

Benefits of food growing for health & wellbeing – overview of the evidence

This is a working document of the Growing Health Project. The aim of the table below is to collect and summarise published evidence on the benefits of gardening and food growing in relation to specific health and wellbeing issues. We use a simple structure to make the evidence available to a wide audience beyond the often narrow circles of academia. The published evidence considered consists of documents in the English language across the world, which are either peer-reviewed (but often not-open access for the general public), or other published evidence which is open access (project reports, government documents). The table is a working document with gaps in areas where either no published evidence exists, or was not found online using publicly available search engines. To structure the table we use five headings:

Short scientific reference	Full title of the paper or report	Location (country, region)	Type of documented benefits of gardening and food growing (key results of the publication)	Main research and evaluation methods used
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We have reviewed the literature under a list of health and wellbeing headings, concurring with some of the major physical and mental health issues that face our society at present. The focus was to search specifically for studies where the impact of gardening and food growing (including community growing) had been evaluated in relation to specific health issues, as opposed to more generic health outcomes, though in many instances the focus of the studies are not that specific.

The available literature published in English language has been collated under the following headings:

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Allergies, asthma and intolerances				
Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Sadako, 2002	The effects of gardening therapy for asthmatic children	Japan	Horticultural therapy was carried 3 times a week for children with intractable bronchial asthma who were hospitalized in facilities, and questioning was executed on them. The therapy seems to be useful for them to recover their confidence through experience in growing plants from the beginning while feeling a sense of the seasons, a feeling of freedom from an ordered life in a ward and communicating among each other	Horticultural therapy (HT) and questioning
Kamata, 2008	The practicability of horticultural therapy for asthmatic children	Japan	Horticultural therapy (HT) was provided for long-stay asthmatic children as a supplemental holistic treatment to complement other treatments at the Osaka Prefecture Medical Centre for Respiratory and Allergic Disease. Children ages 4-14, from April 2003 to May 2004 Results showed that asthmatic children, who have not previously experienced nature, relaxed and harmonised with others. They learned teamwork skills and expressed their own feelings towards nature and towards other people.	Horticultural therapy (HT)
Alcohol and drug misuse				

Cancer				
Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Blanchard et al., 2003	A comparison of physical activity of post treatment breast cancer survivors and non cancer controls	Canada	The paper determines whether, after treatment, the survivors were meeting the Centre for Disease Control and Prevention/American College of Sports Medicine recommendations for physical activity and were similar to the controls in physical activity. Secondly it compares the modes of activity of the 2 groups in frequency, min/session, and sessions/wk. Result showed that breast cancer survivors engaged in as much moderate, vigorous, and combined physical activity as the controls, however, chi-square analyses showed that survivors engaged in more garden/yard work than the controls did. Independent-sample t tests showed that the frequency and the total min/wk of stretching were significantly higher in breast cancer survivors, suggesting that breast cancer survivors engage in as much physical activity as controls do, but that the groups differ in specific activities (e.g. more gardening).	Comparison of breast cancer survivors obtained data from 335 breast cancer survivors and 6,880 non-cancer controls. Adjusted logistic regression analyses
Unruh, 2004	The meaning of gardens and gardening in daily life: a comparison between gardeners with serious health problems and healthy participants	Canada, Nova Scotia	The study revealed important benefits of gardening on physical, emotional, social, and spiritual well-being, and highlighted a key role of gardening as a coping strategy for living with stressful life experiences. The prospective nature of the study revealed the personal and subjective ways in which interest in gardening might change in response to the person's own situation and needs.	Phenomenological method. 27 women and 15 men were interviewed about the meaning of gardens and gardening in their daily life. Gardens are located in small towns or rural areas of Nova Scotia. 18 participants were diagnosed with cancer. The majority of the participants were aged 45 - 65 years. Semi-structured interviews (2 hours average) were done 4 times per year in each season The data analysis used a constant comparative approach based on a construction of an emergent set of themes and sub-themes from the interview transcripts

Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Kirshbaum, 2006	A review of the benefits of whole body exercise during and after treatment for breast cancer	UK and global	<p>Many early studies had limited internal and external validity. Recent studies were considerably more rigorous and robust. Consistent support for all types of aerobic exercise was most evident in studies of patients during adjuvant cancer treatments (chemotherapy and radiotherapy), compared with post-treatment studies. The evidence, which suggested that aerobic exercise limits, cancer-related fatigue was particularly strong. Only one study (Blanchard et al. 2004 specifically included gardening exercise.</p> <p>Additional studies with higher methodological quality are particularly for patient subgroups (e.g. older people, those with advanced cancer and the disadvantaged) are recommended.</p>	Literature review with systematic search strategy. 29 articles were retained for critical review, appraised for quality and synthesized
Cardiovascular diseases, heart diseases				
Diabetes				

Dementia, Alzheimer's				
Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Jarrot and Gigliotti, 2004	From the garden to the table: Evaluation of a dementia-specific HT program	USA	The study considers whether planting, cooking, or craft HT activities engender differential responses from adult day service (ADS) participants with dementia. Two trained HT students led alternating planting, cooking, and craft activities three times each week over a nine-week period with 5-10 ADS participants. Each participant was assessed for ability to complete the activities and benefits experienced. Most participants required some physical and/or verbal help with each activity, regardless of the category, although variability existed within each category. The most common benefits were: interaction, initiation, concentration, and activity completion. Special accommodations were rarely used, but activities were composed of steps requiring different abilities. Thus, individuals experienced success by performing at least one step in the activity. Preliminary analysis indicates that the categories of HT activities promote cognitive, psychosocial, and physical benefits equally.	HT and patient assessment
Connell et al., 2007	Therapeutic Effects of an Outdoor Activity Program on Nursing Home Residents with Dementia	USA	1-year pilot study to compare outdoor and indoor activity program on sleep and behaviour in nursing home residents with dementia. Design: A two-group (outdoor program, indoor program) two phase (baseline, intervention), randomised subjects. Sleep and behaviour disturbance were assessed over a 10-day period. Because this was a pilot study, the significance level was set at $p < 0.10$. Results showed that the outdoor activity group experienced significant improvements in maximum sleep duration. Both groups showed significant improvements in total sleep minutes. There also was a significant improvement in verbal agitation in the outdoor activity group.	Sleep was assessed with wrist actigraphs with photocells, which also allowed for monitoring of light exposure. Behaviour disturbance was assessed with the Cohen-Mansfield Agitation Inventory.

Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
D'Andrea et al., 2008	Effect of horticultural therapy on preventing the decline of mental abilities of patients with Alzheimer's type dementia	USA	Horticultural activities (twice weekly for 12 weeks) resulted in maintenance of memory and sense of wellbeing. The HT group had an overall higher functional level than the control group ($t(36) = 5.7, p < .0005$). It is concluded that HT may be a useful alternative therapy for individuals with Alzheimer's disease.	HT Group of randomly selected individuals, 20 and 20 control, urban nursing home with Alzheimer's patients Mini mental state examination
Yasukawa, 2009	Horticultural Therapy for the Cognitive Functioning of Elderly People with Dementia	Japan	Horticultural activities over 3 months resulted in improvements in communication, engagement, behaviour and cognitive abilities	Interview and Mini mental state examination (MMSE)
Jarrot and Gigliotti, 2010	Comparing responses to horticultural-based and traditional activities in dementia care programmes	USA	Compared a randomly assigned HT treatment group with traditional activities (TA). HT twice weekly at 4 treatment sites for 6 weeks. Results demonstrated HT based activities are a viable and desirable choice for dementia-care programs. They reached groups of participants who are often difficult to engage in activities. There was no difference on affective domains, however HT resulted in higher levels of active and passive engagement.	Mini mental state examination (MMSE)
Luk, 2011	The effect of horticultural activities on agitation in nursing home residents with dementia	Hong Kong	Horticultural activities for nursing home residents (30 min, twice weekly, for 6 weeks) resulted in no significant reduction of agitation but a decrease in aggressive behaviour	Chinese equivalent of Cohen Mansfield Agitation Inventory School of Nursing, The Hong Kong Polytechnic University
Detweiler et al., 2012	What Is the Evidence to Support the Use of Therapeutic Gardens for the Elderly	USA, Korea	Despite the history of HT in various clinical settings, to the best of our knowledge there are no controlled clinical trials demonstrating the positive or negative effects of the passive or active rehabilitation of older people in garden settings. Experience suggests that regular time spent in a garden results in less agitated behaviour, improved mood and less pro re nata (PRN) medications. Quantitative analysis of the benefits of garden settings for older individuals is overdue and there is need for scholarly innovative studies investigating this treatment modality.	Literature review

Mental health, stress and depression				
Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Catanzaro and Ekanem, 2004	Home Gardeners Value Stress Reduction and Interaction with Nature	USA, Tennessee	Respondents rated the statements “Home gardens provide a reduction in feelings of stress” and “Home gardens provide interaction with nature” as very important. Results suggest that although gardeners select from a wide range of plant materials and activities in an individualistic manner, the interaction with nature in a nurturing environment provides a number of benefits important to them, including mental well-being.	A written survey instrument was developed in 2001 and conducted at two events: the Tennessee Green Industries Field Day (McMinnville), and the Tennessee State Fair (Nashville)
Stigsdotter and Grahn, 2004	A garden at your workplace may reduce stress	Sweden	Results show that having access to a garden has a significant positive impact on stress. There is also a significant positive relationship between frequency of garden visits and stress prevention. The study also showed that the amount of verdure in the garden is crucial to its restorative quality.	953 randomly selected persons in 9 Swedish cities answered a mail questionnaire concerning their experiences of their own health status and access to and use of gardens at home. Statistical analysis with SAS software the distribution of socio-demographic data is representative for Sweden, meaning no statistically significant deviation regarding socio-economic grouping, sex or age
Stigsdotter, 2005	Urban green spaces: Promoting health through city planning	Sweden and global	On the basis of the research results, urban green spaces are viewed as a health-promoting element of city planning. The purpose of health-promoting environments is to offer visitors rest or activities that help to promote their health over time.	Review of literature and design theories based on the research results
Calleau, 2005	The benefits of volunteers attending Cherry Tree Nursery	UK	After attending the nursery, volunteers’ visits to psychiatric hospitals reduced dramatically with some were not returning. In addition, self-harming behaviour stopped or reduced and half of the volunteers had their medication reduced or removed completely.	

Reference	Paper name	Country	Documented benefits of gardening and food growing	Research methods
Gonzalez et al., 2010	Therapeutic horticulture in clinical depression: a prospective study of active components	Norway	Mean Beck Depression Inventory scores declined by 4.5 points during the intervention ($F = 5.5$, $p = 0.002$, F-test Fisher-Snedecor distribution, $p =$ probability value.). The decline was clinically relevant for 50% of participants. Attentional Function Index scores increased ($F = 4.1$, $p = 0.009$), while Brooding scores decreased. The changes in Beck Depression Inventory and Attentional Function Index scores were mediated by increases in Being Away and Fascination, and decline in Beck Depression Inventory scores was also mediated by decline in Brooding. Participants maintained their improvements in Beck Depression Inventory scores at 3-month follow-up.	A single-group study with a convenience sample of 28 people with clinical depression in 2009. Data were collected before, twice during, and immediately after a 12-week therapeutic horticulture programme on 4 farms near Oslo, Norway and at 3-month follow-up. Assessment instruments were the Beck Depression Inventory, Attentional Function Index, Brooding Scale, and Being Away and Fascination subscales from the Perceived Restorativeness Scale
van den Berg et al., 2010	Allotment gardening and health: a comparative survey among allotment gardeners and their neighbors without an allotment	Netherlands	After adjusting for income, education level, gender, stressful life events, physical activity in winter, and access to a garden at home as covariates, both younger and older allotment gardeners reported higher levels of physical activity during the summer than neighbours in corresponding age categories. Allotment gardeners of >62 years scored significantly or marginally better on all measures of health and well-being than neighbours. Health and well-being of younger allotment gardeners did not differ from younger neighbours. The greater health and well-being benefits of allotment gardening for older gardeners may be related to the finding that older allotment gardeners were more oriented towards gardening and being active, and less towards passive relaxation	Survey among 121 members of 12 allotment sites in the Netherlands and a control group of 63 respondents without an allotment garden living next to the home addresses of allotment gardeners. 5 self-reported health measures (perceived general health, acute health complaints, physical constraints, chronic illnesses, and consultations with GP), 4 self-reported well-being measures (stress, life satisfaction, loneliness, and social contacts with friends) and one measure assessing self-reported levels of physical activity in summer.
Hine et al. 2011	The mental health and wellbeing effects of a walking and outdoor activity based therapy project	UK	In this study, mental wellbeing was assessed using 3 outcome measures chosen for the measurement of wellbeing, self esteem and mood (Warwick Edinburgh Mental Well Being Scale (WEMWBS), Rosenberg Self Esteem scale (RSE) and the Profile of Mood States (POMS) to act as a proxy for mental wellbeing parameters. Positive changes in all 3 wellbeing measures were observed, with a statistically significant improvement	Monitoring and evaluation programme to assess key outcomes of the Discovery Quest project. 2 phases: first a 6-month longitudinal study during the programme; secondly a series of before and after activity evaluations at regular intervals with quantitative and qualitative analysis using, questionnaires, on-site observation

			in participant wellbeing, self esteem and total mood disturbance for the majority of participant.	and informal interviews, and participatory appraisal techniques
van den Berg and Clusters, 2011	Gardening promotes neuroendocrine and affective restoration from stress	Netherlands	Results showed that both, gardening and reading had cortisol decreases during the recovery period, however decreases were significantly stronger following gardening. Positive mood was fully restored after gardening, but further deteriorated during reading. The authors highlight that these findings provide the first experimental evidence that gardening can promote relief from acute stress	Stress-relieving effects of gardening in a field experiment with 30 allotment gardeners (allotment complex 'Amstelglorie' in Amsterdam, the Netherlands) either gardening or reading on their allotment for 0.5 hour
Hawkins et al. 2011	Allotment gardening and other leisure activities for stress reduction and healthy aging	Wales, UK, indoor exercise, walkers, allotment gardeners, home gardeners	Results show a significant difference in perceived stress levels between the activity groups: indoor exercise, walkers, allotment gardeners, home gardeners. Allotment gardeners reported significantly less perceived stress than participants of indoor exercise classes. As there were no significant differences in reported levels of social support and physical activity. The explanation for the allotment gardeners' lower stress levels could be the potential contribution of engagement with nature and psychological restoration. The results contribute to the understanding of the benefits of allotment gardening a health-promoting behaviour in later life.	94 individuals aged 50 - 88 who were members of indoor and outdoor activity groups. Participants completed five physiological measures (height and weight to calculate BMI, systolic and diastolic blood pressure, lung function) and a questionnaire containing psychometric scales of self-rated health, perceived stress, physical activity level, and perceived social support.
Hawkins et al. 2013	"Doing" gardening and "being" at the allotment site: Exploring the benefits of allotment gardening for stress reduction and healthy aging.	Wales, UK	The study investigates the benefits to health and well-being of allotment gardening in community-dwelling older adult sample with a particular emphasis on stress recovery. Results indicate that allotment gardeners appreciate both "doing" gardening activity as well as "being" at the allotment landscape for affording a wide range of benefits to their health and well-being.	Semi-structured interviews were used to explore allotment gardener participants' personal beliefs and ideas of the benefits of their allotment gardening activity. The sample consisted of 14 older adults with an age range from 53-82. The transcribed interviews were examined using thematic analysis.

Obesity – Adult and Childhood

Adult Obesity

Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Nelson et al., 2007	Low-income diet and nutrition survey.	UK	Men and women living in households that grew food consumed more fruit and vegetables than other men and women (fruit: men 95g vs.56g, women 86g vs.67g, vegetables: men 124g vs. 100g, women 123g vs.99g).	3,728 people from 2,477 households were included in the survey (15% of the population in terms of most material deprivation). Used a doorstep survey and four 24-hour recalls of diet on random days
Alaimo et al., 2008	Fruit and Vegetable Intake among Urban Community Gardeners	USA, Michigan	Adults with a household member who participated in a community garden consumed fruits and vegetables 1.4 more times per day than those who did not participate, and they were 3.5 times more likely to consume fruits and vegetables at least 5 times daily. Household participation in a community garden may improve fruit and vegetable intake among urban adults	766 adults in a cross-sectional random phone survey conducted in 2003. A quota sampling strategy was used to ensure that all census tracts within the city were represented. Behavioural Risk Factor Surveillance System. Generalized linear models and logistic regression models assessed the association between household participation in a community garden and fruit and vegetable intake, controlling for demographic, neighbourhood participation, and health variables
Kingsley et al., 2009	Cultivating health and well-being: members' perceptions of the health benefits of a Port Melbourne community garden.	Australia	Results showed that the garden was felt by members to be a sanctuary where people could come together and escape daily pressures, a source of advice and social support, and a place, which gave them a sense of worth and involvement. Members also identified spiritual, fitness and nutritional benefits arising from participation in the community garden.	Small qualitative study. Semi-structured questions with 10 members from an urban community garden in Port Melbourne

Reference	Paper name	Country	Documented benefits of gardening and food growing	Research methods
McCormack et al. 2010	Review of the nutritional implications of farmers' markets and community gardens: a call for evaluation and research efforts.	USA	In total, 16 studies were identified, 4 focused on community gardens. It is concluded that only a few well-designed research studies (e.g., those incorporating control groups) utilizing valid and reliable dietary assessment methods on nutrition-related outcomes have been completed.	Review paper of studies published between January 1980 and January 2009 were identified via PubMed and Agricola database searches and by examining reference lists from relevant studies. Studies included took place in the US and were qualitatively or quantitatively examined for nutrition-related outcomes, including dietary intake;
Draper and Freedman, 2010	Review and analysis of the benefits, purposes, and motivations associated with community gardening in the United States	Global	Results showed sparse literature however, a large body of qualitative data. Eleven themes related to the purposes, benefits of, and motivations for participating in community gardens are identified.	Review paper of the scholarly literature from 1999 to 2010
Zick et al. 2013	Harvesting more than vegetables: The potential weight control benefits of community gardening	USA, Utah	Results showed that both women and men community gardeners had significantly lower BMIs (Body mass index) than their neighbours. Similarly significantly lower BMIs were found in the siblings comparison. The third comparison spouses showed no statistically significant differences and the authors hypothesise that spouses would likely enjoy the dietary advantages of the community garden and might also help with the physical demands of gardening.	The study used unique administrative data to examine, for the first time, the relationship between community gardening and a health outcome. Gardeners (423 in total) were drawn from a pool of individuals active with a 20-year old community garden. Data for neighbours, siblings and spouses were drawn from administrative records, using the Utah Population Database

Childhood obesity				
Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Lineberger and Zajicek, 2000	School gardens: Can a hands-on teaching tool affect students' attitudes and behaviors regarding fruit and vegetables	USA	Third and fifth grade students involved in hands-on school gardening programmes were reported to have more positive attitudes towards vegetables and increased snack preference for fruit and vegetables	Pupils (8-11 years old)
Hermann et al., 2006	After-school gardening improves children's reported vegetable intake and physical activity	USA	Children involved in an after-school gardening programme self-reported a significant increase in physical activity levels. 43 completed the pre and post evaluation questions (47% were male 53% female) There was a significant increase in the proportion of children reporting "I eat vegetables every day" and "I am physically active every day" after the education and gardening program	Responses were scored as "yes" 2, "sometimes" 1, and "no" 0. Data were analyzed with SAS and non-parametric test. In order to conduct the data analysis the responses "sometimes" and "no" were collapsed into one group and labelled "no." Significance was set at $p = 0.05$
Phelps et al., 2010	Advantages of gardening as a form of physical activity in an after- school program	USA	Children participating in an after-school gardening programme resulted in a positive impact on childrens' activity levels The study evaluated the effect of an Oklahoma Cooperative Extension Service after-school gardening program. The ACTIVITY instrument described 3 physical activity levels: non-moving, moving, and fast-moving. A significant difference between pre- and post-test scores of children's self-reported physical activity level was observed. The results show that gardening is an effective non-competitive way to increase children's self-reported physical activity level in an after-school setting.	Self-reported physical activity level of children in 3rd through 5th grade using the ACTIVITY self-report questionnaire. The nonparametric Wilcoxon signed rank test for a matched sample was used to analyze the difference between pre- and post-test scores of children's self-reported physical activity level. Statistical significance at $p = 0.05$

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Ransley et al., 2010	Does nutrition education in primary schools make a difference to children's fruit and vegetable consumption?	UK	An evaluation of the School Fruit and Vegetable scheme found that, in schools running food-growing clubs, children ate more vegetables and intake was higher if parents were involved in the initiative. In schools that achieved a high total score (derived from five key types of initiatives to promote fruit and vegetables in school) children ate more vegetables, 123 g/day, compared with those that did not 98 g/day. It is concluded that gardening, parental involvement and other activities promoting fruit and vegetables to children in school may be associated with increased intake of vegetables but not fruit. Effects were independent of deprivation status and ethnicity.	129 English primary schools Year 2 children (aged 6-7 years, n 2530). Cross-sectional dietary survey. Main outcome measures were intakes of fruit, vegetables and key nutrients; and a score for initiatives promoting fruit and vegetables in school.
Nelson et al., 2011	Food Growing Activities in Schools. Report submitted to Defra	UK	Review of academic studies (UK and international) concluded that food growing programmes in schools can have positive impacts on pupil nutrition and attitudes towards healthy eating, specifically related to willingness to try new food and taste preferences.	Review of the literature and paper-based survey questionnaire for senior leaders or other individuals with responsibility for food growing activities in schools, sent to a total of 4479 institutions with 29% response rate
Ratcliffe et al., 2011	The effects of school garden experiences on middle school-aged students' knowledge, attitudes, and behaviors associated with vegetable consumption	USA	A study of 320 sixth grade students in the USA, involved in food growing over a 4 month period found that students were more willing to taste, and ate a greater variety of, vegetables than those in the control group Future research should explore whether effects persist over time and if and how changes in children's behaviour affect the their parents/guardians.	320 pupils (11-12 years old), 236 students completed the Garden Vegetable Frequency Questionnaire and 161 complete a taste test
Rehabilitation and falls prevention				

Sexually transmitted diseases				
Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
O'Hara Murdock et al., 2003	Peer led HIV/AIDS prevention for women in South African informal settlements	South Africa	Results from this social influences peer led approach demonstrated that women residents are a valuable resource in providing effective HIV/AIDS prevention programs to South Africa's most vulnerable residents.	24 women trained from informal settlements to lead HIV/AIDS education workshops for 480 residents. reaching 1,440 residents. Focus groups
Mubvami, T. and M. Manyati, 2007	HIV/AIDS, urban agriculture and community mobilisation: cases from Zimbabwe	Zimbabwe	The authors highlight the benefits of food growing at family or community level for HIV/AIDS. The benefits are indirect, but substantial, and include improved nutrition of HIV/AIDS affected families, savings on food expenditures, added income from the sale of surpluses, and community mobilisation to respond to HIV and AIDS. This can also include the integration of former commercial sex workers from HIV/AIDS affected families.	Case studies descriptive: New Dawn of Hope Community Gardens, Harare; Allotment Gardens, Bulawayo; School gardens, Harare and Bulawayo; Household gardens, Harare; Integration of former Commercial Sex Workers, Gweru
Weiser et al., 2010	Food Insecurity as a Barrier to Sustained Antiretroviral Therapy Adherence in Uganda	Uganda	Food insecurity was common and an important barrier to accessing medical care and antiretroviral adherence. Among other mechanisms research showed that while working for food for long days in the fields, participants sometimes forgot medication doses. Despite these obstacles, many participants still reported high antiretroviral adherence and exceptional motivation to continue therapy.	Open-ended interviews with 47 individuals (30 women, 17 men) living with HIV/ AIDS recruited from AIDS treatment programs in Mbarara and Kampala, Uganda. Interviews were transcribed, coded for key themes, and analyzed using grounded theory (grounded theory is not a descriptive method, it has the goal of generating concepts that explain the way that people resolve their concerns)

Social health and wellbeing (social and therapeutic horticulture)				
Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Sempik et al., 2003	Social and Therapeutic Horticulture: evidence and messages from research	UK and global	Hard evidence as to effectiveness of social and therapeutic horticulture is scant and of variable quality. Client groups include those recovering from major illness or injury, those with physical disabilities, learning disabilities and mental health problems, older people, offenders and those who misuse drugs or alcohol. The reported benefits of social and therapeutic horticulture include increased self-esteem and self-confidence, the development of horticultural, social and work skills, literacy and numeracy skills, an increased sense of general well-being and the opportunity for social interaction and the development of independence.	Literature review: >300 articles examined from ~1000 available titles. Identified by searching library databases, references from known published work and by consulting with researchers in the field
Waliczek et al. 2005	The Influence of Gardening Activities on Consumer Perceptions of Life Satisfaction	USA Texas	Results indicated statistically significant differences in comparisons of the overall life satisfaction scores with gardeners receiving higher mean scores indicating more positive results on the LSIA. When responses to individual statements were analyzed, results indicated statistically significant differences on statements relating to energy levels, optimism, zest for life, and physical self-concept with gardeners answering more positively on all statements when compared to non-gardeners' responses. Additionally, gardeners rated their overall health and their physical activity levels higher than did non-gardeners	A survey based on the Life Satisfaction Inventory A (LSIA) was used to investigate gardeners' and non-gardeners' perceptions of life satisfaction. The LSIA was developed in 1961 by Neugarten and measures five components of quality of life including zest for life, resolution and fortitude, congruence between desired and achieved goals, high physical, psychological and social self-concept, and a happy optimistic mood tone. The survey was on one of the largest online resources for Texas Master Gardeners. During the 4 months, 402 responses were gathered. Additionally, identical 'paper/pencil' format surveys were distributed to garden, church, social and community groups with about 400 responses received. In each group of participants, respondents differentiated themselves as gardeners or non-gardeners by responding positively or

				negatively to the survey question, Do you garden?
Sommerfeld et al., 2010	Growing Minds: Evaluating the Effect of Gardening on Quality of Life and Physical Activity Level of Older Adults	USA	Results indicated statistically significant differences in comparisons of overall life satisfaction scores with gardeners receiving higher mean scores indicating more positive results on the LSIA. Four individual quality-of-life statements included in the LSIA yielded statistically significantly more positive answers by gardeners when compared with non-gardeners. Other questions regarding healthful practices revealed that personal reports of physical activity and perceptions of personal health were statistically significantly more positive among gardeners when compared with non-gardeners.	A questionnaire based on the Life Satisfaction Inventory A (LSIA) was used to investigate older adult (age 50+ years) gardeners' and non-gardeners' perceptions of personal life satisfaction and levels of physical activity. The LSIA measures five components of quality of life: "zest for life," "resolution and fortitude," "congruence between desired and achieved goals," "physical, psychological, and social self-concept," and "optimism." The survey was posted on a university homepage for ≈1 month. Responses were gathered from 298 participants.
Sempik, 2010	Green care and mental health: gardening and farming as health and social care: Mental Health and Social Inclusion	UK	Social and therapeutic horticulture (STH) is described as a community of vulnerable people working together on horticultural activities in a garden or allotment, with the aim of providing mutual support and benefit to their health and well-being. It argues that STH is an inexpensive way to treat and care for people with mental health problems, and that there is room for expansion of service provision.	Discussion article and literature review: history of STH and horticultural therapy; evidence of its effectiveness; and current services and their funding
Sempik et al., 2010	Green Care: A Conceptual Framework, A Report of the Working Group on the Health Benefits of Green Care	EU countries	It is concluded that research into green care spans a variety of different subject areas and issues. One area of specific interest is regarding the effectiveness of green care interventions. There is now an overwhelming body of evidence that shows that the natural environment is beneficial to health and well-being. There are opportunities where nature can be placed within existing therapies, which will help to spread the greening of medical, social and psychiatric services.	Literature review and conceptual framework. Report on European COST action

General health benefits of community gardens and green spaces

Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Armstrong, 2000	A survey of community gardens in upstate New York: Implications for health promotion and community development	USA, New York State	The most commonly expressed reasons for participating in gardens were access to fresh foods, to enjoy nature, and health benefits. Gardens in low-income neighbourhoods (46%) were four times as likely as non low-income gardens to lead to other issues in the neighbourhood being addressed; reportedly due to organizing facilitated through the community gardens.	Survey of 20 community garden programs in upstate New York (representing 63 gardens)
Twiss et al. 2003	Community Gardens: Lessons Learned From California Healthy Cities and Communities	USA California	<p>Community gardens enhance nutrition and physical activity and promote the role of public health in improving quality of life. California Healthy Cities and Communities (CHCC) promotes an inclusionary and systems approach to improving community health. CHCC has funded community-based nutrition and physical activity programs in several cities.</p> <p>Results show that successful community gardens were developed by many cities incorporating local leadership and resources, volunteers and community partners, and skills-building opportunities for participants.</p> <p>Through community garden initiatives, cities have e.g. improved access to produce and elevated public consciousness about public health</p>	'Field action report' Description of California's community gardens and public health funding regime

Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Quayle H., 2007	The True Value of community farms and gardens: social, environmental, health and economic	UK	Results demonstrate the contribution to well-being of individuals and communities: reconnect people, promote local action on global environmental issues, (recycling, composting, use of organic methods, creation of wildlife areas), uptake of healthier diets.	22 projects (farms, gardens, allotments and stables) across England using informal interview sessions, participatory appraisal (PA), rapid appraisal (RA) and postal questionnaires.
Wakefield et al., 2007	Growing urban health: community gardening in South-East Toronto	Canada	Results suggested that community gardens were perceived by gardeners to provide numerous health benefits, including improved access to food, improved nutrition, increased physical activity and improved mental health. Community gardens were also seen to promote social health benefits and community cohesion. Mental health benefits are described by the gardeners as more general, like helping to be more mentally (and physically) active or to reduce stress	Community-based research (CBR = research with a substantial level of community participation). Involving participants helping in 2004 growing season and attending garden meetings. 10 focus groups, 1-2 hours long with overall 55 people and 13 in-depth interviews. All focus groups and interviews recorded and professionally transcribed verbatim
Teig et al., 2009	Collective efficacy in Denver, Colorado: Strengthening neighborhoods and health through community gardens	USA, Colorado	Descriptive results of social processes (like social connections, reciprocity, mutual trust, collective decision-making, civic engagement and community building) and the activities supporting them. No specific findings on health issues despite title.	Semi-structured interviews with community gardeners in Denver. 90 minutes 15 interviews were conducted with individuals and 14 were conducted in groups with at least 2 and up to 8 participants. Data from individual and group interviews were pooled to generate the final dataset (67 respondents, 29 garden sites). All coding, sorting, and comparing of the data during the analysis process took place using NVivo 7 (QSR International Pty. Ltd.)
Chen et al., 2010	Exploring Dimensions of Attitudes Toward Horticultural Activities	Taiwan	Five dimensions of attitudes toward horticultural activities were extracted: increasing positive mood, improving the environment, leisure belief, improving social relationships, and escaping. These dimensions of attitudes toward horticultural	Two steps: First open-ended interviews were used to conceptualize attitudes toward horticultural activities, and 7 themes and several sub themes of attitudes were induced. Based on the results, a quantitative survey was

			activities had activity-based attributes that differed to some extent from those of general leisure.	conducted to identify the dimensions of attitudes towards horticultural activities and their interrelationships
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Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Hale et al., 2011	Connecting food environments and health through the relational nature of aesthetics: Gaining insight through the community gardening experience	USA, Colorado	<p>Gardeners' aesthetic experiences generate meaning that encourages further engagement with activities that may lead to positive health outcomes.</p> <p>The physical and social qualities of garden participation awaken the senses and stimulate a range of responses that influence interpersonal processes and social relationships that are supportive of positive health-related behaviours and overall health.</p> <p>The research suggests that the relational nature of aesthetics, can help guide community designers and health planners when designing environment and policy approaches to improve health behaviours.</p>	Key-informant interviews to explore gardeners' tactile, emotional, and value-driven responses to the gardening experience and how these responses influence health at various ecological levels (<i>n</i> = 67 participants, 28 urban gardens).
Anderson, 2011	An Exploration of the Potential Benefits of Healing Gardens on Veterans with PTSD	USA	<p>This study looks at the potential benefits of using healing gardens in addition to traditional methods of treatment for veterans suffering from posttraumatic stress disorder (PTSD).</p> <p>Results are descriptive and design based but state that many PTSD practitioners at VA facilities across the country show interest in the use of healing gardens. However, there is also hesitation of professionals expressing concerns regarding a number of perceived obstacles for healing garden implementation.</p>	<p>Master study for landscape architecture. The study examines the history of healing gardens, problems facing veteran populations today, current treatment methods for PTSD, and how healing gardens could be beneficial to veterans with PTSD</p> <p>A Veterans Affairs (VA) healthcare facility that is in the process of implementing a healing garden was used to determine how their PTSD patients will potentially use a healing garden space during treatment.</p>
MacKerron and Mourato 2011	Mappiness: Quantifying wellbeing in relation to environment across space and time. (www.mappiness.org.uk)	UK	<p>Wellbeing is a topic of increasing interest to economists, including environmental economists, however, available quantitative evidence remains limited. The paper describes a new primary research focused on individuals' momentary experiences of their environment.</p> <p>Results show that even after controlling for other factors (weather, daylight, activity, companionship, location type, time, day) participants are substantially happier outdoors in any natural or green habitat type than in the urban environment.</p>	<p>Environmental economics primary research using individuals' momentary experiences of their environment. Respondents are 'beeped' with questions at random moments via smart phones, creating a GPS geo-located panel data set comprising of 1,5m responses from 30k individuals. Using GIS to associate response locations with environmental data, we estimate a model relating habitat</p>

				type to self-rated happiness.
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Reference	Title of paper	Location	Documented benefits of gardening and food growing	Research and evaluation methods
Pretty et al. 2011	The UK National Ecosystem Assessment Technical Report Chapter 23: Health Values from Ecosystems.	UK	The report concludes that observing nature and participating in physical activity in green spaces play an important role in human health and wellbeing. Ecosystems provide direct positive effects on both mental and physical health. In addition, there are indirect positive effects by facilitating nature based activity and social engagement, which positively influence health and provide a catalyst for behavioural change in terms of encouraging the adoption of healthier lifestyles.	Literature review and ecosystem assessment
White et al., 2013	Would You Be Happier Living in a Greener Urban Area? A Fixed-Effects Analysis of Panel Data	UK	Results showed that on average, individuals have both lower mental distress and higher well-being when living in urban areas with more green space. Although effects at the individual level were small, the potential cumulative benefit at the community level highlights the importance of policies to protect and promote urban green spaces for well-being.	Earlier research was unable to control for time-invariant heterogeneity (e.g., personality) and focused on indicators of poor psychological health. The current research advances the field by using panel data from over 10,000 individuals to explore the relation between urban green space and well-being (indexed by ratings of life satisfaction) and between urban green space and mental distress (indexed by General Health Questionnaire scores) for the same people over time