


Positive aging benefits of home and community gardening activities: Older adults report enhanced self-esteem, productive endeavours, social engagement and exercise

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Abstract

Objectives: This study examined relationships between home and community gardening and older adults' self-reported psychosocial and physical well-being, attitudes to aging relative to gardening activities and benefits of membership to a gardening group.

Methods: A survey addressing (a) demographic characteristics, (b) gardening interests and sentiments, (c) activities, (d) benefits, (e) self-rated health and quality of life and (f) attitudes to aging was administered online and via mail-out.

Results: Participants, 331 gardeners aged 60–95 years from Australia, reported numerous benefits from leisure gardening. According to multiple regression analysis, Restoration and Physical benefits were the strongest explanatory variables of participants' positive aging self-perceptions. Members of gardening groups reported significantly more social and physical benefits than non-members.

Conclusion: The current study provides support for promoting positive aging through gardening. Regardless of 'doing' gardening or simply 'being' in the garden, having contact with nature was key to attaining positive therapeutic benefits for this sample.

Keywords

Gardening, home gardens, community gardens, older adults, aging, ageing, well-being

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Introduction

As the Australian population ages, similar to other regions of the globe, research into functional health and other aging issues has become a priority. Good functional health is a profoundly important factor in older Australians' ability to remain living in the community with good quality of life.¹ Successful aging theories suggest that gardening shares common components of activities proposed to increase quality of life, such as social engagement, productive endeavours and exercise. The benefits of gardens are also linked to the restorative properties of nature.² Simply being in or near nature has potential well-being benefits for older adults. Therefore, active involvement in gardening should accrue benefits. This article aims to contribute to a body of literature by systematically measuring the psychosocial and physiological benefits of gardening participation, comparing home

and community gardening activities and exploring the role of older adults' aging attitudes in gardening participation.

Positive aging

Despite varying definitions, successful or positive aging is generally accepted to entail more than an absence of disease and the preservation of physical and cognitive functioning.³ Most models of successful aging identify the importance of activity^{3–5} and include continued and active engagement in

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social and productive life activities.⁵ Older adults possess enormous reserves of capacity in terms of functioning, and aging is merely another stage in development according to Selection, Optimization and Compensation theory.⁶ As such, successful aging is a dynamic between losses and gains, that is, compensating for losses or limitations in functioning with gains in the development of new skills or tangible support (e.g. social or technological) where necessary. Positive aging is a psychological mind-set that reflects an individual's ability to cultivate well-being though later life, despite declining functioning; having a positive attitude to aging is a form of psychological resistance to age-related declines.⁷ According to these successful aging theories, activity engagement despite age-related decline in physical functioning increases later-life well-being. Attending to the daily task of gardening may provide an outlet for purposeful activity, which is associated with increased self-esteem, creativity and mental stimulation.⁸ While gardening is a productive and gratifying activity for many, the well-being benefits of gardens may be more rudimentary and linked to a basic love of nature and the restorative properties of natural environments. Maintaining some form of engagement in leisure gardening, especially as one ages, may be crucial to the older adult gardener's continued well-being and is therefore an important topic to explore in research.

Psychological benefits of gardening

Exposure to nature through gardens and gardening activities can enhance psychological well-being through emotion regulation and relief from stress. Classic early research shows that viewing nature through windows or in pictures can positively affect stress recovery, lowering blood pressure and slowing heart rate.^{9,10} Because natural environments require less effortful attention and may act as a distraction from daily hassles,⁹ in particular for frail older adults, simply being in a garden or viewing elements of a garden may provide benefits such as relaxation and restoration.

Gardens offer older people a place to reminisce about the past. Bhatti et al.¹¹ examined the autobiographical discourses of everyday people who responded to a social research directive to write about the 'importance of their gardens'. 'Being' in the garden evoked memories of childhood gardens, real or imagined. Touching a particular plant or smelling a certain flower may transport a person back to their childhood.¹¹ Therefore, memories of past gardens, which can be invoked through touch or smell in the present in a garden, may serve to cultivate feelings of well-being for older adults. This is in line with the 'nostalgia' literature that supports that these reflections on the past imbue life with meaning and self-continuity, bridging the past to present¹² through the recreation of experiences and relational bonds.

Gardening provided older adults with opportunities for nature connection,¹³ nurturing the environment and the responsibility of caring for and raising plants,¹⁴ and for being

creative in planning, designing and choosing suitable plants for a garden.¹⁵ When older adult gardeners are driven to learn about new plants or plan new gardening projects, it is an opportunity for mental stimulation as well. Opportunities for cognitive enhancement exist if they belong to gardening societies or groups where the focus is often on learning about new plants, a history of gardening, or learning the Latin names of plants, for example.

Physical benefits of gardening

Gardening requires regular and continuous care; therefore, for older adults actively engaged with their home gardens, gardening provides opportunities for increased physical activity, which can prevent osteoporosis, reduce the risk of some cancers, Type 2 diabetes, depression and heart disease.¹⁶ These are significant contributors to health care costs and pose a risk to older adults.¹⁷ One UK study found that moderate to heavy gardening activity of four or more hours per week was associated with significantly reduced risk of morbidity and mortality rates in a sample of middle-aged and older men with cardiovascular disease.¹⁸

Social benefits of gardening: community gardens and gardening clubs

Benefits may accrue for individuals that belong to a gardening group. Gardening groups offer a way for people to connect with nature and each other, allowing social benefits to accrue. Group membership may be especially important for older adults, especially during periods of change such as retirement from paid employment.¹⁹ Connecting with other members of a gardening group allows people to receive social support and to contribute positively to the lives of others, an important protective factor against isolation and loneliness.¹⁹

In Australia, gardening groups are non-profit organizations where members may meet on a regular basis to attend group discussions or educational seminars, or to maintain and cultivate fruit, vegetable, herb and ornamental plants in small public allotments.²⁰ Group participation in gardening activities can build social capital and enhance group cohesiveness and community well-being by providing a physical location to meet other people with shared interests and common goals.²¹⁻²⁵ Gardening group membership can provide opportunities for an increased sense of achievement and pride through collaborative endeavours towards environmental restoration²⁵ and cultivating and sharing herbs, fruits and vegetables.²⁰

Positive aging and gardening

These studies have demonstrated that gardening as a leisure pursuit may maintain or promote an older adult's psychosocial and physical functioning and therefore enhance their

quality of life. Despite age-related limitations in physical functioning, gardening participation may provide important occupation and activity engagement. Membership in communal gardening groups offers a context for social interaction and collaboration, which may be particularly important for socially isolated older adults. Older adults have considerable leisure hours available, and gardening is a popular leisure activity for them, yet it remains one of the least systematically studied.²⁶

Study aim

We aimed to systematically examine the positive aging benefits of leisure gardening for community-dwelling older adult gardeners. Specifically, we examined relationships between gardening characteristics, involvement, and gardening benefits. In addition, we compared the results for members of gardening groups with non-members.

Method

The study was approved by the Human Research Ethics Committee of The University of Queensland, Australia.

Participants and procedure

Participants were recruited through invitation via gardening clubs, seniors' groups, research databases and by word-of-mouth. A minimum of 176 participants were targeted, based on G*Power analysis. The survey was distributed via online or hard copy. Informed consent was implied by returning the survey form (hard copy versions) or by agreement and moving forward with the survey (online). Participation was voluntary, no incentive was provided. Eligible participants were self-identified older gardeners aged 60 years and over who lived in the community and gardened in their own homes or community gardening groups for a minimum of 1 h/week.

A self-administered gardening survey was constructed consisting of quantitative and qualitative data: (a) demographic information questions; (b) several open questions about involvement in, and feelings about gardens; (c) activity inventory;²⁷ (d) attitude statements ('gardening benefits questionnaire'); (e) self-rated health and quality of life; and (f) Attitudes to Ageing Questionnaire (AAQ).²⁸ The qualitative data, that is, open responses, were extensive and are reported elsewhere.²⁹ The survey was first pilot tested with a small sample of older adult gardeners ($N=40$) and subsequently refined to improve face validity and content validity. The final version of the survey was delivered online, or via mail together with a reply-paid envelope, to potential participants across Australia. This resulted in the return of 362 surveys: 129 via the online survey site and 202 via mail. Thirty-one surveys were excluded because the respondents did not meet the selection criteria of gardening for more than 1 h/week; 331 were retained for analyses.

For the purposes of this study, gardening was defined as any activity that involved tending (planning, planting, watering, nurturing) outdoor ornamental plants, shrubs or fruit plants in a garden, or in pots or containers, including passive engagement such as wandering through gardens, relaxing in or viewing gardens, and active engagement, such as cultivating plants, mowing lawns, weeding and raking.

Materials and instruments

Gardening benefits questionnaire. A gardening benefits questionnaire comprising 42 items was developed after review of focus group discussions with 27 older adult gardeners, consultation with interested and expert groups (e.g. community gardening groups, colleagues working within the domain of therapeutic horticulture) and a review of the literature relating to biophilia theory, successful aging and sources of meaning in later life. Several items were generated in relation to the 'gardening benefits' that were identified through these discussions and a comprehensive search of the literature. The gardening benefits questionnaire was pilot tested and the final version comprised 42 attitude statements rated on a 5-point Likert-type scale ranging from 1 = 'strongly disagree' to 5 = 'strongly agree'. These statements were designed to measure participants' opinions and attitudes of gardening relative to purpose (e.g. 'I garden for relaxation'; 'I enjoy gardening because it keeps me physically active'), feelings (e.g. 'The garden holds many special memories for me'; 'If I'm feeling down, I go to my garden and it lifts my spirits') and social engagement (e.g. 'Gardening has helped me to meet new people'). Several open questions were included to allow participants to express their feelings about their gardening experiences in their own words and to allow more reliable interpretations of the quantitative data (e.g. the attitude statements). A principal components analysis (PCA) was conducted to reduce the large number of correlated variables to a smaller set of uncorrelated components or subscales.

Gardening activity inventory. A gardening activity inventory²⁷ was also included to measure participants' involvement in a range of 19 different gardening activities, including, for example, wandering through gardens, tending a vegetable or herb garden, or tending house-plants. Participants indicated by checking the relevant column whether or not they engaged in the particular gardening activity during the past month. They were given the opportunity to include other activities that were not shown on the list provided.

Self-rated health and quality of life. Subjective health and quality of life was measured via two items from SF-36 Health Survey for Australia/New Zealand,³⁰ to ascertain an overall measure of self-reported health. Participants were asked to rate their current perceived health status as well as how this is compared with their health one year ago. The aim

of this was to use their prior health status as a baseline indication of their current health status.

AAQ. The AAQ²⁸ is a 24-item measurement instrument that assesses quality of life and experiences of aging from the subjective perspective of older adults, specifically their ‘aging satisfaction’. Participants’ positive attitudes to aging are used as an indicator of their subjective well-being. Respondents are asked to rate their agreement with the items relating to aging on a 5-point scale, from either ‘strongly disagree’ to ‘strongly agree’ or ‘not at all true’ to ‘extremely true’. The total 24 items group together as three factors: Psychosocial Loss, Physical Change and Psychological Growth. Psychosocial Loss relates to negative experiences of older adulthood (‘Old age is a time of loneliness’), Physical Change relates to positive experiences of health and physical functioning (‘It is important to take exercise at any age’) and Psychological Growth has a positive focus related to wisdom and growth (‘As people get older they are better able to cope with life’). Scores on each of three factors can range from 8 to 40, with a higher score indicating a stronger endorsement of the respective attitude.

Statistical analyses. The results of this study were based on data relating to demographic information, activity inventory, the gardening benefits questionnaire (the Likert-type attitude statements) and AAQ. Data were screened for missing values and outliers and to ensure the data met the various assumptions of statistical analyses; no violations of assumptions were discovered. Quantitative analyses were conducted using PASW Statistics 22.0 package (IBM Corp, NY, USA) and included descriptive statistics to describe basic patterns in the data; frequency distributions to show the distribution of cases into the different categories of variables (e.g. time spent gardening); factor analyses of the hypothesized motivations/benefits subscales of the gardening survey, and statistical measures of scale reliability; and Pearson’s bivariate correlation coefficients to test the relationships between the gardening benefits subscales, the AAQ scales and sample demographics. *T*-tests for independent means were used to examine any reported differences between the two independent groups – that is, those who belonged to a gardening group and those who did not.

Results

Characteristics of sample

Table 1 describes the demographic characteristics of the sample. Participants ranged in age from 60 to 95 years ($M=68.90$, standard deviation (SD)= 7.36). Most participants resided in a house (90.60%) in an urban area (77.80%); length of residency varied between 1 and 69.08 years (interquartile range= 5.50 – 25.20 years). On average, participants engaged in gardening activities for 1–40 h/week ($M=10.40$, $SD=8.17$). Most participants had been gardening for several years (Table 1), and a majority (60.90%) wanted to spend

Table 1. Socio-demographic characteristics of respondents ($N=331$).

Social demographic variables	N	%
Gender		
Male	55	16.6
Female	276	83.4
Country of birth		
Australia	249	75.2
New Zealand	13	3.9
USA	2	0.6
UK	39	11.8
Africa	5	1.5
Asia	8	2.4
Europe	13	3.9
Not disclosed	2	0.6
Current perceived health		
Excellent	48	14.6
Very good	131	39.9
Good	119	36.2
Fair	24	7.3
Poor	6	1.8
Current health compared with 1 year ago		
Much worse	4	1.2
Somewhat worse	38	11.5
About the same	229	69.2
Somewhat better	30	9.1
Much better	26	7.9
Marital status	321	
Single	21	6.5
In a relationship/married	214	66.7
Separated/divorced	27	8.4
Widowed	59	18.4
Formal education	325	
Up to year 10	89	27.4
Up to year 12	21	6.5
Trade	75	23.1
Diploma course	21	6.5
University degree	60	18.4
Postgraduate degree	59	18.1
Current employment status	328	
Employed (outside the home)	56	17.1
Retired	209	63.7
Volunteer	63	19.2
Home ownership		
Own	310	93.7
Rent	21	6.3
Age when first gardened		
Child or adolescent (up to 19 years)	140	42.3
Young adult (20–49 years)	159	48.0
Older adult (50+ years)	32	9.7
Gardening type/size	326	
Mostly container/pots	13	4.0
Courtyard	30	9.2
Raised planter beds	28	8.6
Up to ¼ acre house block	182	55.8
More than ¼ acre house block	73	22.4
		<i>M (SD)</i>
Gardening variables	269	
Time spent gardening (hours)		10.40 (8.17)

Table 2. The range of gardening activities and the percentages of respondents who reported them grouped according to active and passive involvement ($N=324$).

Active	Percentage
Tending outdoor shrubs and plants	96.1
Weeding and/or raking	91.0
Propagating plants	79.0
Tending vegetables and herbs	74.8
Tending house plants	73.4
Touring garden shows	60.5
Applying herbicides	52.7
Mowing lawns and/or digging	51.4
Working in glass house or nursery	22.7
Other (e.g. composting, bird watching, visiting open gardens, displaying garden)	22.7
Passive	
Watering	98.1
Watching TV garden programmes	91.6
Sitting or lying admiring plants and wildlife	86.1
Relaxing in the garden	75.1
Planning and designing gardens	58.8
Browsing/shopping at garden centres	88.0
Wandering through gardens	85.8
Perusing garden books and magazines	83.0
Attending a club or meetings	68.1
Flower cutting or arranging	46.4

more time gardening than they currently were ($M=16.91$ h/week). Furthermore, most participants reported their garden was an average house block (up to one-quarter acre), with 22.40% being greater than this and 21.80% smaller than this; 17.80% of gardens were mostly raised planter beds, courtyard or balcony gardens; 4.00% were mostly potted plants. A range of gardening activities²⁹ and the percentages of respondents who participated in them are shown in Table 2.

Perceived health was measured using 5-point Likert-type scales, with response options ranging from 'poor' to 'excellent', with higher values indicating better health. As shown in Table 1, the majority of participants rated their health as 'good' to 'excellent', and a majority (69.20%) rated their health as 'about the same' compared with 1 year ago. There was a significant negative correlation between age and self-rated health, $r=.20$, $p \leq .001$. On average, participants' self-rated health scores decreased as age increased. Participants' gardening group membership was measured by a dichotomous variable (yes/no). Approximately half of the sample (52%) reported they belonged to a gardening club or group.

Data reduction of gardening benefits items

PCA determined the factor structure of the full gardening benefits dataset. Inspection of the component correlation matrix and relationships between factors confirmed the suitability of varimax rotation. The Kaiser–Meyer–Olkin

(KMO) measure verified the sampling adequacy for the analysis, $KMO=.91$ and all KMO values for individual items were well above the acceptable limit of .5 (Field, 2009). Bartlett's test of sphericity $\chi^2(861)=6799.59$, $p=.000$, indicated that correlations between items were sufficiently large for PCA. We initially obtained eigenvalues for each component in the data. Eight components had eigenvalues over Kaiser's criterion of 1; in combination, they explained 63.45% of the variance. Table 3 shows the factor loadings after rotation.

Scale reliability. The items comprising each of the components were subjected to reliability analysis and reliable composite scales were created and labelled. The reliability coefficients for these eight 'benefits of gardening' scales are shown in Table 3.

AAQ

Factor analysis of the AAQ showed support for the proposed three-factor model of the scale,²⁸ with all items loading on the appropriate factors: Psychosocial Loss, Physical Change and Psychological Growth. The factor scales showed good internal consistency, in line with earlier validation studies of the AAQ (Laidlaw et al., 2007); scale reliability and scale means are shown in Table 3. The total scale means indicated that on average this sample were likely to endorse positive attitudes to aging, expressed through responses to the items on the Psychological Growth ($M=28.17$; 'It is a privilege to grow old') and Physical Change subscales ($M=27.73$; 'It is important to take exercise at any age') subscales. Furthermore, they were less likely to endorse a negative attitude to aging as demonstrated by responses to the items comprising Psychosocial Loss subscale ($M=15.22$; 'Old age is a depressing time of life').

Correlations among AAQ subscales, gardening benefits scales and demographic variables

Preliminary correlation analyses were performed at $\alpha=.05$ to explore potential relationships between the variables of interest. As shown in Table 4, these yielded significant zero-order correlations between self-rated health and age and between self-rated health, time spent gardening and size of garden. Significant correlations were observed among the gardening benefits scales and the AAQ scales as shown in Table 4.

There was a significant positive correlation between age and the AAQ Psychosocial Loss subscale (all $ps < .05$) indicating that increasing age was related to increasing endorsement of the negative attitude of old age being characterized as a time of psychosocial loss for participants. However, there was no significant relationship between age and Physical Change, or age and Psychological Growth; attitudes

Table 3. Factor analysis of the gardening benefits questionnaire items showing item mean across number of participants, item loading, factor mean, reliability and percentage of variance explained by factor.

Scale domain/item	Factor loading	Item mean	Scale mean	SD	Valid cases	Alpha	% variance explained
Factor 1: Restoration benefits							
Q1_When I am stressed I know I can go to the garden and feel relaxed	0.73	4.21	3.99	0.63	298	.91	32.68
Q2_When my mood is low, the garden is one of the best places for me	0.72	4.17		0.74	320		
Q3_When I am in the garden I feel a sense of peace	0.70	4.32		0.76	320		
Q23_If I have a problem to think about, I go to my garden and it helps me cope better	0.65	3.59		0.69	320		
Q22_When I'm feeling bored, I go to my garden and it relieves the boredom	0.65	3.77		0.89	316		
Q21_If I'm feeling down I go to the garden and it lifts my spirits	0.61	4.00		0.95	311		
Q24_I feel rejuvenated when I am in the garden	0.60	3.98		0.78	317		
Q28_I garden for relaxation	0.53	3.97		0.79	315		
Factor 2: Attachment							
Q26_I would feel very unhappy if I had to stop gardening in the near future	0.75	4.30	4.34	0.54	314	.85	6.99
Q5_If I did not have this garden to come back to I would miss it	0.67	4.47		0.77	320		
Q11_I feel much attached to my garden	0.67	4.21		0.68	320		
Q20_If I had to leave this garden, it would be important for me to continue to garden elsewhere	0.65	4.36		0.70	316		
Q9_It makes me happy to be in the garden	0.61	4.37		0.70	318		
Factor 3: Physical benefits							
Q31_Gardening helps keep my physically active/fit	0.78	4.05	4.06	0.59	307	.86	5.64
Q29_When I am gardening, I feel the physical benefits	0.76	4.07		0.74	318		
Q36_Gardening for me is an outlet for physical activity/exercise	0.75	3.96		0.73	314		
Q27_I enjoy gardening because it keeps me physically active	0.74	4.29		0.78	316		
Q33_I know that I sleep better after being active in the garden	0.45	3.88		0.70	319		
Factor 4: Spirituality benefits							
Q16_I feel a sense of spirituality when I am in the garden	0.89	3.46	3.67	0.70	304	.85	4.85
Q25_I feel a spiritual connection to the garden	0.85	3.50		0.98	312		
Q4_I feel a sense of spiritual healing when I am in the garden	0.87	3.71		0.95	309		
Q17_The garden holds many special memories for me	0.55	3.77		1.00	313		
Q18_Gardening helps me to feel connected to the outside world	0.44	3.66		0.91	318		
Q32_I have lots of good memories associated with my garden	0.44	3.95		0.90	313		
Factor 5: Social benefits							
Q13_Gardening has helped me to meet new people	0.86	3.67	3.80	0.82	305	.82	3.96
Q14_I have met or maintained friends through my gardening activities	0.83	3.62		1.05	318		
Q10_My gardening gives me a common interest to talk about with others	0.60	4.12		1.08	316		
Factor 6: Identity benefits							
Q19_I love the way my garden looks	0.76	3.84	3.97	0.60	308	.82	3.47
Q35_I feel a sense of pride from my garden	0.74	4.12		0.60	308		
Q34_My garden feels vibrant and alive	0.56	3.94		0.84	317		
Q41_I feel that my garden is a part of me	0.40	3.98		0.69	319		
Factor 7: Purpose							
Q39_My appetite increases after being active in the garden	0.71	3.37	3.58	0.65	305	.61	3.12
Q38_Growing vegetables, herbs or fruit for use is the most rewarding aspect of gardening for me	0.68	3.47		0.87	314		
Q40_My gardening activities give me a sense of purpose	0.44	3.90		0.99	309		
Factor 8: Shared experience							
Q8_Gardening is more enjoyable if it is shared with someone else	0.87	3.63	3.57	0.71	315	.71	2.74
Q12_I enjoy sharing the active task of gardening with others	0.76	3.50		0.86	313		
				0.99	319		
				0.96	313		

SD: standard deviation.

Each item was measured on a 5-point Likert-type scale ranging from 1 = 'strongly disagree' to 5 = 'strongly agree'.

Table 4. Inter-correlations and significance levels for the gardening benefits and AAQ subscales and demographic variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age	68.90 (7.36)														
2. Self-rated health	-0.203***	3.59 (0.89)													
3. Time gardening	0.05	0.04	10.40 (8.17)												
4. Size of garden	-0.10	0.23***	0.31***	3.83 (1.02)											
5. Restoration	-0.03	0.05	0.26***	0.06	3.99 (0.63)										
6. Attachment	0.02	0.12*	0.17**	0.04	0.65***	4.34 (0.54)									
7. Physical	0.10	0.14*	0.25***	0.20**	0.58***	0.46***	4.06 (0.59)								
8. Spiritual	0.13*	0.01	0.08	0.03	0.67***	0.51***	0.44***	3.67 (0.70)							
9. Social	0.20***	-0.01	0.24***	0.14*	0.38***	0.38*	0.43*	0.40*	3.80 (0.82)						
10. Identity	0.043	0.066	0.17**	0.107	0.63***	0.60***	0.54***	0.55***	0.41***	3.97 (0.60)					
11. Purpose	0.09	-0.10	0.19**	0.01	0.40***	0.20**	0.43***	0.36***	0.24***	0.38***	3.58 (0.65)				
12. Shared	-0.03	-0.02	0.01	0.14*	0.18***	0.19**	0.22***	0.27***	0.28***	0.21***	0.36***	3.57 (0.86)			
13. AAQ Growth	-0.04	0.11	0.01	-0.03	0.31***	0.23***	0.19**	0.30***	0.09	0.27*	0.17*	0.19**	28.17 (4.77)		
14. AAQ Change	-0.050	0.45***	0.11	0.14*	0.20**	0.20**	0.21***	0.12*	0.09	0.17**	0.07	-0.01	0.45***	27.73 (5.39)	
15. AAQ Loss	0.17**	-0.33***	0.05	-0.17**	-0.03	-0.09	-0.01	0.04	0.02	-0.04	0.07	0.04	-0.37***	-0.33***	15.22 (4.48)

AAQ: Attitudes to Ageing Questionnaire.
 The values on the diagonal are means (with standard deviations in parentheses). Higher scores denote higher measures of the construct. Benefits factors: Restoration = factor 1; Attachment = factor 2; Physical = factor 3; Spiritual = factor 4; Social = factor 5; Identity = factor 6; Purpose = factor 7; Shared gardening = factor 8; AAQ Growth = AAQ Psychological Growth; AAQ Change = AAQ Physical Change; AAQ Loss = AAQ Psychosocial Loss.
 *p < .05, **p < .01 or ***p < .001.

towards physical change and psychological growth were unrelated to age for this sample of older gardeners.

Self-rated health was significantly positively correlated with Physical Change; as self-rated health increased, endorsement of positive aging experiences and functioning healthily also increased (all $ps < .05$). Positive attitudes to taking exercise at any age, keeping fit and active as one ages, as measured in the scores on this scale, were associated with participants' increased self-rated health. Self-rated health was not statistically related to the Psychological Growth subscale; participants were no more or less likely to endorse the positive attitude that old age was a time of development and wisdom based on their self-rated physical health. Thus, it appeared that self-rated health played an important role in participants' negative psychosocial and physical attitudes to aging, but not in positive psychological attitudes.

Time spent gardening was significantly positively correlated with several of the gardening benefits scales, including Restoration, Attachment, Physical, Social, Identity and Purpose (see Table 4). The more time spent gardening, the more benefits that accrued. However, time spent gardening was not correlated significantly with any of the AAQ attitudes to aging subscales, Psychological Growth, Physical Change and Psychosocial Loss (as shown in Table 4).

Time spent gardening was neither significantly correlated with age nor self-rated health, indicating that age and health status did not have an effect on the amount of time that participants engaged in gardening activities. However, self-rated health was significantly positively associated with 'size of garden'; that is, increases in 'size of garden' were related to increases in (positive) scores of self-rated health. These results seem to suggest that older adults' gardening areas may change as they age or as their health changes, although the amount of time they spend gardening does not change. In other words, they may modify the size of their gardens relative to their age and health status in order to maintain their level of activity.

Members and non-members of gardening groups

A series of independent sample t -tests were conducted to assess any differences in responses between members and non-members of gardening groups. The results of these analyses are shown in Table 5. There were significant differences between members and non-members of gardening groups for several of the gardening benefits (correlations and significance levels are reported in Table 6). According to these results, being a member of a garden club or group augmented the positive benefits of gardening, such as Restoration, Attachment, Physical, Social and Identity benefits.

Benefits of gardening: regression analyses

Standard multiple regression analyses

To test the strength of the relationship between positive attitudes to aging (AAQ scales Psychological Growth and Physical Change) and the benefits of gardening scales (Restoration, Attachment, Physical, Social, Spiritual, Identity, Purpose and Shared), a series of regression analyses were conducted. Psychosocial Loss was not included in the analyses as the only significant zero-order correlation observed with this subscale was with age. Gender was included in the regression only as a control variable as there were so few males compared with females in the sample.

Table 5. Average overall scores on the AAQ subscales.

Domains of AAQ	Mean	SD	Valid cases	Alpha
AAQ Psychological Growth	28.17	4.77	294	.75
AAQ Physical Change	27.73	5.39	294	.76
AAQ Psychosocial Loss	15.22	4.48	300	.73

AAQ: Attitudes to Ageing Questionnaire; SD: standard deviation.

AAQ scale scores each range from 8 to 40, higher scores indicate greater endorsement of the attitude.

Table 6. Mean statistic and significance levels of t -tests comparing members and non-members of gardening clubs across gardening benefits subscales.

Variables	Factor 1: Restoration		Factor 2: Attachment		Factor 3: Physical		Factor 4: Spiritual		Factor 5: Social		Factor 6: Identity		Factor 7: Purpose		Factor 8: Shared	
	M	t	M	t	M	t	M	t	M	t	M	t	M	t	M	t
Member: Garden club																
Yes	4.08	2.39*	4.42	2.71**	4.21	4.54***	3.73	1.64	4.28	13.74***	4.05	2.45*	3.59	0.32	3.61	0.89
N	150		165		160		161		166		161		165		167	
No	3.90		4.25		3.91		3.60		3.27		3.89		3.56		3.52	
N	144		148		146		147		144		146		149		145	
eta squared	.02		.02		.06				.38		.02					

M: mean of respective factor (benefits of gardening) scales; t: t -test.

t -test is significant (two-tailed).

* $p < .05$, ** $p < .01$ or *** $p < .001$.

Table 7. Multiple regression analyses predicting positive attitudes to aging on AAQ Physical Change and AAQ Psychological Growth subscales.

Variables	R	R ²	F	df	β
Prediction of AAQ Psychological Growth	.34	.12	3.39**	241	
Restoration					.21*
Attachment					-.01
Physical					-.04
Spiritual					.12
Identity					.05
Purpose					.01
Shared					.08
Prediction of AAQ Physical Change	.26	.07	2.13*	251	
Restoration					.06
Attachment					.12
Physical					.17*
Spiritual					-.01
Identity					-.05
Shared					-.06

AAQ: Attitudes to Ageing Questionnaire; df: degrees of freedom.
* $p < .05$, ** $p < .001$.

Psychological growth. A standard multiple regression analysis was performed with AAQ Psychological Growth as the outcome variable, and all of the gardening benefits scales as explanatory variables, controlling for age and gender in the first step. As shown in Table 5, at the second step Restoration was the only variable to emerge as significant and the strongest explanatory variable of positive attitudes to aging in relation to Psychological Growth.

Physical change. A standard multiple regression analysis was performed with AAQ Physical Change as the outcome variable, and the gardening benefits scales that correlated with this variable as explanatory variables, controlling for age and gender in the first step. As shown in Table 7, Physical (benefit) was the only variable to emerge as significant in relation to AAQ Physical Change. Physical benefit, such as keeping active, was the strongest explanatory variable of positive attitudes to aging in relation to Physical Changes (correlations and significance levels are reported in Table 7).

Moderated multiple regression analyses

Group membership. To test whether gardening group membership influenced these results, a series of moderated multiple regression analyses were conducted first with AAQ Psychological Growth as the outcome variable, then with AAQ Physical Change as the outcome variable. All variables were mean-centred prior to analysis to reduce multicollinearity and to aid coefficient interpretation.³¹ An interaction term for group membership and each of the gardening

benefits subscales was computed. Age, gender and group membership were entered in the first step to control for their direct influence. In the second step, the mean-centred gardening benefits variables were entered and at the third step the two-way interaction terms (group membership and gardening benefits) were entered. In sum, the group membership did not qualify the relationships between gardening benefits and Psychological Growth, $R^2_{ch} = .03$, $F_{ch}(3, 237) = 0.97$, $p > .05$; Physical Change, $R^2_{ch} = .03$, $F_{ch}(5, 241) = 1.73$, $p > .05$, or Psychosocial Loss, $R^2_{ch} = .02$, $F_{ch}(8, 219) = 0.54$, $p > .05$.

Discussion

Study overview

This study explored the perceived psychosocial and physical benefits of leisure gardening for a group of older community-dwelling adults, and the relationship between their motivations to garden and attitudes to aging. In addition, the perceived psychosocial and physical benefits for older adults who participated in gardening groups were compared with those who did not belong to such a group. Overall, the results showed that older adults took part in numerous gardening-related activities and reported that they obtained psychological, social and physical benefits from these; in addition, the more time spent in these activities, the more benefits accrued for participants. There were three main findings. The first was that restoration benefits and physical benefits were the main aspects of gardening that were associated with participants' positive self-perceptions of their own aging. The second was that being involved in a gardening group led to accrued benefits. The third was that regardless of engagement level, access to the biophilia effects of gardens was key to enhanced well-being.

Defining gardens

The conventional definition of a garden as the green space surrounding an average house block is challenged in this research: Participants' 'gardens' varied greatly in size and function. These might have comprised a balcony with potted plants, or raised planter beds in a courtyard, through to large quarter-acre house blocks. Watering the garden was the most common gardening activity reported by participants. The results of this study suggest that *gardening*, however defined in terms of size or activity, is a key leisure pursuit for older adults that is fundamental to their well-being. These results provide support for the suggestion that gardening could be an effective and affordable population level intervention to promote or sustain the health and well-being of older adults. Older adults could be encouraged to actively garden as a preventive health measure, or to engage in passive gardening pursuits, for example watering the garden to reduce mental fatigue, as a health promotion measure.

Attitudes to aging and gardening engagement

The participants in this study were more likely to endorse positive attitudes towards their own aging on average, than negative attitudes, and these endorsements were in line with population means.³² Having positive attitudes to aging into older adulthood creates a necessary resilience to health and physical changes that result.³² This study used participants' positive self-perceptions of their own aging as an indicator of their well-being²⁸ and found that positive self-perceptions of aging were related to the benefits obtained from gardening. Specifically, possessing positive attitudes to aging may either flow from or be the result of the restoration benefits and physical benefits of gardening as one ages.

Positive attitudes to aging, self-rated health and gardening

The results indicated that poor self-rated health played an important role in participants' negative psychosocial and physical attitudes to aging, but it did not have an effect on their positive psychological attitudes to aging. That is, participants may have experienced poor physical health but this did not necessarily determine their psychological attitudes to aging. Furthermore, poor self-rated health did not have an effect on the amount of time that participants spent gardening. In other words, poor physical health did not limit participants' time spent gardening, nor affect their positive psychological attitudes to aging.

Benefits of, and motivation for gardening

The 'benefits' scales derived from the data reduction of the gardening benefits questionnaire items included Restoration, Attachment, Physical, Spiritual, Social, Identity, Purpose and Shared. These scales were all inter-correlated which was to be expected, given that these were theoretically all measuring the same overarching construct: motivations for, and benefits of gardening. The most important of the scales in terms of an association with positive attitudes to aging were Restoration and Physical benefits. These are discussed below.

Physical benefits of gardening

Physical benefits obtained from gardening were not unexpectedly the most important predictor of participants' positive self-perceptions of their aging related to Physical Change. The regular and continuous care of maintaining a garden provides an outlet for meaningful engagement in life's activities, an important aspect of successful aging.⁵ Furthermore, four or more hours of moderate to heavy intensity gardening activity on four or more occasions per week

was related to significantly reduced risk of morbidity and mortality rates in a sample of older participants experiencing cardiovascular disease in a UK sample.¹⁸ This current sample of older participants spent an average of 10h/week gardening at varying intensity levels, including weeding and raking, watering, tending plants and shrubs, composting and mowing the lawn. Gardening may be one way to offset declines in other physical activities, such as when participation in other recreational or sporting endeavours declines.

Time spent gardening: a dose–response relationship

More time spent engaged in gardening activities led to an increase in the magnitude of the benefits experienced by participants – in particular, Restoration, Physical, Social, Purpose and Identity benefits, therefore suggesting there is a dose–response relationship between time spent gardening and benefits. In other words, the extent to which older adults experience gardening benefits may be affected by the level of time investment in gardening.

Restoration benefits of gardening

Restoration benefits of gardening were significantly associated with positive attitudes to aging, especially Psychological Growth (positive factors about growing older). Exposure to nature through one's garden can enhance psychological well-being, through emotion regulation and relief from stress. Positive emotional responses such as rejuvenation, peace and recovery from stress that typified biophilia theory³³ underpinned the Restoration subscale (derived from the gardening benefits questionnaire items). Biophilia theory³³ suggests that because humans evolved in verdant environments, we find natural environments more relaxing than artificial ones. Gardens were perceived to be restorative places in prior research;²⁶ the participants of this study also endorsed this attitude. Our participants established daily contact with nature through gardening, finding it especially restorative.

Restorative benefits were not affected by the size or type of garden. The absence of a relationship between *size of garden* and either of the Restoration or AAQ Psychological Growth subscales suggests that gardening benefits can be obtained regardless of garden size. Access to nature, at least through having potted plants or courtyard gardens and with consideration of garden characteristics³⁴ and vegetation density,³⁵ may be important considerations for older adults downsizing their homes and gardens.

Membership to a garden club

Experiencing the restorative properties of gardening is not only a solitary experience as Ashton-Shaeffer and Constant found, but can also be a shared experience according to the present study. For example, gardening group members report

exchanging stories or pictures of gardens and plant cuttings, as well as visiting gardens and community gardening events. Home gardeners who belonged to a gardening club or society experienced additional Restoration, Attachment and Physical benefits resulting from membership. Being a member of a gardening club was also associated with increased Identity benefits – likely due to collaborative endeavours that take place in gardening groups and which are intimately linked to the gardener's identity, such as learning about new plants, and learning Latin names and growth habits of plants. Garden club members may feel they are contributing to environmental renewal through communal gardening and planting new shrubs and trees, which would also play a part in their self-esteem and sense of self.

Increased social connectedness appears to be a benefit of gardening group membership, as indicated by the significantly higher means on the Social benefits scale for members compared with non-members. The social benefits of gardening as defined by this scale included meeting new people, making and maintaining friendships, and having a shared interest to connect with other people. Gardening groups might be particularly valuable to older persons because of the social contact with other gardeners that membership to a gardening group afforded. Shared gardening interests could help overcome the social isolation some older adults experience, through a greater sense of belonging, community and social support.^{19,25}

Limitations

While this study contributes to a clearer understanding of the impact of garden participation on older adults' well-being, the results must be considered in relation to the self-report measures used. The limits to survey use include the difficulty of knowing whether participants understood all of the questions, answered them honestly, or were influenced by how the questions were phrased. Notwithstanding that the self-selected participants' responding patterns may have varied in some way to the wider population, this study aimed to examine gardeners only, not to compare non-gardeners to gardeners. Future research should be conducted to explore possible group differences.

In terms of interpreting the causal direction of the findings, correlational research does not imply causality, and it is therefore not possible to know whether, for example, participation in gardening activities promotes greater well-being or if the reverse is true, or if the relationship is bidirectional. Furthermore, although this study explored the benefits of leisure gardening for older adults, it is acknowledged that gardening can burden the body and may even injure the older adult gardener; future research is necessary to explore this aspect.

A limitation of the study sample is the overrepresentation of females. Other studies that targeted older adults and examined gardening activities also reported unequal representation

of females to males.^{11,36} While the current gender bias is consistent with earlier findings, it may be that older women are more devoted gardeners than older men,²¹ or that more women than men respond to survey invitations.^{37,38}

Conclusion

This sample of gardeners experienced several psychological, physical and social benefits via regular contact with nature in their gardens. The home garden may provide an outlet for mental and physical activity as well as engagement in social and productive activity. Vegetables, flowers, fruit, herbs as well as psychological and physical benefits were the proceeds of gardening for these older adults. The more positive attitudes to aging were, the greater was the will to garden despite delimiting physical health, in this sample.

The present results highlight an imperative to establish home and community care programmes that support older adults residing in their own homes to continue to garden as they age. Future research should focus on identifying the benefits supported gardening can bring to older adults. The results here have important implications for planners of retirement and residential aged-care settings who wish to accommodate older adults' desire to continue to garden; when older adults are forced to make a change to their housing situation, being able to establish or frequent a garden may be one way to establish a connection to a new place.

This sample of older gardeners gave high rankings to items that tap into sources of meaning in later life, such as achievement, creativity, appreciation of nature and leisure activity,⁸ and expressed that their gardens were 'a part of them', and a source of 'pride'. As such, their continued involvement in gardening may be a particularly important contribution to their sense of self. Indeed, Cheng and colleagues³⁹ reported that those with strong identification and a community ethos of themselves as gardeners are more likely to perceive gardening as an activity that contributes strongly to their overall life satisfaction. Consequently, the impact of being forced to give up gardening due to illness or a fall could have devastating effects on an individual's sense of self. Some level of involvement in gardening, as it relates to sources of meaning in later life, such as watering or wandering through a garden, may be especially important to the older adult gardener's continuity of identity and sense of well-being.⁸ Finally, the results of this study show that regardless of 'being' in the garden or 'doing' gardening, gardens provide important restorative benefits for older adults. This is compelling support for including gardens in aged-care facilities, where an increasing number of older adults will reside over the coming decades, and whose relocation to institutional living will be typically prompted by health issues or the loss of a caregiving partner, and who therefore stand to gain maximum benefit from the rejuvenation that being in a garden provides.

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Ethical approval

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Informed consent

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References

- Begg S, Vos T, Barker B, et al. *The burden of disease and injury in Australia 2003*. PHE 82. Canberra: AIHW, 2007.
- Berto R. The role of nature in coping with psycho-physiological stress: a literature review on restorativeness. *Behav Sci* 2014; 4(4): 394–409.
- Peel N, Bartlett H and McClure R. Healthy ageing: how is it defined and measured? *Australasian J of Ageing* 2004; 23: 115–119.
- Lemon BW, Bengtson VL and Peterson JA. An exploration of the activity theory of aging: activity types and life satisfaction among in-movers to a retirement community. *J Gerontol* 1972; 27(4): 511–523.
- Rowe JW and Kahn RL. Successful aging. *The Gerontol* 1997; 37: 433–441.
- Baltes PB and Baltes MM. Psychological perspectives on successful aging: the model of selective optimization with compensation. In: Baltes P and Baltes MM (eds) *Successful aging: perspectives from the behavioral sciences*. New York: Cambridge University Press, 1990, pp. 1–34.
- Hill R. *Positive aging*. New York: W.W. Norton & Co, 2005.
- Lampinen P, Heikkinen RL, Kauppinen M, et al. Activity as a predictor of mental well-being among older adults. *Ageing Ment Health* 2006; 10(5): 454–466.
- Ulrich RS, Simons RF, Losito BD, et al. Stress recovery during exposure to natural and urban environments. *J Env Psych* 1991; 11: 201–230.
- Ulrich RS. View through a window may influence recovery from surgery. *Science* 1984; 224(4647): 420–421.
- Bhatti M, Church A, Claremont A, et al. 'I love being in the garden': enchanting encounters in everyday life. *Soc & Cul Geog* 2009; 10: 61–76.
- Tilburg WA, Sedikides C, Wildschut T, et al. How nostalgia infuses life with meaning: from social connectedness to self-continuity. *Eur J Soc Psychol* 2009; 49: 521–532.
- Cleary A, Fielding KS, Murray K, et al. Predictors of nature connection among urban residents: assessing the role of childhood and adult nature experiences. *Env and Behav*. Epub ahead of print 12 November 2018. DOI: 10.1177/0013916518811431.
- Lewis C. Plants and the community: effects of plants and gardening in creating interpersonal and community well-being. In: Relf D (ed.) *The role of horticulture in human well-being and social development*. Portland, OR: Timber Press, 1992, pp. 55–65.
- Ashton-Shaeffer C and Constant A. Why do older adults garden? *Activities, Adapt and Aging* 2008; 30: 1–18.
- Mathers CD, Vos T, Stevenson CE, et al. *The burden of disease and injury in Australia*. Canberra, ACT, Australia: Australian Institute of Health and Welfare, 1999.
- Hoffman C, Rice D and Sung HY. Persons with chronic conditions, their prevalence and costs. *JAMA* 1996; 276(18): 1473–1479.
- Wannamethee S, Shaper A and Walker M. Physical activity and mortality in older men with diagnosed coronary heart disease. *Circulation* 2000; 102: 1358–1363.
- Haslam C, Steffens NK, Branscombe NR, et al. The importance of social groups for retirement adjustment: evidence, application, and policy implications of the social identity model of identity change. *Soc Iss and Pol Rev* 2019; 13: 93–124.
- Australian City and Farms Community Garden Network (ACFCGN), <https://communitygarden.org.au/>
- Bhatti M. 'When I'm in the garden I can create my own paradise': homes and gardens in later life. *Soc Rev* 2006; 54: 318–341.
- Glover TD. Social capital in the lived experiences of community gardeners. *Leisure Sc* 2004; 26: 143–162.
- Glover TD, Parry DC and Shew KJ. Building relationships, accessing resources: mobilizing social capital in community garden contexts (*Special Issue: Leisure and Social Capital*). *J Leis Res* 2005; 37: 450–474.
- Kingsley JY and Townsend M. 'Dig in' to social capital: community gardens as mechanisms for growing urban social connectedness. *Urb Pol and Res* 2006; 24: 525–537.
- Townsend M. Feel blue? Touch green! Participation in forest/woodland management as a treatment for depression. *Urb Fores Urb Green* 2006; 5: 111–120.
- Wang D and MacMillan T. The benefits of gardening for older adults: a systematic review of the literature. *Activ Adapt Aging* 2013; 37: 153–181.
- Kidd JL, Pachana NA and Alpass FM. Benefits of gardening: an exploratory study of mid-aged women in New Zeland. *Am Horticult Ther Assoc* 2001; 11: 4–19.
- Laidlaw K, Power MJ and Schmidt S. The Attitudes to Ageing Questionnaire (AAQ): development and psychometric properties. *Int J Geriatr Psychiatry* 2007; 22(4): 367–379.
- Scott TL, Masser BM and Pachana NA. Exploring the health and wellbeing benefits of gardening for older adults. *Age Soc* 2015; 35: 2176–2200.
- Ware JE, Kosinski M and Keller SD. *SF-36 physical and mental summary scales: a user's manual*. Boston, MA: The Health Institute, 1994.
- Jaccard J, Turrissi R and Wan CK. Interaction effects in multiple regression. Newbury Park, CA: Sage Publications, 1990.

- 95 p. (Sage university papers series. Quantitative applications in the social sciences).
32. Trigg R, Watts S, Jones R, et al. Self-reported quality of life ratings of people with dementia: the role of attitudes to aging. *Int Psychoger* 2004; 24: 1085–1093.
 33. Wilson EO. *Biophilia*. Cambridge, MA: Harvard University Press, 1984.
 34. van Heezik Y, Freeman C, Buttery Y, et al. Factors affecting the extent and quality of nature engagement of older adults living in a range of home types. *Env and Behav*. Epub ahead of print 23 December 2018. DOI: 10.1177/0013916518821148.
 35. Chiang Y-C, Li D and Jane H-A. Wild or tended nature? The effects of landscape location and vegetation density on physiological and psychological responses. *Land and Urb Plan* 2017; 167: 72–83.
 36. Kohlleppe T, Bradley JC and Jacob S. A walk through the garden: Can a visit to a botanic garden reduce stress. *Hort Tech* 2002; 12: 489–492.
 37. Curtin R, Presser S and Singer E. The effects of response rate changes on the index of consumer sentiment. *Public Opin Q* 2000; 64(4): 413–428.
 38. Singer E, Van Hoewyk J and Maher MP. Experiments with incentives in telephone surveys. *Public Opin Q* 2000; 64(2): 171–188.
 39. Cheng EH-P Stebbins R and Packer J. Serious leisure among older gardeners in Australia. *Leis Stud* 2017; 36: 505–518.