randomized controlled trial to attempt to replicate the processes likely to be used in interventions designed to encourage older people to commence volunteering to improve their health. Non-volunteering older people were allocated to either an intervention or control condition to identify any physical, psychological, or social outcomes associated with commencing volunteering. Trials of this kind are considered vital in providing an evidence base to support policies and programs that encourage people to volunteer to improve their own health while making important contributions to society [12, 50].

Across the assessed physical, psychological, and social variables, a significant difference in sit-to-stand scores was found in both the per-protocol and pragmatic analyses, and a further significant difference in the fast pace walk was identified in the pragmatic analyses. Both sit-to-stand and fast pace walk activities require large and rapid force production, and outcomes on these measures have been identified as important indicators of both physical and psychological well-being [5, 39, 51]. The numerous other positive outcomes from volunteering that have been identified in previous research but were not observed in the present study may require more sustained engagement to emerge. For example, improvements in social support may accrue gradually as new volunteers establish and consolidate relationships. In addition, it is likely to take time for improvements in physical functioning to translate into enhanced psychological and social outcomes. A further consideration is that much prior research on the health benefits of volunteering has been cross-sectional and involved the comparison of existing volunteers and non-volunteers (for a review see [10]). As such, differences identified between the groups in previous research may at least partially reflect benefits resulting from long-term participation in volunteering activities.

Limitations, strengths, and future research directions

There were several aspects of the present study that limit the generalizability of the results. In the first instance, the study participants were all effectively volunteers in that they elected to join a study that involved a substantial time and effort commitment. As such, they are likely to be more receptive to volunteering than others who did not choose to participate. There are two major potential implications of this situation that operate in different directions: compliance rates may have been higher than would be experienced when attempting to encourage seniors in general to commence volunteering, but the results may be underestimated because benefits accrued may be greater among those not predisposed to participation due to possibly lower baseline scores on the assessed physical, psychological, and social outcome variables.

A second and related limitation was that the sample comprised relatively healthy and mobile seniors, reducing the generalizability of the results to older people in general. Third, the 6-month study period may have been too short to permit adequate expression of change across many of the outcome variables. Anecdotal evidence was provided by participants in the intervention arm that volunteering commencement was often considerably delayed due to the time taken to identify and access volunteering opportunities and comply with documentation and approval requirements (e.g., police clearances and working with children licenses). Future studies could include a longer intervention period to better assess the extent to which individuals maintain or expand their volunteering activities over time and the implications for the outcome variables under examination.

The primary strength of this study was the randomized controlled trial design that involved recruiting those who were not currently volunteering and had no known interest in participating in volunteering in the future. The few previous randomized controlled trials in this field have been typically limited by their use of participants who had already indicated interest in volunteering [20, 32–34]. By comparison, the present study provides novel results as it appears to be the first to replicate the situation of attempting to encourage participation among those who have not already decided that they would like to volunteer. In addition, the use of a combination of per-protocol and pragmatic analyses enabled the real-world complexities affecting the study outcomes to be accommodated while also abiding by the rigorous requirements of randomized controlled trials [36]. This approach resulted in the generation of many null effects (which have been noted as being missing in the literature due to a reliance on cross-sectional data and potential publication bias [10]), along with two demonstrated positive physical effects. Also of note is the use of a comprehensive range of objective measures that differentiates this study from previous work in this area that has primarily relied on self-report data.

There are various ways in which future research could build on the present study to provide more definitive evidence of the potential for volunteering to confer health benefits on older people. In particular, a longer intervention period (e.g., 12 months) appears warranted given the time needed to select, access, and adjust to new volunteering roles. In addition, little is known about the most effective methods of encouraging older non-volunteers to consider participation in volunteering. Research could be undertaken

to identify the most appropriate authority figures and persuasive arguments for different segments of older people (e.g., medical practitioners advocating volunteering for personal health benefits vs. representatives of volunteering organizations making pleas for assistance).

Conclusion

Of the physical, psychological, and social outcomes assessed, the commencement of low-level volunteering among older Australians was found to produce improvements in sit-to-stand and fast pace walking outcomes. As such, the results provide some support for policies and programs designed to encourage older people to engage in volunteering to maintain or improve their health. Further research is needed to identify the most effective methods of promoting volunteering to this age group.

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Author contributions SP conceptualized the study and took primary responsibility for preparing the manuscript. MJ conducted the analyses and assisted with study design and manuscript preparation. RN, BJ, and JW provided conceptual input for the study design and contributed to the preparation of the manuscript. The funder played no role in the conducting of the research or the reporting of the results.

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Compliance with ethical standards

Disclosure of potential conflicts of interest The authors declare that they have no conflict of interest.

Ethical approval All the 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.

Statement on the welfare of animals This article does not contain any studies with animals performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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