NATURE-BASED INTERVENTIONS IN INSTITUTIONAL AND ORGANIZATIONAL SETTINGS: A SCOPING REVIEW

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Abstract

The objective of this review was to scope the literature on nature-based interventions that could be conducted in institutional settings where people reside full-time for care or rehabilitation purposes. Systematic searches were conducted across CINAHL, Medline, Criminal Justice Abstracts, PsycINFO, Scopus, Social Care Online and Cochrane CENTRAL. A total of 85 studies (reported in 86 articles) were included. Four intervention modalities were identified: Gardening/therapeutic horticulture; animal-assisted therapies; care farming and virtual reality-based simulations of natural environments. The interventions were conducted across a range of settings, including inpatient wards, care homes, prisons and women's shelters. Generally, favourable impacts were seen across intervention types, although the reported effects varied widely. There is a growing body of literature on nature-based interventions that could be applied to a variety of institutional settings. Within most intervention types, there is sufficient research data available to perform full systematic reviews. Recommendations for future systematic reviews are offered.

There is extensive evidence that contact with nature has a range of beneficial effects for human health and wellbeing. These include positive effects for specific groups such as people with dementia (e.g. de Bruin et al, 2015), clinical depression (Gonzalez et al, 2010) and cancer (Cimprich and Ronis, 2003), as well as more general impacts (e.g. Bowler et al, 2010). Using public health data for the whole of England, Mitchell and Popham (2008) showed that access to green spaces significantly reduced levels of poor health associated with income deprivation. A recent review of research on urban green spaces for the World Health Organization concludes that they have a positive effect on health, especially for children, pregnant women, senior citizens and economically deprived communities more generally (WHO, 2016). Evidence increasingly indicates that active engagement or connection with nature is especially valuable (Mayer et al, 2009). However, even passive exposure to nature has been shown to potentially have a positive effect (e.g. Honold et al, 2016; Van den Berg et al, 2016).

This substantial evidence for the benefits of contact with nature has led to the growth of nature-based programmes run by governmental, private or third sector organizations in many parts of the world. Such programmes are diverse in their design, settings and target populations. Some of the main types are Green Exercise activities (including “exercise prescription” programmes) (e.g. Pretty, Peacock, Sellens & Griffin, 2005; Swinburn, Walter, Arroll et al, 1998), therapeutic horticulture (e.g. Sempik, Rickhuss &

Beeston, 2014), wilderness or wild-nature based activities (e.g. Clark, Marmol, Cooley & Gathercoal, 2004) and programmes focused on encounters with animals - such as Care Farms (e.g. de Boer, Hamers, Zwakhalen et al, 2017), Animal-Assisted Therapy and Animal-Assisted Activity (e.g. Majic, Gutzman, Heinz et al, 2013). Individual programmes within these categories may be targeted at people with specific health/wellbeing problems or be open to anyone who feels they may benefit from involvement. Similarly, programmes vary in whether they take referrals from health and social care agencies, attract participants through self-referral, or a mixture of the two.

Given this diversity in nature-based programmes, it can be difficult to gain an overview of the literature in terms of what kinds of intervention may be helpful in what settings to what types of people. There have been numerous evidence reviews and syntheses in the last five or so years, assessing current knowledge in relation to different kinds of nature-based interventions. Some have focused on particular types of intervention across a range of potential areas of impact, such as horticultural therapy (Kamioka, Okada, Tsutani et al, 2014), animal-assisted therapy (Nimer & Lundahl, 2007), gardening (Clatworthy, Hinds & Camic, 2013) and conservation activities (Husk, Lovell, Cooper, Stahl-Timmins & Garside, 2016). Others are focused on specific target groups, such as people with dementia (Whear, Coon, Bethel et al, 2014), schizophrenia (Liu, Bo, Sampson et al, 2014), troubled adolescents (Harper, Russell, Cooley & Cupples, 2007), older adults (Wang & Macmillan, 2013) and people in prison (Cooke & Farrington, 2016). However, it may be that these interventions could be helpful for other groups that have not yet been identified in previous systematic reviews.

While the reviews and syntheses cited above provide some very useful insights, we are not aware of any attempts to scope the body of literature on nature-based interventions that could be used in institutional settings. People residing in institutional settings (ie. prison inmates, hospital inpatients, and care home residents) typically have reduced opportunities to engage with the natural world – and indeed reduced agency more broadly. Consequently, nature-based interventions could be of particular relevance to these groups. A scoping review in this area helps to hone future systematic review designs, and identify key questions for primary research studies to address. We would also argue that the specific institutional contexts in which many interventions take place – whether they be schools, hospitals, prisons, workplaces or any other setting – need to be considered when seeking to understand therapeutic processes. The mechanisms through which engagement with nature-based interventions are beneficial may differ substantially in different contexts. The review we present in this article therefore focuses on evidence from both quantitative and qualitative studies, to address the following questions:

1. What types of nature-based intervention are currently being used to support wellbeing in institutional settings? And which other modalities could be feasible?
2. Are particular intervention modalities more commonly used in particular settings?
3. Is there evidence that nature-based interventions in institutional settings impact on the health and wellbeing of those who participate in them?
4. If so, has the literature identified specific therapeutic mechanisms that may be worth examining in future primary and secondary research?

Methods

Literature scoping approach

A scoping review was chosen as the most appropriate way to address our aims. Our research question concerned the impact of nature-based interventions on health and wellbeing in institutional settings. Institutional settings are here defined as any setting in which people reside full-time for care or rehabilitation purposes. Because this is a complex area that has not been comprehensively reviewed before, an approach was needed to clarify key concepts (eg. what types of nature-based interventions are available? What counts as an "institutional setting"? And what outcome and process evaluations of nature-based interventions have been used?). Scoping reviews can enable investigators to map out a field of research but in addition to mapping reviews they begin with specific concerns to identify gaps in the literature for subsequent primary studies and determine appropriate questions for full systematic reviews (Armstrong, Hall & Waters, 2011). Although scoping reviews do not systematically assess the quality of studies or formally synthesise findings, the review methods should be clear and reproducible. To this end, we followed the five stage process developed by Arksey and O'Malley (2005): 1) identifying the research question; 2) identifying relevant studies; 3) study selection; 4) charting the data; and 5) collating, summarizing, and reporting the results.

Search strategy

The Cochrane Library was searched for existing reviews, resulting in a total of 507 hits where, after screening, only 2 Cochrane reviews and 9 other reviews were considered relevant. In addition, 5 other reviews were later found through manual searches. None of the identified reviews specifically addressed benefits and adverse effects of nature-based interventions for people residing in or being referred to institutional environments. An initial list of keywords for intervention types was based on two existing systematic reviews in the

subject area which explored general health benefits of participation in environmental enhancement and conservation activities (Husk et al., 2016) and nature-assisted therapy (Annerstedt & Waehrborg, 2011), neither of which specifically focused on institutional settings. A wide range of intervention-related keywords was drawn up to include any type of nature-based intervention that is considered feasible to conduct with an adult population in an institutional setting, including varieties of therapeutic horticulture, gardening activities, animal-based therapies, outdoor and wildlife interventions. However, this extremely wide initial pilot search resulted in a total 164.666 hits in CINAHL alone, requiring us to significantly narrow down the scope of the search to increase specificity. As a result, subsequent searches combined (AND) a wide range of interventions with the condition of an institutional or hospital-based setting and (AND) relevant health outcomes.

The final search strategy is presented in Appendix 1. The following databases were searched between March and April 2017: CINAHL, Medline, Criminal Justice Abstracts, PsycINFO, Scopus, Social Care Online, Cochrane CENTRAL. Search results were saved and imported into an Endnote database. Table 1 shows the number of 'hits' retrieved from each database.

TABLE 1 ABOUT HERE.

In addition, reference lists of all included studies were screened for further relevant studies but given the limited resources and specific purpose of this scoping review, we concentrated on studies that were thought to add to the breadth of electronic hits to give a better overview of settings and intervention types that are currently being used. A total of 21 additional studies were retrieved and included for data extraction.

Inclusion criteria and data extraction

Only peer-reviewed journal articles published in English were considered in this review. Included target populations were any groups of adult participants who are based in an institutional setting, or who were taking part in nature-based interventions for care or rehabilitation purposes that would be feasible to conduct in institutional settings. Although this meant not all the study samples were based in institutional settings, this inclusion criterion was applied to gain a wider perspective on interventions of possible use in such contexts. Such interventions included:

- Therapeutic horticulture and ecotherapy
- Offenders and Nature (O&N) schemes – e.g. habitat restoration, path maintenance and general forestry
- Animal-based therapies – pet facilitated therapy (PFT), care farms, prison-based animal programs (PAPs)
- Outdoor conservation activities – e.g. litter picking or tree planting
- Gardening-based activities – e.g. guided garden walks, supervised allotment gardening

Conversely, studies which could not realistically be conducted in an institutional environment and general experiences of nature in an open setting, such as natural environment therapies, wilderness-based and adventure programmes, were excluded. Likewise, exercise and sport-based interventions taking place outdoors were excluded as well as interventions primarily aiming to increase physical wellbeing. All full-text screening was performed independently by two reviewers who met regularly to discuss emerging conflicts.

Two reviewers undertook data extraction and met regularly to discuss emerging issues, progress and potential conflicts. For all studies, data were extracted into standardised tables, covering: type of institutional setting; target population; participants; study design; methods; intervention details; key findings; and conclusions. For qualitative studies, we summarised main themes and key concepts based on the reporting and included quotes, while for quantitative designs measurements in group differences and effect sizes were extracted where reported. No duplicate entries were created for any studies that employed more than one intervention type.

Data collation approach

Individual studies were analysed in a three-part process designed to address the review aims. First, similarities and differences among different interventions were noted; second, the common methodologies used to evaluate each intervention type were noted; finally, general patterns in study findings were noted and narratively summarised. For this purpose, studies were grouped and tabulated into the following intervention types: 1) Garden and horticulture-based interventions, 2) Animal-based interventions, 3) Care farms; and 4) Simulated nature-based interventions. It is important to note that these categories are deliberately broad for the purposes of this scoping review. Future systematic reviews and meta-analyses should aim for a more fine-grained analysis of specific intervention subtypes, because different types of intervention within each class are likely to have different therapeutic mechanisms – for instance, an animal-based intervention that involves training service animals is likely to produce different effects to an intervention where companion animals are brought into an institution.

Findings

Overview of studies

Figure 1 shows the study selection process. The database searches yielded 3336 hits, and a further 17 articles were identified through manual searching. The majority of articles were excluded at title/ abstract stage, and of 201 screened full-texts, a total of 85 studies (reported in 86 articles) were included. There were almost twice as many quantitative designs (n=49) compared to qualitative studies (n=28) with only 8 employing a mixed-methods design.

FIGURE 1 ABOUT HERE.

The reported nature-based interventions were conducted in a range of different settings:

- 34 in a hospital or psychiatric setting
- 11 in rehabilitation or wander garden settings
- 15 in nursing or retirement homes
- 9 at care or animal farms
- 7 in prisons
- 2 at women's shelters
- 4 at other institutions
- 3 in a closed laboratory setting

Target populations

Across all included studies (n=85), total participant population was approximately 3208, with some studies not reporting or only inadequately reporting population figures. A third of all studies (n=28) were conducted with mental health patients or those referred for a mental health problem. The second biggest target group was that of elderly citizens and

nursing home residents (n=19). Table 2 shows the specific settings and target populations studied within each type of nature-based intervention. It can be seen that people with mental health problems were the most commonly targeted population for both garden-based/ horticultural therapies (n=18/41 studies), and for care farms (n=8/8 studies). By contrast, animal assisted therapy was most commonly offered to hospital inpatients (n=12/33 studies), and virtual reality based interventions have not yet been studied in an applied setting. More detailed descriptions of the target populations and settings are available in the Online Tables S1, S2, S3, and S4.

TABLE 2 ABOUT HERE.

Gardening and horticulture-based interventions

41 studies used some form of gardening or horticultural intervention, almost half of which (n=20) were also set in a garden space. 7 were conducted in nursing homes, 7 in a hospital setting, 5 at other institutions and only 1 in prisons and on care farms respectively. There was a balance between quantitative (n=18) and qualitative (n=18) designs, with 5 studies using a mixed-methods approach (Table 2).

Among the quantitative studies, a range of designs were reported, including controlled (n=3) and uncontrolled (n=6) before-after studies, RCTs (n=3), cross-sectional surveys (n=3), quasi-experiments (n=2), one case study, and one retrospective cohort study (Table 2). The majority of the interventions in this class were therapeutic gardens. However, there was substantial variation in terms of the level of active engagement required of participants – some of the interventions comprised only an attractive garden for participants to wander around (Detweiler, 2005; Edwards 2012; Heath 2001;Ottosson 2005;

Rappe, 2005, 2006), while others involved varying levels of engagement with structured gardening activities ranging from flower arrangement and seed nursing, to conservational activities (see online Table S5 for additional details).

The outcomes of interest in the quantitative studies typically included measures of quality of life, health-related quality of life, and activities of daily living (see Online Table S5 for a full description of measures). Some studies also included objective measures of physical health (Austin 2006), and biomarkers for inflammation (Bay-Richter, 2012) and stress (Ottosson, 2005). The findings of the quantitative studies generally showed a trend toward improvement with horticultural and garden-based therapies. However, the effect sizes for improved outcomes were often modest, and many studies did not find statistically significant improvements or between-group differences on primary and secondary outcome measures (Online Table S6). Of particular note, the three RCTs did not report significant between-group differences on most outcomes, although Bay-Richter (2012) did note a reduction in inflammatory biomarkers in the horticulture group. It may be that horticultural therapy has a long-term benefit in reducing inflammatory responses, though this would need confirming in larger studies with a longer follow-up.

Among the 18 qualitative studies, all collected some data through semi-structured, in-depth interviews or focus groups with participants, while ten studies combined these with some form of participant observation to gain additional insights into experiences of the gardening activities. The majority of studies used a structured thematic analysis approach, four studies used a grounded theory approach, and two others drew on some form of phenomenology. The exact type of intervention varied between studies and was rarely reported in detail, ranging from general gardening activities and growing produce to

supervised garden walks and more recovery-oriented approaches in combination with arts therapy, craft-making and relaxation techniques (see Online Table S5).

Across the case studies there was considerable overlap between emerging themes, frequently stressing the benefits from community and togetherness gained by sharing the experience of horticulture with people in similar situations as well as a sense of mutual nurturing with improved resilience from the contact with nature. Overall, gardening and horticulture were perceived as beneficial to both physical and mental wellbeing, and the studies identified a range of mechanisms through which therapeutic benefits were gained. These included: purposeful activities to improve mood and to escape life's pressures, learning new skills, making new social contacts, and being part of a group (Barley, 2012; Adevi, 2013; Eriksson 2010). Another recurring theme was the value of sensory stimulation and physical engagement in the gardens (see Adevi, 2012) where in addition to gaining increased autonomy and self-confidence through growing and harvesting plants and fruit, participants also appreciated the aesthetic experience including bright colours and smells with reported beneficial effects to their emotional wellbeing. However, Parr (2007) also reported that participants encountered several difficulties resulting partly from a lack of training and being under the effects of medication where conflicts arose between participants when having to perform hard work in bad weather conditions. While providing valued aesthetic and visual improvements to public places, there are dangers of exploitation where other parties benefit more from the participants' unpaid labour. Overall however, the studies emphasised the therapeutic potential of garden-based interventions for mental and physical health as well as wider benefits to the community (Online Table S6).

Animal-assisted interventions

Thirty-three studies of animal-assisted therapy (AAT) were identified, including quantitative (n=25), qualitative (n=5), and mixed-method (n=3) designs. Of the quantitative studies, a majority of pretest-posttest or quasi-experimental designs was seen (n=15), as well as six randomised controlled trials. The majority of the interventions were carried out in hospital settings (n=19), as well as nursing homes (n=7), prisons (n=6), and one hospice (Table 2).

The outcomes of interest in these studies predominantly comprised measures of self-reported mood (eg. the Brief Symptom Inventory, the Profile of Mood Survey, and the Trait-State Anxiety Instrument), and physiological proxies for stress, such as cortisol levels (see Online Table S7 for full details). Additionally, several studies examined the types of social interaction facilitated by the presence of an animal. Generally, favourable improvements in mood and increases in social interaction were observed throughout the corpus of literature (Online Table S8). However, several studies reported a lack of significant between-group differences on key measures (Johnson, 2008; Stasi, 2004). The qualitative studies identified a number of common psychosocial mechanisms through which AAT provided benefits, such as taking responsibility for an animal (Cushing, 1995; Mercer, 2015; Rossetti, 2008), and stress reduction (Katsinas 2000; Mercer, 2015; Sockalingham, 2008; Turner, 2007; Online Table S8).

Care farms and simulated nature interventions

Eight studies were conducted at care farms, with the majority (n=5) using exploratory qualitative designs, followed by 2 quantitative and 1 mixed-methods design. The qualitative studies (Ellings, 2008; Ellingsen-Dalskau, 2015; Hassink, 2010; Iancu, 2014; Pedersen 2012) all conducted semi-structured interviews or focus groups with participants on the farms to explore and interpret their experiences using thematic analysis. Hassink also included other

groups of farm workers and farmers to compare their experiences with those of the clients (Online Table S9). Across these studies, participants valued their stay at the farms and particularly appreciated the different farming activities (including fetching feed, cleaning, milking and feeding) and spending time with the animals and farmers which gave them both a sense of daily routine and renewed confidence and resilience. Participants also benefited from feeling appreciated by farmers and animals alike, while being treated as equals in a tranquil community (Hassink, 2010) which also helped them stay away from areas where they were tempted by drugs and alcohol (Ellings, 2008). Overall, the daily work routines, nature-based environment and contact with farmers and animals were found to promote autonomy and mental health and support people's transition back into work. However, in their focus groups Ellings (2008) found that care farms only had limited effects in achieving longer-term occupational change (Online Table S10).

Using video recordings of the participants' daily activities and interactions on the farms in addition to before-after psychiatric measures, Berget (2007) and Pedersen (2011) both found that occupational therapy with farm animals and performing challenging and complex work tasks at the dairy farm can result in a decline in depression, and state-anxiety symptoms. Work intensity correlated with increased self-efficacy (r-0.82, $p<.01$) and decreased anxiety (r-0.7, $p<.05$) as observed by Berget (2007), while depression scores on the BDI-IA scale in Pedersen (2001) decreased from 25.9 (SE=2.8) at the start of intervention to 19.1 (SE=3.9) at the end, as anxiety levels also decreased by 5.7 points and generalized self-efficacy scores were improved from 22.3 (SE=1.6) to 25.6 (SE=2.1). Pedersen (2012) also found significant negative correlations between anxiety and farming activities such as milking procedures ($r = –0.62$, $p = 0.02$) and moving animals ($r = –0.58$, $p = 0.03$). In their

mixed methods study, Hine (2008) found that after spending time on a care farm, participants' self-esteem (RSE) increased by 1.82 points ($p<.01$) with significant improvements on 6 indicators of mood (anger, confusion, depression, fatigue, tension, vigour, all, $p<.01$). The potentially beneficial effects of these activities for participants' mental health clearly add to the general appreciation of the natural setting and social interactions found in the qualitative studies (Online Table S10).

Virtual reality-based

Three studies of virtual reality (VR)-based simulations of natural environments were identified (Alvarsson, 2010; Annerstedt 2013; de Kort, 2006). All three were experimental, lab-based studies which compared different types of natural environment simulations with respect to objective and/or self-reported stress reduction. Alvarsson compared different kinds of natural or non-natural noise simulation in a simulated natural environment; Annerstedt compared natural sounds vs no sounds, while de Kort compared different levels of immersion (72" vs 31" screens) on recovery from stress (Online Table S11). Alvarsson (2010) and Annerstedt (2013) both found that the addition of natural sounds to virtual environments could facilitate faster recovery from stress, while de Kort (2006) found that increased immersion could enhance the restorative potential of a simulated natural environment (Online Table S12).

Discussion

Nature-based interventions offer a promising way to support the wellbeing of a range of groups with varied occupational, clinical and social needs – and this may be particularly important for people based in institutional settings, who typically have reduced access to

nature in everyday life. To our knowledge, this is the first scoping review of nature-based interventions in institutional settings to become available, and we have described a large body of literature across a variety of populations and contexts. Based on our findings, we have been able to identify a number of important gaps in the literature. Particularly, we have identified a number of challenges and questions for future systematic reviews and primary studies to address, which we will now discuss.

First, it was notable that different intervention types were more popular in different institutional settings, and with particular client groups. For instance, care farms were typically conducted with clients with occupational needs, such as re-entry into paid work and overcoming drug and alcohol addiction. The structured, work-based format of care farm interventions may be particularly well suited to supporting such clients. Therapeutic horticulture was often applied in residential care settings, and may be a useful therapy modality for interventions that aim for general improvements in wellbeing. Animal-assisted therapy was particularly popular in prison settings, and, again, may be well suited to the context and desired outcomes for this group – such as taking responsibility for an animal's wellbeing, and learning how to care for and train them. The qualitative findings for each therapy modality do suggest the interventions have been matched to the context in such a way, and it may be worthwhile in future research to compare different therapy modalities in the same setting, and to explore whether differing psychosocial mechanisms of benefit can lead to different types of outcome.

However, comparing intervention types is complicated by the fact that, even within each therapy modality identified in this review (horticulture and gardening-based therapy; animal-assisted therapy; care farming; and virtual reality-based therapy), there were often

substantial divergences in activities, delivery, and intensity. Future systematic reviews would benefit from examining the effects of specific types of nature-based intervention within these categories separately. Broadly speaking, we would suggest the following classifications might be useful to obtain more fine-grained analyses of different intervention modalities:

- Gardening and horticulture-based therapies: 1. Therapeutic wander gardens (ie. Gardens based on-site of institutional settings that require no active input from participants); 2. Therapeutic crop and plant growing (comprising planting and plant caring activities); 3. Arts and commercial-based horticulture (using the products of therapeutic growing to create artistic objects, food, and produce for sale at local markets).
- Animal-assisted therapies: 1. Time-limited, structured visits from therapeutic animals (eg. Bringing dogs into care homes for a weekly allotted time); 2. Animal adoption (eg. Providing a canary for residents of a facility to care for); 3. Animal training programmes (eg. Training service dogs)
- Care farming: 1. Primarily arable farming; 2. Primarily livestock farming; 3. Mixed farming.

In terms of future systematic reviews, several modalities of nature-based interventions have already been examined, notably animal-assisted therapy in prisons (Cooke & Farrington, 2016), gardens for supporting wellbeing among people with dementia (Whear et al. 2014), gardening for people with mental health difficulties (Clatworthy et al. 2013), and horticultural therapy for various illness outcomes (Kamioka et al. 2014). Our findings suggest that additional systematic reviews of animal-assisted therapy in hospital and care home

settings, and of care farming for occupational rehabilitation, may be warranted. Additionally, future reviews will likely need to incorporate a range of evidence types to gain an informative picture of these interventions. For example, the evidence for care farming typically comes from detailed qualitative field studies, and so may be well suited for a qualitative metasynthesis, which may be helpful for gaining insights about the therapeutic mechanisms of care farming that go beyond the findings of the original studies. In terms of garden-based and horticultural therapies, a wide range of qualitative and quantitative evidence is available, and a realist review approach may be of use for understanding these interventions. Realist reviews address the question of what works for whom in what context (Wong, Greenhalgh, Westhorp, Buckingham & Pawson, 2013), and so may be able to unpick the linkages between the qualitative and quantitative evidence pertaining to such interventions. The evidence for virtual reality-based simulations of nature is currently limited to lab-based studies, and we would advise interested researchers to wait until further evidence becomes available before attempting a systematic review of this type of therapy, whereas more original primary research in this area is clearly required and encouraged. Additionally, future systematic reviews of any therapy modality will have substantial complexity to manage in terms of the duration and intensity of therapy.

This scoping review has identified a wide range of empirical literature on nature-based interventions to support wellbeing. Due to the time and resource limitations of the project, we have certainly not included all the available literature for each therapy type, and we had to make a trade-off between sensitivity and specificity in our searching strategy. Additionally, as is typical for a scoping review, we have made no attempt to formally assess the quality of the included literature, nor to synthesise findings from individual studies.

Consequently, definitive conclusions about the efficacy of these therapies is beyond the scope of our study. However, the review benefited from a systematic search, a thorough process for including and excluding studies involving two reviewers, and detailed extraction of key aspects of the methods and findings across this body of literature. This enabled us to identify the overall pattern of evidence for these types of interventions, to examine the contexts in which they are typically implemented, and to identify important questions for subsequent primary and secondary research to address.

Figure 1. Study selection flow chart.

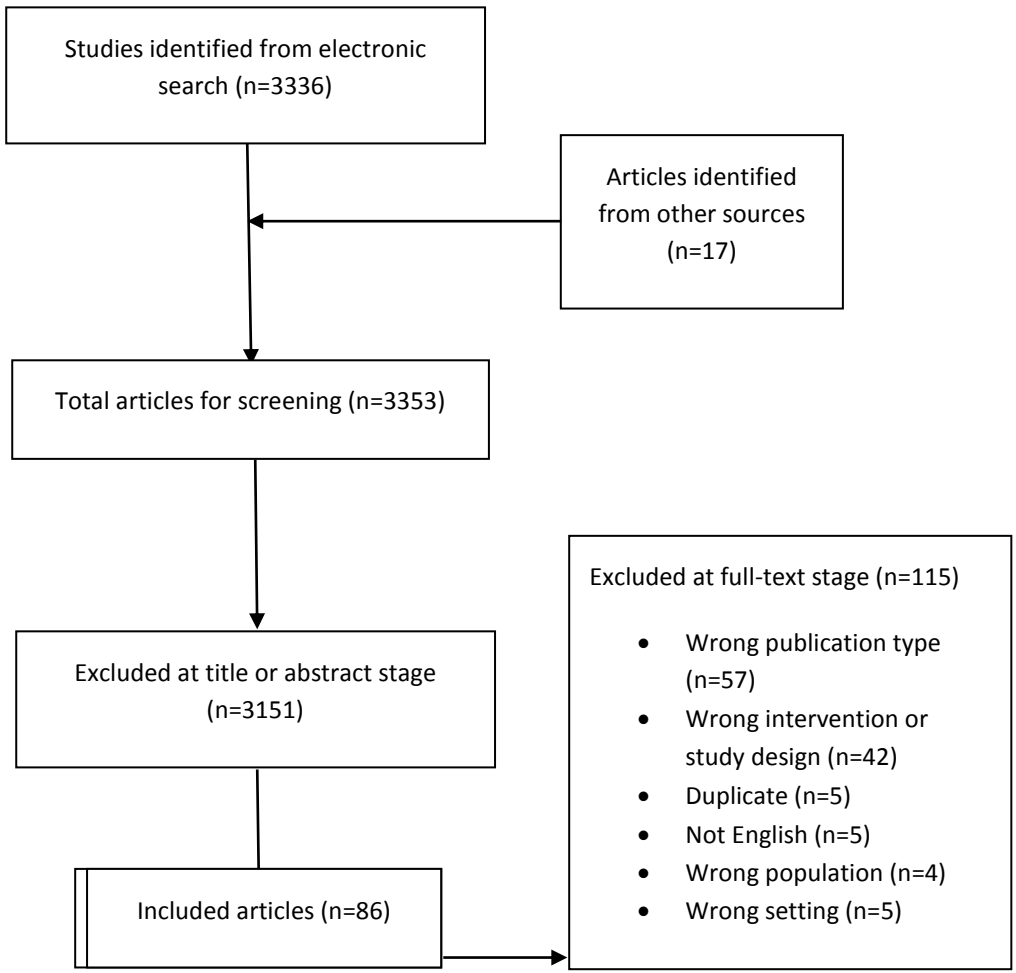

Table 1. Databases searched and hits identified.

Database	Searched in	Hits
CINAHL	Title, abstract, full text	**377**
Medline (via CINAHL)	Title, abstract, full text	**842**
Criminal Justice Abstracts (via CINAHL)	Title, abstract, full text	**686**
PsycINFO	Any field	**426**
SCOPUS	Title, Abstract, Keywords	**1043**
Social Care Online	Any field	**177**
Cochrane CENTRAL trials register	Title, Abstract, Keywords	**89**
Total		**3640**

Table 2. Study contexts, settings, target populations and designs

		Gardening/ Horticulture (n=41)	Animal-assisted therapy (n=33)	Care farms (n=8)	Virtual reality-based (n=3)
Population	Any hospital inpatients (including rehabilitation clinics)	7	12	-	-
	Any hospital outpatients	-	3	-	-
	Nursing / residential home residents	7	8	-	-
	People with dementia	5	1	-	-
	Students	1		-	3
	Prison inmates	1	6	-	-
	Domestic violence survivors	2		-	-
	People with mental health or substance abuse problems	18	0	8	-
	Other	-	3	-	-
Setting	Hospital/ rehabilitation centre	15	19	-	-
	Nursing/ retirement home	8	7	-	-
	Garden	11	-	-	-
	Prisons	1	6	-	-
	Laboratory	-	-	-	3
	Farm	1	-	8	-

		Gardening/ Horticulture (n=41)	Animal-assisted therapy (n=33)	Care farms (n=8)	Virtual reality-based (n=3)
	Women's shelter	2	-	-	-
	Other	3	1	-	-
Design (quantitative)	RCT	3	6	-	
	Controlled before-after study	3	2	-	-
	Uncontrolled before-after study	9	8	3	-
	Crossover study	1	4	-	-
	Retrospective cohort study	1	-	-	-
	Quasi-experiment	2	3	-	3
	Cross-sectional/ survey	3	1	-	-
	Case study	1	1	-	-
Design (qualitative)	Thematic analysis	3	-	3	-
	Phenomenology	1	-	1	-
	Grounded theory	5	-	-	-
	Ethnography/ observational	5	1	-	-
	Other	3	4	1	-
Mixed method (any)	-	1	3	-	-

Supplementary Table S1. Study settings, target populations, and participants (Therapeutic gardening/ horticulture)

Author year	Setting	Target population	Participants
Therapeutic gardening/ horticulture			
Adevi 2012	Alnarp Rehabilitation Garden in Sweden	People with stress and exhaustion Disorders	5 interviews and 1 focus group with caregivers, observations with 13 participants
Adevi 2013	Alnarp Rehabilitation Garden	People with stress and exhaustion Disorders	5 participants 3 female, 2 male
Aslan 2016	Outdoor environment	Recovery from substance abuse	Interviews, n=8 (3 female, 5 male) Observation (n=37)
Austin 2006	Senior centre in New York	Senior citizens	N=6 (3 female, 3 male) Age: 68.17 (SD=8.035)
Barley 2012	Sydenham Garden horticultural and participatory arts rehabilitation project in South London	People with severe mental and physical health problems	N=16 (7 female, 9 male) Age: Between 38 and 91
Bay-Richter 2012	Not reported	Patients with a mood- or an anxiety disorder	Not reported
Cerwén 2016	Rehabilitation garden in Alnarp, Sweden	Patients with stress-related mental disorders	N=59 (50 females, 9 males) Age: 25-62
Detweiler 2005	Dementia wander garden	Stroke patients without dementia	N=1 (male) Age: 74
Edwards 2013	Magnolia House Therapeutic Garden	Elderly care residents with dementia	N=10 (9 female, 1 male) Age: 79-90
Eriksson 2010	Vocational rehabilitation clinic in Sweden	Clients with stress-related disorders	N=8 (Former clients, 7 female, 1 male) Age: 41 (32-50) N=7 (Team members, 6 female, 1 male) Age=44 (29-52)
Eriksson 2011	vocational rehabilitation clinic in Sweden	women with stress-related ill health who are on sick leave	N=5 All female Age: 43
Galvin 2000	Wholesale shrub nursery	People with mental health problems	N=27 (23 male, 4 female) Age: 40 (21-58)
Gigliotti	adult day	People with dementia	N=14

Author year	Setting	Target population	Participants
Therapeutic gardening/ horticulture			
2004	service (ADS) program		Age: 83 (70-97)
Gonzalez 2011a, b	4 urban green care farms	adults diagnosed with clinical depression	Study 1: N=18 (3 male, 15 female) Age: 49.7 Study 2: N=28 (7 male, 21 female) Age: 44.1
Heath 2001	Care facility for the elderly	Elderly residents and families	N=190 (110 male)
Hewitt 2013	1 horticultural garden and 1 dementia hospital garden	people with young-onset dementia	N=9
Jagger 2016	Community learning garden	students, faculty staff and wider community	N=3
Jonveaux 2013	Healing garden in Nancy, France	Dementia patients, visitors and caregivers	Survey N=63 (nursing homes) Interviews N=123
Kim 2010	Three hospitals in Seoul, Korea	Stroke patients with hemiplegia	N=40 (14 female) Age: 58 (treatment group only) Duration of hemiplegia from 6 months to >25 months
Lee 2008	Women's shelter in Korea	Domestic violence survivors	N=24 women 12 intervention; 12 control Age: NR
Lidén 2016	Alnarp Rehabilitation Garden, Sweden	women on long-term sick leave	N=52 (all female) Age: 21-62
Luk 2011	Nursing home	Nursing home residents with dementia	N=14 (13 female, 1 male) Age: 84.9 (SD=8.3)
O'Brien 2011	Meanwhile Wildlife Garden in London	Referred volunteers with mental health problems	N=77(Case study 1) Age: 16-76 N=10 (Case study 2) Age: 22-60
Ottosson 2005	Nursing home in Sweden	Residents in a nursing home	N=15 (13 female, 2 male) Age: 86
Pálsdóttir	rehabilitation garden in	People with stress-related mental	N=21 (19 female, 2 male)

Author year	Setting	Target population	Participants
Therapeutic gardening/ horticulture			
2014	Alnarp, Sweden	illness	Age: 29-68
Parr 2007	2 urban garden schemes in the UK	people with mental-health problems, addiction or learning disabilities	Ecoworks: Not reported Coach House Trust: 50-60
Perrins-Margalis 2000	Clubhouse Facility	People with chronic mental illness	N=10 Age: NA
Rappe 2005	Nursing home in Finland	Elderly people in institutional care	N=30 Age: 84 (70-98)
Rappe 2006	Nursing home in Finland	Elderly people in institutional care	N=45 (all female) Age: 85 (64-98)
Rappe 2008	Gardening plot in Helsinki, Finland	mental health outpatients	N=12 (11 male, 1 female) Age: 53.3 (41-64)
Raske 2010	Nursing home	Nursing home residents	N=16 (6 male, 10 female) Age: 81.4 (65-99)
Renzetti 2015	Women's shelter in Kentucky	Shelter administrators and staff	N=17
Richards 1999	Patuxent Institution, maximum security prison in Maryland US	incarcerated offenders with substance abuse history	N=33 (8 female, 25 male) Age: 33.5 (17-54)
Sahlin 2015	Nature-based rehabilitation centre in Sweden	Employees with stress-related mental disorders who had been on sick leave	N=57 (RHB group, 53 women, 4 men) Age: 45 (26-63)
Sarno 1997	Garden facility at Rusk Institute in New York	Individuals with Acquired Aphasia	N=19 (11 male, 8 female) Age: 73.9 (49-90)
Stein 1997	Residential care facility	Residents with disabilities	NA
Verra 2012	Rehabilitation clinic in Bad Zurzach, Switzerland	patients with chronic musculoskeletal pain	N=37 Age: 47.1 (20.4—66.9)
Währborg 2014	Designed rehabilitation garden in Alnarp, Sweden	Patients referred with stress-related illness or depression	N=103 (92 female, 11 male) Age: 45.9 (SD=9.7)
Whatley 2015	Community garden in Melbourne	Referred patients with mental health problems and staff	N=13 (Observations) N=6 (interviews)
Wichrowski	The Rusk Institute of	Cardiac rehabilitation inpatients	N=59 (34 male, 25 female)

Author year	Setting	Target population	Participants
Therapeutic gardening/ horticulture			
2005	Rehabilitation, New York		
Zhu 2016	Minhang District Mental Health Center	Inpatients with schizophrenia	N=55 (24 males, 31 females) Age: 46.5 (SD=9.0)

*: Mean (SD), unless otherwise stated

Supplementary Table S2. Study settings, target populations, and participants (Animal-assisted therapy)

Author year	Setting	Target population	Participants
Animal-assisted therapy			
Barker 1998	Inpatient psychiatry service of an urban academic medical center	Referred Hospitalized Psychiatric Patients	N=313 (174 female, 139 male) Age: 37 (SD=12)
Barker 2003	Electro-convulsive therapy suite in academic psychiatry medical centre	Psychiatric inpatients and outpatients awaiting ECT	N=35 (25 female, 10 male) Age: 54.2 (±18.6)
Beck 1986	Psychiatric hospital unit	Psychiatric inpatients	Intervention group N=8 (2 female, 6 male) Age: 41.6 (SD=13.5) Comparison group N=9 (3 female, 6 male) Age: 41.4 (SD=11.3)
Buettner 2011	Oncology waiting room in a Cancer Center	Cancer patients and family members	N=80 (23 male, 57 female) Age: 62.4 (18-87)
Chinner 1991	15-bed hospice in Adelaide, Australia	Terminally ill hospice residents	Time 1: N=8 (5 female) Age: 70.25 (range: 55 to 83) Time 2: N=6 (3 female) Age: 67.6 (range: 59 to 75) Time 3: N=4 (2 female) Age: 69.25 (range: 66 to 71)

Author year	Setting	Target population	Participants
Animal-assisted therapy			
Chu 2009	Psychiatric institution in Hualien County, Taiwan	Taiwanese inpatients with schizophrenia	N=30
Coakley 2009	3 hospital inpatient units	Hospital patients	N=61
Colombo 2006	Seven elderly rest homes in Veneto Region of Northern Italy	cognitively unimpaired institutionalized elderly	N=144 (97 female, 47 male) Age: 78.7 (SD=9.4)
Cushing 1995	Correctional facility in New Mexico (US)	Inmates	Inmates N=8 Age: 35.5 Staff interviews N=12 Staff questionnaires N=25 Age: 40
Fick 1993	Veterans Administration Medical Center	Nursing home residents	N=36 (all male)
Fournier 2007	Minimum security men's prison in Virginia, USA, housing 352 inmates	Prison inmates	N=48 men (24 control, 24 intervention) Age: 29 (range: 21 to 46) Mean education time 11.6 years (range: 9 to 15)
Haughie 1992	NHS psychiatric hospital	Elderly psychiatric patients	Ward 1 N=18 (13 female, 5 male) Age: 65-86 Ward 2 N=19 (all female) Age: 70+
Hoffmann 2009	Charite University Medicine Berlin.	Hospitalised patients meeting the DSM IV criteria for unipolar major depression.	N=12 (6 male) Age: 40.5 $\pm$10
Jasperson 2010	Utah State Prison	Women inmates with mental health difficulties	N=1 Age: 42

Author year	Setting	Target population	Participants
Animal-assisted therapy			
			Incarcerated for drug charges Diagnosis of Schizo-affective disorder
Johnson 2008	Radiation oncology units of two hospitals	Cancer patients undergoing radiation therapy	N=30 Dog intervention group N=10 (8 female, 2 male) Age: 61 (39-77)
Katsinas 2000	Nursing home	Nursing home patients with dementia	N=12 (9 female, 3 male) Age: 84 (69-98)
Kovács 2004	Social institute for psychiatric patients	middle-aged schizophrenic patients	N=7 (4 female, 3 male) Age: 43.6
Kumasaka 2012	Palliative care unit	Nursing home patients	N=20 (9 male, 11 female) Age: 69.45 (SD=11.66)
Le Roux 2009	Nerina Place, an old age home in Bishop Lavis (Capetown, South Africa)	Elderly residents in a long-term care facility	N=16 (8 female, 8 male) Age: NA
Lynch 2014	Hospital setting at University of Arkansas	Antepartum hospitalised women with high-risk pregnancies	N=82 (all female) Age: 26.9 (SD=5.7)
Marr 2000	state psychiatric facility	Psychiatric patients	N=69 (48 male, 21 female) Age: 41.5 (SD=1.7)
Mercer 2015	Animal centre in a UK prison unit	Offenders and staff involved with animal programme	N=8 (3 offenders, 5 staff)
Neer 1987	1 nursing care facility 1 mental health facility	Geriatric residents	N=66
Orlandi 2007	Oncology centre in Italy	Oncology patients undergoing chemotherapy	N=89 (61 males, 28 females) Age: NA
Perelle 1993	Mixed care nursing home in Westchester, New York.	Care home residents	N=53 (18 male, 35 female) Age: 75.39 $\pm$11.72
Rossetti 2008	Psychiatric hospital in Chicago	Behavioural health staff	N=10
Savishinsky 1992	3 nursing homes in upstate New York	Nursing home volunteers	N=52 (patients) N=45 (pet visitors) N=21 (volunteers)
Sockalingam	Psychiatric hospital	Single case study of patient with	N=1 (male)

Author year	Setting	Target population	Participants
Animal-assisted therapy			
2008		bipolar-disorder	Age: 43
Stasi 2004	Nursing home for elderly patients	Nursing home residents with chronic age-related disabilities	N=28 Age: 85 (SD=12.6)
Turner 2007	Medium security prison for adult men	Male inmates	6 inmates arrested for a variety of offences
Walsh 1994	Women's prison in South Australia (Northfield Prison Complex, Women's Section)	Women prisoners	N=8 (All female) Age: 25.8
Winkler 1989	Nursing home in Perth, Australia	Nursing home residents and staff	N=20 (patients, 19 female, 1 male)
Zisselman 1996	Wills Eye Hospital Geriatric Psychiatry Unit	Geriatric psychiatry inpatients with chronic age-related disabilities	N=33 (22 female, 11 male) Age: 76.7 (SD=8.1)

Supplementary Table S3. Study settings, target populations, and participants (Care farms)

Author year	Setting	Target population	Participants
Care farms			
Berget 2007	Farms with animals	severely ill psychiatric patients	N=35 (26 female, 9 male) Age: 35.7 (SD=10.9)
Elings 2008	8 Green care farm in the Netherlands	people with a psychiatric or addiction history	N=42
Ellingsen-Dalskau 2015	4 Care farms in Norway	People with mental health problems	N= 10 (2 male, 8 female) Age: 20-42
Hassink 2010	Care farms in the Netherlands	3 client groups: severe mental health problems, youth care, frail elderly	psychiatry clients N=16 (12 male and 4 female) Age: NA Elderly care N=12 (9 male, 4 female)

Author year	Setting	Target population	Participants
Care farms			
			Age: NA
Hine 2008	UK care farms	Care farm users for various psychosocial issues	N=72 (pilot)
Iancu 2014	13 care farms in the Netherlands	Users of care farms with mental disorders	N=14 (9 male, 5 female) Age: 39.6 (SD=13.3)
Pedersen 2011	8 dairy farms in Norway	Persons with Clinical Depression	N=14 (3 male, 11 female) Age: 37.4 (23-54)
Pedersen 2012	Dairy farm in Norway	Persons with Clinical Depression	N=8 (1 male, 7 female) Age: 37.6

Supplementary Table S4. Study settings, target populations, and participants (Virtual reality)

Author year	Setting	Target population	Participants
Virtual reality			
Alvarsson 2010	Laboratory	Students	N=40 (24 female, 16 male) Age: 27
Annerstedt 2013	Virtual reality laboratory of Lund University	Students and staff with good health and no hearing impairment	30 males with a mean age of 27.7 (SD = 6.7)
de Kort 2006	Virtual natural environment in a laboratory	Students	N=80 (29 female, 51 male) Age: 24 (SD=4.8)

Supplementary Table S5. Study design, methods, and intervention details (Garedening and horticulture-based therapies).

Authors, year	Design	Methods	Intervention details
Garden and horticulture-based interventions			
Adevi 2012	Qualitative case study; grounded theory	In-depth interviews (n=5) Focus group (1*5 participants) Participant observation (13 participants over 2 periods of 12 weeks)	Garden therapy in Alnarp rehabilitation centre, Sweden. Participants with stress/ exhaustion disorders referred by GPs for a rehabilitation programme over 12 weeks (4 half-days/ week). Activities include horticultural therapy, picture therapy, physical therapy and rehabilitation.
Adevi 2013	Grounded theory	Semi-structured interviews (n=5) on expectations and evaluation of the rehabilitation programme. Analysis via open coding and data saturation	Garden therapy in Alnarp rehabilitation centre, Sweden. Participants with stress/ exhaustion disorders referred by GPs for a rehabilitation programme over 12 weeks (4 half-days/ week). Activities include horticultural therapy, picture therapy, physical therapy and rehabilitation.
Aslan 2016	Applied thematic analysis	Semi-structured interviews (n=8); 4 observation days; 4 focus groups (n=37); themes developed through coding.	Recovery through nature programme (UK), where service users are taken to engage in conservation activities, in conjunction with conservation agencies in the UK (National Trust; John Muir Trust, Forestry Commission, local parks)
Austin 2006	Single group before-after pilot study	Functional health (Dartmouth COOP Functional Health Assessment Charts), depression (GDS), and physical fitness (6-minute walk test) were taken before the gardening intervention and after 8 weeks.	Senior Centre in Upstate New York. A garden was developed in which residents who wanted to garden were provided with space, containers filled with dirt, and plants for growing.
Barley 2012	Qualitative study, thematic analysis	Semi-structured interviews with open-ended questions. Interview transcripts (n=16) analysed in Nvivo with several iterations of coding.	Sydenham Garden is managed as a nature reserve where clients may grow vegetables, herbs and flowers. Clients may then use these plants or sell them at local fairs. The programme also includes the opportunity to engage in arts activities.
Bay-Richter 2012	RCT	Blood samples were taken at baseline, 4 weeks, and 8 weeks and assessed for inflammatory factors. Psychopathology was measured with MADRS. Analysis with repeated measures ANOVA	8-week garden rehabilitation or treatment as usual.
Cerwén 2016	Qualitative, IPA	Semi-structured interviews (n=59) focusing on participants' experience of rehabilitation after 12 weeks of the intervention. The analysis focused on the experience of sounds by searching systematically through interview	12 weeks of nature-based rehabilitation therapy in Alnarp garden, Sweden. The garden is 2 hectares in size and includes a nature-like area and an area for cultivation. The garden is prescribed for people with stress-related illness and is designed to include relaxing features.

Authors, year	Design	Methods	Intervention details
		transcripts. References to sounds were then coded, categorised, and analysed for meaning.	
Detweiler 2005	Case study	Observational study, focusing on improvements in gait, walking distance, and independent toileting in the stroke patient during rehabilitation in the dementia wander garden	After initial indoor rehabilitation, the patient was rehabilitated in the dementia wander garden for increased durations of time (15 mins initially to 45 mins after 30 days). The patient was trained by rehabilitation professionals to navigate obstacles and lift his right foot while walking.
Edwards 2013	Mixed methods, before-after study	A new garden was built in a care home for people with dementia, and participants were assessed before the garden was opened, and 3 months after, for: cognition (MMSE); dementia-related quality of life (DEMQOL); depression (SCDD), and agitation (CMAI). Scores before and after were compared with t-tests. Semi-structured interviews for qualitative data.	A therapeutic, interactive, sensory wandering garden with adjoining atrium/ sunroom. The garden was designed after a review of the literature, and included components aimed at evoking pleasurable memories and experiences (eg. a viewing platform over the Australian bush, a finch aviary, a water feature and growing beds).
Eriksson 2010	Qualitative, exploratory grounded theory study	Patients with stress-related illness were recruited from rehabilitation clinics with theoretical sampling. Data collection included field observations and an open-ended interview with each participant. Open and focused coding, and constant comparison were used to derive themes.	Four rehabilitation programmes in a rehabilitation clinic in Sweden. Two of the programmes involved therapeutic gardening activities such as flower arranging and planting cuttings. These were performed in a garden designed to promote relaxation and healing.
Eriksson 2011	Longitudinal, grounded theory study	Participants (n=5) in a therapeutic gardening rehabilitation programme were interviewed three times at weekly during the rehabilitation process, and once three months after the intervention. Data were analysed using grounded theory techniques (memo writing, constant comparison)	Vocational rehabilitation clinic in Sweden, including a therapeutic garden. The garden is in a 500-metre square greenhouse and the rehabilitation is supported by a multidisciplinary team (occupational therapist, physiotherapist, social worker, gardener).
Galvin 2000	Qualitative, thematic analysis	Focused conversational interviews used to explore: personal circumstances; health & social care; self-perception; and views of the sheltered work opportunity project. Data	Sheltered Work Opportunities Project – a non-profit shrub nursery based in Dorset, UK. All aspects of horticulture are undertaken by people from rehabilitation and hospital services, who are supported by paid staff.

Authors, year	Design	Methods	Intervention details
		analysis with thematic content analysis.	
Gigliotti 2004	Observational, quasi-experimental study	People with dementia were offered three types of HT: cooking, crafting, and planting. Observational data were collected during HT and traditional therapies using a dementia care mapping technique, and compared between groups using paired samples t-tests.	26 different types of HT offered by students: nine planting, nine cooking, and eight crafts. Activities took place both within the dementia care home and outside in planting beds.
Gonzalez 2011a&b	Single group before-after study	Two before-after studies examined existential issues and depression following a brief HT programme. Both studies used the BDI to measure depression. Existential issues were measured with the LRI-R in study 1 and the SOC in study 2. Repeated measures ANOVA used to compare scores at baseline, during the intervention, and 3-months after.	12-week HT programme for depression, including "active" components (sowing, germinating, pollinating) and "passive" components (walking, watching nature)
Heath 2001	Cross-sectional survey	25-item survey based on the design goals of the garden was sent to residents, family members, and care staff. The survey included likert-type questions and yes/ no/ unsure items. Descriptive statistics were presented and compared between stakeholder groups with chi-square tests.	Eight therapeutic gardens were built on The Lodge, a care home for residents with cognitive impairments. Residents were free to use the garden as they wished – there were no structured activities offered.
Hewitt 2013	Mixed method, before-after study	Participants were assessed for activities of daily living (BADL), cognition (MMSE), and wellbeing (Bradford Wellbeing Profile). Measures were taken at baseline, 6, and 12 months.	2 hours' weekly structured gardening activities over 12 months. The sessions began with group socialising, followed by structured gardening activities, and a discussion of the day's work.
Jagger 2016	Duoethnography; critical pedagogy of place	Ethnographic collection of field notes, observations and photographs Informal and formal conversations with faculty members and students	Creation of a learning gardening in urban education facility. University of Toronto students, staff and members of the community were invited to engage in garden-based learning programmes. Participants used the garden as a social space and grew food together.
Jonveaux 2013	Mixed-methods design	Survey of geriatric care centres (N=63) Structured interviews (N=123) Survey for postoccupancy	Garden visits, active gardening activities and transgenerational workshops

Authors, year	Design	Methods	Intervention details
		Evaluation	
Kim 2010	Nonrandomised pretest-posttest, between-group study	Patients were assigned to groups involving occupational therapy only, or horticulture-based occupational therapy (approach for group allocation unclear). Groups were evaluated before and after the intervention on visual-motor coordination skills (Grooved Pegboard Test); mood (GDS); and activities of daily living (FIM)	Horticultural occupational therapy was designed to support physiological and psychological improvements among stroke patients. The course was run over 4 weeks and included activities such as sowing sprout seeds, making flower baskets, making soup, and making calendars with tree leaves.
Lee 2008	Two-group, pretest-posttest study	Participants were assessed on self-esteem (RSE) and depression (ZDS) at baseline and after 12 weeks of horticultural therapy or no horticultural therapy.	The shelter was fitted with a kitchen garden, a farm in the field, and farming tools. 24 HT sessions were delivered over 12 weeks. Activities included flower pressing, flower arrangement, adopting herb cuttings, group planting, herbal hair rinse making, and outside walks.
Lidén 2016	Before-after single group study	Health-related quality of life (HRQoL) of the 123 female participants was assessed using SF-36 measures at baseline, after 14 weeks and at the end the programme.	The four-leaf clover project combined established horticultural therapy at Alnarp garden with Supported Employment (SE) as job coaching for the rehabilitation of people with disabilities or stress-related illness. Participants engaged in gardening and handicraft activities, mindfulness exercises and spent time in a natural and relaxing environment.
Luk 2011	RCT (Single-blinded pre- and post-test)	14 nursing home residents with agitation were randomly assigned to a horticulture and a control group. Levels of agitation were measured pre- and post-intervention using the Chinese version of the Cohen-Mansfield Agitation Inventory (C-CMAI).	Participants engaged in weekly horticultural activities including seeding, planting and fertilising in an outdoor garden for a period of 6 weeks. The control group engaged in social indoor activities for stimulation including origami, doing puzzles, drawing, and making collages.
O'Brien 2011	Ethnographic case studies	Participant observation Interviews (n=10) 2 focus groups with practitioners Thematic analysis	In the therapeutic gardening programme (case study 2), participants with mental health problems were either referred or self-referred and volunteered in the garden 2 to 3 times a week for a full day. They engaged in outdoor conservation activities
Ottosson 2005	Crossover pre-post study	Measurement of systolic and diastolic blood pressure and heart rate, The Necker Cube Pattern	Over a period of 6 months, participants spent 1h of recreational time in an outside garden (intervention) or indoors (control). Individual tests were conducted on 3 days

Authors, year	Design	Methods	Intervention details
		Control Test (NCPC), Digit Span Forward (DSF), Digit Span Backward (DSB) and The Symbol Digit Modalities Test (SDMT) Structured staff interviews	pre and post recreational time at intervals of 14 days. In both settings participants were resting and not engaging in any physical activity. Seven participants began the study with the outdoor intervention, while 8 began in the indoor control group before crossover. Blood pressure and heart rate were recorded and staff were interviewed for background information.
Pálsdóttir 2014	Longitudinal mixed-methods design	Measures pre and post intervention and at 1 year follow-up: experiences of everyday occupations (Oval-pd), self-assessed occupational competence (OSA-F), health status (EQ-VAS, SCI-93), and sense of coherence (SOC-13) Semi-structured interviews 12 weeks after intervention	The rehabilitation programme took place in a specially designed two-hectare health garden where participants could use the garden freely and according to their individual needs. The intervention programme ran for 12 weeks in which 4 weekly sessions of 3 to 3 and a half hours combined relaxing exercises with horticultural activities in between meetings with the physiotherapist or psychiatrist. At baseline, the following instruments were used: SCI-93, SOC, OSA-F, Oval-pd, and Eq-VAS. At follow-up 1 (12 weeks), the following instruments were used: SCI-93, SOC, and OSA-F. At follow-up 2 (36 weeks), the following instruments were used: Oval-pd, Eq-VAS, and semi-structured interviews. One year after the intervention ended, return to work rate was assessed (follow-up 3).
Parr 2007	2 ethnographic case studies	Documentary analysis Interviews Observations	Volunteers at the Ecoworks allotments project engage in a range of gardening activities, both individually and in groups. The focus is on landscaping and restoration rather than food production and participants do not work towards specific therapeutic goals. At the coach house trust, activities include recycling, composting and general gardening and furniture making. Organic food is grown for use by the project and local residents and participants also landscape private residential gardens on a contract basis in addition to receiving a £20 reimbursement for travel and food expenses.
Perrins-Margalis 2000	Qualitative case study	Participant observation Journals completed by participants	Over a 6 week intervention period, participants in the rehabilitation clubhouse took part in 2 weekly structured

Authors, year	Design	Methods	Intervention details
		Semi-structured interviews (N=10) Hermeneutic phenomenological analysis	horticultural activities and were asked to reflect on their experience in a journal after each session to explore QOL impacts. Activities varied each week and included planting seedlings, creating wreaths and flower beds and preparing soil.
Rappe 2005	Survey design	Questionnaire including the Zung self-rating depression scale (ZFDS) and personal assessments of different aspects of the garden	Nursing home residents were given access to an activity garden and visit a balcony overlooking the garden.
Rappe 2006	Survey design	QoL questionnaire including the Nottingham Health Profile (NHP)	The nursing home residents have access to a park within the institution along with walking paths and a pond, where outdoor visits were defined as either walking in the outdoor space or viewing it from the balcony.
Rappe 2008	Mixed-methods case study	Questionnaires Diaries completed by participants Participant observation	The group of mental health outpatients met weekly at a gardening plot to cultivate vegetables and grow flowers, herbs and berries. Other tasks included weeding, picking flowers and produce and watering the plot and compost heap. During the sessions participants engaged in group conversations and were given diaries and access to cameras to document their own experiences.
Raske 2010	Qualitative case study	Semi-structured interviews	Residents were given access to an enabling garden in the courtyard of the nursing home. Activities included indoor seed planting, soil preparation, garden maintenance, harvesting, and eating the produce
Renzetti 2015	Qualitative evaluation	Semi-structured interviews (with staff) Grounded theory	The project offers shelter and support services to victims of domestic violence, including a working farm where participants voluntarily take part in farming activities such as preparing beds, planting, watering, weeding and harvesting for up to 9 hours per week. Other farm-related activities include cooking farm-to-table, flower arranging, making crafts and body products from harvested products.
Richards 1999	Pretest-posttest design	Questionnaires including Symptom Checklist-90-Revised (SCL-90-R), Comprehensive Review of Addiction Variables and Effects (CRAVE), Frequency of Self-Reinforcement	Over a 6 month period, offenders took part in class lectures, group therapy and weekly gardening work under supervision. The gardening programme is linked to environmental and anti-drug education where offenders are taught the values of

Authors, year	Design	Methods	Intervention details
		Questionnaire (FSRQ) and the Generalized Expectancy for Success Scale (GESS)	hard work, respect for self and for all living things, and cooperative vocational skills.
Sahlin 2015	Before-after study	Questionnaires at baseline, 3 follow-ups and 6 and months after intervention: Shirom-Melamed Burnout Questionnaire (SMBQ), The Beck Depression Inventory (BDI-II), The Beck Anxiety Inventory (BAI), The Psychological General Well-Being Index (PGWB) Register data on health and rehabilitation	The rehabilitation included garden activities, weekly guided walks in the nearby nature reserve, therapeutic painting, group therapy and guided relaxation in nature and indoors. After 16 weeks of rehabilitation (3h per day for 4 times a week), participants gradually re-entered work over a period of 12 weeks. The activities took place in a small house with a conservatory, garden and a greenhouse bordering a 222-acre nature reserve.
Sarno 1997	Qualitative pilot study	Observations Interviews	Patients, their families and staff had access to a restorative conservatory (1,700f^2) and outdoor greenspace (12,000f^2) where patients propagate seeds and cuttings, arrange flowers, make cactus gardens and terrariums, and also work on various horticultural craft projects. Patients in the Aphasia Community Groups met three different times over an eight-week period in hour-long horticulture sessions.
Stein 1997	Qualitative case study	Participant observation	In weekly gardening sessions, residents (all in wheelchairs) take part in gardening activities and are supported by volunteers who also facilitate discussions and relationship building within the group.
Verra 2012	Prospective, nonrandomized, controlled cohort study	Pre- and posttest group comparison between programme without horticultural therapy (control, n = 42) and with horticultural therapy (intervention, n = 37) using Medical Outcome Study Short Form-36 (SF-36), West Haven-Yale Multidimensional Pain Inventory (MPI), Hospital Anxiety and Depression Scale (HADS), the Coping Strategies Questionnaire (CSQ), and two functional performance Tests	The horticultural therapy program consisted of seven sessions of group therapy, each of 1-hour duration. Participants in the control group received a standard pain management programme, while the horticultural therapy programme consisted of 7 sessions of group therapy, each of 1-hour duration, held twice a week for 4 weeks. Under the guidance of a physiotherapist and horticulturalist, participants were engaged in walking through the garden and greenhouse, examining plants and seeds, potting and vegetable gardening, digging and making bouquets of flowers.
Währborg 2014	Retrospective cohort	Comparison of sick-leave status and	The programme took place in a rehabilitation garden over a

Authors, year	Design	Methods	Intervention details
	study	healthcare consumption using national databases	period of 12 weeks where participants engaged in gardening activities, relaxation exercises, psychotherapeutic activities and walking.
Whatley 2015	Qualitative case study	Participant observation Semi-structured interviews	Participants took part in the gardening project 3 days per week where outdoor areas included a Japanese garden, communal garden beds for growing vegetables and herbs and a chicken coop. Gardening activities included planting seedlings, watering, harvesting, composting and writing plant labels. Other programmes for skill development included the running of a community kitchen, market and creative projects.
Wichrowski 2005	Quasi experiment	Group comparison of heart rate, POMS total mood disturbance (TMD) score and HR pre- and postintervention	Participants in the horticulture group attended a single session, while those in the control group attended a patient education class (PEC). After an initial tour of the horticulture facility, participants immersed themselves in the sensory environment and engaged in a planting activity.
Zhu 2016	RCT	Measured psychiatric changes using the Positive and Negative Syndrome Scale (PANSS) at baseline, the end of the 4th week session and the end of the 12th session	Participants in the intervention group (n=52) engaged in guided horticultural therapy for a period of 12 weeks for 3 times every week with each session lasting for 90 minutes. Activities included ridging, planting, watering, fertilising, collecting vegetables and cooking. The control group (n=52) only received the standard medication treatment.

. ANOVA, analysis of variance; BADL, Bristol Activities of Daily Living Scale; BSI, Brief Symptom Inventory; CSDD, Cornell Scale for Depression in Dementia; DEMQOL, Dementia Quality of Life Instrument; FIM, Functional Independence Measure; GDS, Geriatric Depression Scale; HT, horticultural therapy; IPA, interpretative phenomenological analysis; MMSE, Mini Mental State Exam; POMS, profile of mood survey; RSE, Rosenberg Self-esteem Scale; VAS, visual analogue scale; ZDS, Zung Depression Scale

Supplementary Table S6. Study findings and conclusions (Gardening and horticulture-based therapies).

Authors, year	Key findings	Conclusions

Authors, year	Key findings	Conclusions
Gardening/ horticulture-based therapies		
Adevi 2012	Three themes developed: (1) sensory impressions. Sensory stimulation and engagement in the gardening were reported to have therapeutic effects. (2) self-chosen places in the garden. People found places they identified with in the garden that gave them a sense of belonging; and (3) interactions between concrete and symbolic activities. Interacting in the garden in an autonomous way, and finding ways to symbolise difficult experiences had therapeutic effects	The role of the natural environment in developing a model for stress recovery was discussed. The garden therapy opened participants up for other modalities of therapy.
Adevi 2013	Two main themes developed: 1. "The garden and me – sensuous, moods and symbolism of nature" – participants described the therapeutic benefits of their "favourite places" in the garden, and the pleasure of doing the work. 2. "Together in a garden – the garden, the caregivers and the group" – participants described the benefits of sharing the experience of horticulture with people in similar situations.	Overall, the "calmness and the kindness" of the garden was contrasted with the harshness of other aspects of participants' lives. The relaxing practice of gardening was proposed as a way to enhance self-regulation.
Aslan 2016	Two overarching themes were found: "the process" and "experiencing change". "the process" was made up of four sub-themes: "childhood and innocence; nature; community as method, and staff lead. "Change was made up of "the old versus the new" and "self-development".	The features of recovery through nature – the activity, the relationships, and nature – facilitated a process of enlightenment and change.
Austin 2006	There was a trend toward improvement on most functional activities (physical fitness, feelings, change in health, overall health, social support, social activities, QoL), though only social activities was significant (p=.046). Total emotional score improved (p=.042). There was a trend to reduced depression levels, and participants walked further in the 6 minute walk test (significance for both measures, NR)	The study found some support for the possible benefit of therapeutic gardening among older people. Two measures showed significant improvements, and there was a general trend to improvement on all measures. The study was limited by a small sample size, and better powered studies are needed.
Barley 2012	Participants in the programme reported benefits of horticulture in terms of: providing purposeful activity; improving mood; escaping life's pressures; being outdoors and social contact.	Horticultural and arts-based therapy are feasible for improving health in primary care patients with serious physical and mental health problems. Follow-up studies are required to understand longer-term impact.
Bay-Richter 2012	The 8-week garden rehabilitation programme had no effect on depression scores; however, biomarkers of inflammation (interleukin 2 and interferon gamma) were reduced by the garden therapy.	Garden therapy did not appear to have an effect on depression scores, but may play a role in reducing inflammation.
Cerwén 2016	Three classes of sound were identified in the garden, which had different effects on therapeutic impact. "Natural sounds" were generally described as calming and "soft", they also often spoke	"Quietness" and natural soundscapes can be useful in promoting therapeutic

Authors, year	Key findings	Conclusions
	about silence. "Technological sounds" most often came from the motorway near one edge of the rehabilitation centre, and were described as annoying and unpleasant. Finally, "human sounds" (conversations, speech etc) elicited varied responses, with some types of talk being very relaxing, and others stressful.	benefits in rehabilitation.
Detweiler 2005	After rehabilitation, the patient could complete most of his ADLs (eg moving from bed to chair, chair to standing, toileting, getting in and out of a car), and his aphasia and self-esteem increased.	Nature may support healing by reducing the negative physiological impact of stress. The need for voluntary attention in natural environments may support improved executive control function.
Edwards 2013	Participants' mean QoL (DEMQOL) increased pre-posttest (91 $\pm$6.5 to 102.6 $\pm$11.0, p=.00068), while agitation (CMAI) and depression (SCDD) both decreased (46.7 $\pm$23.4 to 25.1 $\pm$15.0, p=0.0002; and 8.3 $\pm$6.8 to 7.2 $\pm$6.3, p=.01994, respectively). Comments from qualitative interviews showed a positive view of the garden.	All 10 participants appeared to benefit from the garden. This was even the case where participants did not actively engage in the garden, but simply sat outside and enjoyed the views.
Eriksson 2010	The following features of rehabilitation were identified as important: 1. Changing self image; 2. Receiving respect from others; 3. Being part of a group; 4. Taking control of everyday life; 5. Developing conscious strategies to manage stress; 6. Doing homework to integrate new practices into everyday life; 7. Re-evaluating occupations; 8. Discovering enjoyment in activities; and 9. Changing attitudes towards activities.	Two routes to integrating rehabilitation into everyday life were identified: Changing ways of handling stressful situations was associated with the cognitive approach to rehabilitation, whereas clients who participated in the combined programmes including therapeutic horticulture changed their occupational repertoires. Different approaches to rehabilitation appear to lead to different changes in everyday life.
Eriksson 2011	Four "phases" were identified in the rehabilitation process in the therapeutic garden: 1. Being in the atmosphere of acceptance (ie. away from daily stresses); 2. Being absorbed in the present (taking pleasure in activities and discovering new competencies); 3. Worries about connecting experiences to everyday life (continued concerns and uncertainties about the future after leaving the care farm); and 4. Bridging rehabilitation to everyday life (finding ways to connect the rehabilitation experience with home life, eg. by bringing the plants they had nurtured home).	The study has elaborated some of the processes by which therapeutic gardens bestow benefits for participants. It is important for people with stress-related illness to have the opportunity to spend time in a quiet and calm environment.
Galvin 2000	Three themes were identified, each of which included several sub-categories: Users' social worlds (isolation, friendships, loss, living with mental illness, friendships and relationships, and identity); Stigma and discrimination (accommodation, problems perceived by users, coping with stigma/ discrimination, lack of autonomy, intrusion, confidentiality, employment, unfair treatment, and	Horticultural therapy can play a part in rehabilitation.

Authors, year	Key findings	Conclusions
	fear); and Moving on (positive and negative coping, purpose and place, motivation/ self-esteem, value, independence, indicators of success, being in control, insight/ acceptance and denial, and life changes)	
Gigliotti 2004	Participants' productive activity level was not significantly higher in horticultural activities when compared with traditional dementia care activities (p = .63, t = 2.044, d.f. = 12). However, the mean time spent doing nothing was lower during horticultural activities compared with traditional dementia care activities (p = .002, t = 3.97, d.f. = 12). The average positive affect score was higher for horticultural activities compared with traditional activities (p < .01, t = -5.43, d.f. = 12). No significant differences in affect or engagement were found between three different modalities of horticultural therapy.	Horticultural therapy produced high levels of positive affect and engagement in the care home residents. The authors suggest these programmes should be expanded for dementia care.
Gonzalez 2011, 2011a,	When enrolled in a horticultural therapy programme, participants' (n=18) depression (BDI) scores reduced from 27.3 ±6.8 at baseline to 17.6 ±6.4 at 12 weeks follow-up, and 20.8 ±9.0 at 3 months' follow up (p<.01). However, no significant increase in life regard (LRI-R) was found (48.8±6.8 vs 50.2 ±7.5, p=ns). In a second study (n=28), comparable results were found for the BDI. Existential issues, as measured by the SOC, again failed to reach statistical significance between baseline, 12 week, and 3-month follow-up 43.6 (6.6) vs 44.6 (7.5) vs 45.5 (7.0). Subsequent pooled analyses showed that participants' perceived group cohesiveness increased slightly during the intervention, and no significant correlation was found between cohesiveness and mental health measures.	Horticultural therapy can provide benefits in terms of reducing depression levels. The authors suggest this may be due to psychological distance from everyday environments, involvement in interesting and pleasant activities, and cohesiveness of the group to which one belonged
Heath 2001	Of 110 volunteers, residents, and family members, 83.5% had visited at least one of the gardens in the care home. Compared with volunteers, a significantly higher number of residents and family members had done so ($\chi^2(2, 110) = 12.02$, $p < .005$). Among residents, the most common reasons to visit the garden were to sit (23.5%), visit (17.6%), walk, or reflect (both, 11.8%). There were mixed responses on whether the garden was worth the money (39.9% "definitely yes"; 34.4% "yes"; 14.2% "no"; 10.9% "definitely not"). Staff were more likely to say "no" than volunteers, families, and residents ($\chi^2(3, 182) = 16.20$, $p < .001$).	The majority of respondents judged the garden's aims to have been well met. Staff were generally more critical in their evaluations of the garden than residents and families.
Hewitt 2013	Participants' mean wellbeing scores increased over time, though the change from the baseline to endpoint did not reach significance ($t(5) = 1.43$, $p = 0.21$). Over 12 months, participants' mean cognitive functioning (MMSE score) declined from 17 to 15.87 (paired $t(5) = 3.88$, $p = 0.012$). In qualitative interviews, carers identified benefits in terms of: 1. Enjoyment; 2. Independence; 3. feeling useful; 4. Feeling valued; 5. reduced anxiety.	The findings suggest structured group gardening may help increase or maintain subjective wellbeing among people with dementia despite continued cognitive decline. A larger, controlled trial is needed to confirm these effects.

Authors, year	Key findings	Conclusions
Hine 2008	The survey of UK care farms found 19 city farms, 16 independent farms and 41 farms linked to charities/ external organisations. These varied from 0.3 to 650 hectares. The focus was on developing work, social skills, or accredited education. After spending time on a care farm, participants' self-esteem (RSE) increased by 1.82 points (p<.01), and significant improvements on 6 indicators of mood (anger, confusion, depression, fatigue, tension, vigor) were seen (all, p<.01).	The care farm case study showed significant benefits. However, these need confirming in larger, more controlled studies.
Jagger 2016	In-depth exploration of 3 main themes within community learning garden: the aesthetic experience (importance of bright colours and smells to trigger aesthetic responses), the affective response (joy, peacefulness and relaxation) and the building of community (shared place for learning and socialising).	Users of the garden showed strong emotional responses and experiences the garden as place of pleasure and enjoyment. The concept of community can be extended to include plant life and build better connections with nature and each other.
Jonveaux 2013	All 63 institutions in the Nancy region had green spaces and organized outdoor activities. The post occupancy evaluation of a single garden (N=68) showed that all patients were satisfied with the existence of the garden space, unimpeded view of the garden from their rooms, and the possibility of taking a walk and appreciated the contact with nature, enjoying sunshine, open air, presence of trees (100%), size of the garden (100%), luminosity (90.9%), protected space (81.8%), size (66%), and width of the walkways (50%) as a welcome change from the hospital environment. Garden visits were reported to have a positive effect (100%), a tranquilizing effect (50%), a positive effect on mood (33%) and improve communication with others (41.6%) including the nursing staff.	Garden visits and activities were highly valued by patients and improved their communication with staff. Many older patients had concerns over safety and possible falls which should be addressed in the design of healing gardens.
Kim 2010	Visual-spatial hand dexterity improved in both groups but only reached significance in the horticulture-based group (172.2 to 124 seconds, p<.001). GDS scores decreased by 11.5% in the occupational therapy group (p<.05), vs 48.3% in the horticulture-based group (p<.001). FIM scores also increased significantly in both the occupational therapy group (73.6 to 84.6, p<.01) and the horticulture-based group (78.9 to 95.5, p<.001)	Horticulture-enhanced occupational therapy may be an effective way to improve the physical functioning of stroke patients with hemiplegia by increasing hand dexterity and independence.
Lee 2008	Self-esteem scores increased by +11.6 points (p=.0001) and +6.2 points (p=ns) in experimental and control groups, respectively. Depression scores reduced by 17.9 (p=.0019) and 5.2 points (p=ns) for experimental and control groups, respectively.	HT was found to increase self-esteem and reduce depression among domestic violence survivors. Limitations include the nonrandomised nature of the study and the small nonprobability sample.
Lidén 2016	Of the 52 women who completed all 3 SF-36 measures, significant improvement in HRQoL were observed for mental and social aspects but there were no significant improvements to experienced pain or blood pressure. Social functioning was significantly improved towards the end of the programme.	The precise benefits of combined horticulture and supported employment remain unclear due to confounding factors and limited sample size. However, there are indications that women benefited

Authors, year	Key findings	Conclusions
		from the social aspects in a natural environment. The programme is recommended as viable option for improvising wellbeing and facilitating a return to work.
Luk 2011	Following intervention, no significant differences in C-CMAI scores (p=0.116) or subscales were recorded compared to the control group or within groups (experimental group: p=0.115 and control group: p=0.249). A positive correlation (r=0.809, p=0.028) between Mini-Mental State Examination scores (CMMSE) and the pre- and post-test difference of the CCMAI score was found in the experimental group, while these were negatively correlated in the control group (r=0.975, p=0.005).	Overall, no significant reduction in agitation was recorded following intervention. The correlational results, although not quite statistically significant, indicated that horticultural activity decreased the frequency of agitated behaviors for subjects with relatively lower C-MMSE scores. However, results also indicated that horticultural activity increased agitation for those with a relatively higher C-MMSE score. Horticultural therapy may be suited for lowering agitation in people with severe cognitive impairment.
O'Brien 2011	In the therapeutic programme, 3 key themes were identified: 1) improving relations with others and nature (sense of mutual nurturing, improved resilience from contact with nature, value of team work and learning); (2) working alongside others (building social capital, environmental conservation linked to personal recovery); and (3) developing social and employable skills (Overcoming isolation, better social skills and new knowledge).	Participants in the therapeutic programme reported a range of benefits to their mental wellbeing and improvements to social capital. It shows that hands-on nature-based work can help reintegrate marginalised groups into society and provide them with better skills relevant to their social environment and the job market.
Ottosson 2005	Positive correlations were found between psycho-physiological balance and pulse rate (R=0.79, p<0.001), diastolic blood pressure (R=0.52, p<0.002), pulse pressure (R=0.52, p<0.05) and rate pressure product (R=-0.46, p<0.02) indicating that these are influenced significantly by a period of rest in a garden. Rest outdoors seems to have restored both pulse rate, diastolic blood pressure, pulse pressure and rate pressure product, whereas these values continued to rise during the period of rest indoors.	Time spent in the outdoors is important for individuals with low psycho-physiological balance and can support recovery from stress and fatigue.
Pálsdóttir 2014	At follow-up 2 (36 weeks), the perceived general occupational value was significantly higher (p <	Nature-based rehabilitation helped

Authors, year	Key findings	Conclusions
	0.001) at 44 (SD 8) compared with baseline measurements 35 (SD 5), (n = 15). The Stress and Crisis Inventory (SCI-93) showed a significant reduction in general variable from 68.1 (SD=16.1) at baseline to follow-up 1 (12 weeks) of 53.6 (SD=29.6). Twice as many participants (N=12) scored below 51.0 (normal to slightly raised level of stress) on the SCI-93. 4 main themes were identified in the interviews: 1) "Slower pace in everyday life on one's own terms" (Increased awareness and mindfulness in daily activities), 2) "Everyday occupations more often related to nature" (More free time spent in nature), 3) "Social interaction" (More social interaction and group activities in nature), 4) "Creative occupations" (Resumed or took up creative occupations).	participants improve their functioning in daily life and improved their health. It made them re-engage with nature and creative occupations.
Parr 2007	Documentary analysis of historical documents shows how garden-based interventions in mental health are based on discourses of the healing power of nature and disciplinary benefits of physical labour. Often used as cheap labour, predominantly male patients engaged in heavy physical labour in newly emerging regimes of outdoor recreational therapy as means of social control. Empirical ethnographic data from two contemporary gardening projects show that discourses of integration and normalisation are still informing horticultural allotment projects today, with new links to active citizenship and economic utility. At the Ecoworks project, there was limited socialisation at the remote garden site but despite its non-interventionist design participants still reported positive feelings of personal achievement and productivity and benefiting from the calming and restorative engagement with nature. In contrast, the Coach House Trust gardening project was more productivity- and output-oriented with volunteers locating therapeutic effects in the physical exhaustion, work ethic and psychological contentment. Here the presence of the project was made more socially acceptable by providing aesthetic and visual improvements to public places while symbolically integrating people with mental health problems as useful citizens into the community. Despite gaining confidence in social interactions, participants encountered several difficulties resulting partly from a lack of training and being under the effects of medication and conflicts arose between participants when having to perform hard work in bad weather conditions.	Therapeutic gardening projects can transform passive and isolated patients with mental health problems into active and valued community-workers. Yet, discourses of participatory citizenship remain relevant and there are dangers of exploitation where other parties benefit more from the participants' unpaid labour. Such community work should be financially rewarded more adequately and a range of community-based garden spaces should be made available, including restorative programmes without clinical or policy objectives.
Perrins-Margalis 2000	7 themes related to QOL emerged from the phenomenological analysis: 1) Group experience (Team work, helping others and feelings of accomplishment), 2) Sharing experience (Sharing end products with others, sharing of ideas and strategies during activities), 3) Learning experience (Novel experience and new skills), 4) Sensory experience (Hands-on work with soil, smelling and feeling plants), 5) Creative experience (Creative outlet and individual choice), 6) Emotional experience (Relaxation, fun and stress relief), 7) Reminiscent experience (Sharing memories of gardening, facilitated group discussions)	Group-based horticulture can have positive effects on QOL. It provides participants with a sense of accomplishment and facilitates social interaction and the learning of new skills. Occupational therapy may benefit from introducing purposeful horticultural activities.

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Rappe 2005	While 16 of the 30 participants visited the garden daily, 21 experienced at least one or more hindrances in visiting, mostly due to lack of personal assistance, weather conditions or concerns over safety. Three out of four participants (73.1%) reported feelings of recovery following their visits, while 84.6% felt more cheerful. None of the participants reported using fewer medicines as a result of their visits but 50% reported a reduction in pain. A negative correlation was found between depression scores on the ZSDS scale (r=-0.132) and frequency of garden visits and 80% of depressed participants reported some hindrances compared to only 50% in the non-depressed group. Depressed participants were less likely to report feelings of recovery following a visit compared to non-depressed visitors (58.3% compared to 85.7%, p=0.190) and half of the depressed visitors described garden visits as a burden, compared to only 14.3% among the non-depressed (p=0.090). However, a greater proportion of depressed residents (91.7%) reported feeling more cheerful and alert after a visit, compared to 78.6% of non-depressed residents (p=0.598).	Garden visits and seeing green environment are associated with enhanced emotional wellbeing. Physical barriers, issues of access and personal safety need to be addressed when designing garden spaces. Residents with depression were more likely to perceive the visits as strenuous and less likely to feel recovered, meriting more research.
Rappe 2006	Half of the participants reported visiting the garden only in the company of staff, while only 11% visited them alone. Lack of assistance and adverse weather conditions were the main barriers to accessing the garden. Frequency of outdoor visits had a strong positive effect on self-reported health (B=0.322, Adjusted R^2=0.220, p=0.001).	Visiting outdoor gardens can enhance the self-rated health of older women living in institutional care.
Rappe 2008	Participants were mainly motivated by the opportunity to spend time outdoors and getting fresh air and exercise. Sensory experiences were especially valued and participants derived feelings of usefulness and meaningful activity from the gardening. Group activities and interactions were also highly valued and all participants reported feeling calmer, more cheerful and invigorated after their visits.	Group gardening may be a feasible way for NGOs to support the recovery process of individuals with mental disorders. Gardening activities can be designed with flexibility and a combination with group interaction and physical activity may be particularly beneficial.
Raske 2010	5 themes emerged from the interviews: 1) garden design and construction (Involvement in design), 2) resident quality of life (Value of comfort, security, enjoyment, meaningful relationships and improved autonomy and physical functioning), 3) staff and volunteer quality of life (Improved quality of life), 4) shared stories (Personal stories of garden experience), and 5) enabling garden as marketing tool (economic benefit to nursing home)	The garden had a positive impact on resident quality of life and improved their social relationships with staff and the wider community.
Renzetti 2015	3 major themes emerged from the interviews: 1) Staff Perceptions of Farm Program Benefits (mental health benefits and reduction in social isolation, feelings of fulfilment and accomplishment, improved links with community), 2) Staff Concerns about the Farm Program (Demands on staff, lack of gardening experience, financial sustainability), 3) Reconciling the Farm Program with the Shelter's Mission and Goals (Shared therapeutic goals, positive mental health impact of farming)	The farming programme offered valuable support to shelter residents and had a positive impact on their physical and psychological wellbeing.
Richards 1999	On the SCL 90-R scale, significant changes pre- and post-intervention were only found for Psychoticism (reduction in mean value from 56.75 (SD=10.79) to 54.00 (SD=8.89), t=1.727). On the	Although horticultural therapy may quickly reduce reactive psychological symptoms

Authors, year	Key findings	Conclusions
	CRAVE scales, means for all symptom scales were reduced post-test, while mean FSRQ (t=1.12) and GESS (t=1.04) scores increased but neither were statistically significant.	related to substance abuse, it may be less effective at reducing resistance to addiction due to existing personality and cognitive deficits in the offender population. Prison programmes can benefit from making educational links between chemical-free gardening and drug-free living.
Sahlin 2015	Mean burnout scores decreased from 5.2 (SD 0.88) at start of NBR rehabilitation to 4.4 (SD 1.16) at the end of NBR, 4.26 (SD 1.28) at six months, and 4.12 (SD 1.26) at twelve-month follow-up. On the Beck Depression Inventory (BDI-II), mean scores were reduced from 23.2 (SD = 10.0) at baseline to 15.6 (SD = 8.7), 14.2 (SD = 8.0) and 13.0 (SD = 8.7) at each follow-up and the number of participants scoring “moderate” or “severe” depression decreased from 52% at the start to 21% 12 months after follow-up. Mean scores on the Beck Anxiety Inventory were also reduced from 17.2 (SD 11.8) at baseline to 12.8 (SD 10.1), 12.1 (SD 8.4) and 10.2 (SD 7.8) at each follow-up, while the number of participants scoring “moderate” or “severe” anxiety decreased from 47% at the start to only 19% at 12 months follow-up. Mean values for well-being on the PGWB gradually increased from 41.9 (SD = 8.1) at baseline to 46.7 (SD = 8.8), 47.8 (SD = 9.4) and 49.1 (SD = 10.7) at each follow-up.	Participants in nature-based rehabilitation showed decreased scores of self-assessed burnout, depression, anxiety, and increased scores of well-being at all follow-ups compared to start of rehabilitation. Nature- and garden-based activities made up 42% of the weekly schedule and were likely to play a key role in improving participants’ mental well-being.
Sarno 1997	Patients enjoyed participating in the programme and more than half of those who attended reported they began to care for plants which were acquired in the pilot project at home. Horticultural activities helped improve social interaction between patients with aphasia and their families.	Due to the non-verbal nature of horticultural activities, they are particularly well suited for patients with aphasia and other communication disorders. Interaction with plants can provide a stimulating environment and improve verbal skills.
Stein 1997	The gardening program was perceived as fun and productive because of the physical activity, the resultant beautiful plants and the companionable relationships between volunteers and residents. Choice and voluntary participation are a central aspect of the programme which also helps residents create new memories, as planting flower beds added a sense of normality to the institutional life. The gardening programme also allowed residents to give seedlings or harvested produce to others as a gift. While some participants appreciated being given meaningful work,	A sociocultural approach to horticultural therapy can challenge biomedical perspectives and individualist interpretations by shifting focus to the social and institutional environment.

Authors, year	Key findings	Conclusions
	there is a danger of exploiting participants' efforts and creativity for the benefits of the institution.	
Verra 2012	On discharge, there were small to moderate outcome effects (effect size [ES] up to 0.71) within both groups. The study found significantly larger improvements for the horticultural therapy group vs the control group in SF-36 role physical (ES = 0.71 vs 0.22; P = .018); SF-36 mental health (ES = 0.46 vs 0.16; P = .027); HADS anxiety (ES = 0.26 vs 0.03; P = .043); and CSQ pain behavior (ES = 0.30 vs –0.05; P = .032).	The addition of horticultural therapy to traditional pain-management programmes may improve physical health, coping ability, and health-related QOL in people with prolonged, pain-related disability.
Währborg 2014	A significant reduction in healthcare consumption was noted among participants in the horticulture-based rehabilitation programme compared with the reference population. The main changes were a reduction in outpatient visits to primary healthcare and a reduction in inpatient psychiatric care. No significant difference in sick-leave status was found.	Horticultural rehabilitation programmes can decrease the demand for healthcare consumption.
Whatley 2015	3 main themes emerged from the ethnography of the garden: 1) Creating community (Bringing people together, connections with wider community), 2) flexible environment that supports participation (Improved participation and cooperation), 3) Creating a learning environment (New approaches to coaching and learning)	Participants benefited from the horticulture project as it helped create community, a flexible environment that supports participation and opportunities for learning new skills. Community-based mental-health programmes using garden spaces can improve social inclusion, enable occupational participation and facilitate contact with the neighbourhood.
Wichrowski 2005	Following the horticulture intervention, total mood disturbance (TMD) was reduced from a score of 19.3 T 24.5 to 1.6 T 24.8 (mean ± SD, P < 0.001). Heart rate was also reduced by 5 bpm, from a preintervention level of 79.2 ± 14.7 to 74.1 ± 13.6 bpm (P <0.001). In the control group of educational classes, neither TMD nor heart rate changed significantly.	Horticultural therapy can improve mood state and reduce stress and heart rate and its addition to cardiac rehabilitation programmes can bring significant psychosocial benefits to participants.
Zhu 2016	There were significant differences in total Positive and Negative Syndrome Scale (PANSS) scores in between intervention and control group after 4 weeks (t=-3.97, p<0.01) and 12 weeks (t=-5.57, p<0.001). There was statistically significant difference before and after intervention in the intervention group (F=253.03, p<0.001) and in the control group (F=67.66, p<0.001). There were also statistically significant differences in the positive scale scores at the baseline, the end of the 4th week session and the end of the 12th session both among the intervention group (F=13.76, p<0.001) and the control group (F=5.12, p=0.02) as well as statistically significant difference in the negative scale score at the end of the 12th session among two groups (t=-2.76, p<0.001).	Treatment effects and rehabilitation for schizophrenia patients can be improved when medication therapy is combined with horticultural therapy.

-Mansfield Agitation Inventory, DEMQOL, Dementia Quality of Life Instrument; MMSE, mini mental state exam; ns, non-significant; NR, not reported; POMS, Profile Of Mood States survey; QoL, quality of life; SCDD, Scale for Depression in Dementia

Supplementary Table S7. Study design, methods, and intervention details (Animal-assisted therapies)

Authors, year	Design	Methods	Intervention details
Animal-assisted therapies			
Barker 1998	Pretest-posttest crossover study	Changes in self-rated anxiety (State-Trait Anxiety Inventory) compared after two interventions: animal assisted therapy or therapeutic recreation. Mixed models, repeated measures analysis used to compare conditions.	The animal-assisted therapy session consisted of approximately 30 minutes of group interaction with a therapy dog and the dog's owner. Therapeutic recreation sessions were held daily on the unit. They varied in content, including education about how to spend leisure time, presentations to increase awareness of leisure resources in the community, and music and art activities.
Barker 2003	Controlled crossover quasi-experiment	Patients were assigned to the dog condition or control condition on alternating ECT sessions. Participants were presented with a VAS for anxiety, depression, and fear before the intervention/ control, and after 15 minutes. Patients were briefly interviewed after the session. Nurses completed the same VAS scales to assess inter-rater reliability. Pearson correlations were conducted between patient and nurse VAS ratings. Mixed model, repeated measures ANCOVA and least squares analysis used to compare post-treatment scores for intervention vs control;	15 mins of interaction with a therapy dog and its handler. The handler was instructed to focus conversation on the therapy dog and the patient's experience with pets. Although physical interaction with the therapy dog, such as petting and hugging, was permitted, it was not suggested, and patients were allowed to determine the level of interaction. The control intervention provided patients with news, entertainment, or outdoors magazines to read.
Beck 1986	RCT	Measurement of attendance and participation rates, Brief Psychiatric Rating scale, Nurses' Observation for Inpatient Evaluation (NOSIE)	Participants were randomly assigned to a bird intervention group or nonbird group. Daily sessions were held over a period of 11 weeks in a room which contained a cage with 4 finches or a standard room.
Buettner 2011	Cross-sectional survey	14-item survey about interest in and attitude toward a therapy dog programme in the cancer centre in future.	Hypothetical dog therapy programme

Authors, year	Design	Methods	Intervention details
Chinner 1991	Single group before-after pilot study	A structured interview was conducted with staff and patients to assess mood, frequency and quality of social interactions, degree of religious belief, and attitudes towards animals. Evaluation at 3 time points: baseline, when the miniature poodle was introduced, and after the intervention. The composition of the participant group changed at each time point due to high death rates at the hospice.	"Placement of a Trained Canine Companion in a Hospice" (PATCCH) programme. A miniature poodle was introduced as a resident in the study hospice.
Chu 2009	RCT	Patients with schizophrenia were randomised to receive AAT or treatment as usual (both, n=15). Assessments of self-esteem (GSE), self-determination, social support, and adverse psychiatric symptoms were taken one week before and one week after the intervention.	Weekly 50-minute AAT with two dogs of "nonspecific breeds", over two months.
Coakley 2009	Mixed method, pretest-posttest, quasi-experiment	Physiological measures (blood pressure, pulse, respiration), behavioural measures (self-reported pain and energy using a VAS), and self-reported mood (POMS) were taken before and after a visit from a dog. Scores were compared using one-tailed t-tests with Bonferroni correction.	One-off visit from a dog inside the hospital, lasting ~10 minutes with each participant.
Colombo 2006	RCT	Participants were randomised to receive a canary, a plant, or nothing. Before and after the intervention (3 months), participants were assessed for cognition (MMSE), QoL (LEIPAD II), and mood (BSI).	Participants residing in care homes were given a canary (n=48), a plant (n=43) or nothing (n=53) for a period of three months.
Cushing 1995	Mixed methods design	Semi-structured interviews (staff and inmates) Questionnaire Case file data	The Wild Mustang programme allowed inmates to train and care for wild endangered horses who had been adopted by the general public through donations. Inmates would look after the mustang, nurse it through sickness, trim its hooves, groom it and tame it.
Fournier 2007	2-group, pretest-posttest quasi experimental study	Treatment and control groups (nonrandomised) were compared before and after the intervention. Outcomes included	PenPals program. Dogs are selected from local shelters and trained by volunteer inmates in prison for 8 to 10 weeks. Dogs live with selected inmates who are educated in dog-

Authors, year	Design	Methods	Intervention details
		institutional infarctions (obtained from inmate records); human-animal interactions, and the Social Skills Inventory (a 90-item measure of social and emotional skills). Between-group, repeated measures ANOVA.	training skills. The volunteer inmates provide for the dogs' needs (i.e., food, shelter, grooming), and train them. After the training period, the dog is adopted by individuals in the community and the inmates begin the process again with a new shelter dog.
Flick 1993	Quasi-experimental study	Participant behaviours were assessed in the presence/ absence of a dog. Predetermined, observable behaviours were recorded on a chart (nonattentive behaviour, attentive listening, nonattentive listening, verbal interaction with other person, nonverbal interaction with other person, verbal/ nonverbal interaction with animal). Percentage of time performing behaviours was compared between groups, and ANOVA was used to determine the significance of differences.	A dog was brought in to a nursing home for participants to interact with.
Haughie 1992	Repeated measures design	Observational scale and Nurses Rating Scale	3 types of conditions were compared: 1) baseline (normal interactions), 2) dog and visitor and 3) photos of dog and visitor.
Hoffmann 2009	Controlled crossover study	Patients were provided with two sessions: a control interview or an animal-assisted interview. The order of the interventions was randomised for each patient. State anxiety was measured before and after both sessions with the STAI.	30 mins interview with a research assistant, with or without the presence of a dog. In both sessions, patients were encouraged to talk about their hobbies, attitude towards dogs and other pets, and their previous experience with dogs.
Jasperson 2010	Clinical case study	N-of-1 study. The inmate's history was recorded, and she was observed at therapy sessions, and asked about her views on the intervention at the conclusion.	8 weekly or twice-weekly sessions with a dog aimed at facilitating social skills, coping skills, and self-awareness. The dog was used as a model to discuss issues such as boundaries (eg. where the dog's boundaries were, how it would react to them being breached). Attachment theory was the theoretical basis for the intervention.
Johnson 2008	Pretest-posttest	Participants were randomly assigned to 3 experimental groups of animal visits (N=10), human visits (N=10) or quiet reading (N=10).	10 adult patients undergoing nonpalliative radiation therapy were assigned to the dog visit group and engaged in 15-minute sessions three times per week for four weeks with

Authors, year	Design	Methods	Intervention details
		Participants completed a Profile of Mood States (POMS), self-perceived health questionnaire and Orientation to Life Questionnaire (OTLQ).	one or two visitor dogs and their handlers. Participants' mood, sense of coherence and self-perceived health were assessed before each intervention and at the end of the last session. During the sessions participants combed, petted, played and talked with the dog.
Katsinas 2000	Programme evaluation	Documentary data including staff notes and reports	Dementia patients were referred to the programme by healthcare professionals and participated and participated for approximately six hours, five days a week and received pre-program admission cognitive assessments. The dog was led and supervised by a staff member to greet and be petted by patients and accompanied groups during activities and garden walks.
Kovács 2004	Pretest-posttest	Independent Living Skills Survey (ILSS)	Therapy sessions of 50mins were held weekly for a period of 9 months in the garden or occupational room of the institution. Participants engaged in exercises with the dog and talked to staff about their feelings. Other activities included grooming and feeding the dog as well as physical activities.
Kumasaka 2012	Pretest-posttest	Mood changes in 20 hospital changes were assessed using Lorish's face scale pre and post interaction with dogs.	Once a month, 20 participating patients were allowed to interact with animals (dogs, rabbits and cats) for ca. 30 minutes. Changes in mood were evaluated using Lorish's face scale which allowed participants to choose one of 20 drawn faces along a scale which best fit their mood. Mean scores, standard deviation, t-tests and independent t-tests were calculated in SPSS.
Le Roux 2009	RCT	Beck Depression Inventory and the Beck Anxiety Inventory (BAI)	Participants in the animal intervention group (N=8) met once a week for 6 weeks. Participants were visited by a dog handler for 30min sessions in which the dog was kept on a leash and residents were allowed talk to, groom and pat the dog.
Lynch 2014	Pre-test, post-test pilot study	82 antepartum hospitalised women with anxiety or depression completed the State-Trait Anxiety Inventory and the Beck Depression Inventory before and after pet therapy. Paired t-tests were calculated from	82 pet therapy sessions were included in the study where participants engaged in unstructured indoor contact with the dog for a period of 15 to 20 minutes.

Authors, year	Design	Methods	Intervention details
		the results.	
Marr 2000	RCT	Participants were assessed daily using a social behaviour scale and monitored for 4 weeks. A two-group by weeks repeated measure analysis of variance was conducted for each outcome measure	Participants were randomly assigned to the animal intervention and a control group with traditional rehabilitation therapy. Animal therapy consisted of daily 1h sessions where animal visits (dogs, rabbits, ferrets and guinea pigs) allowed the patients to interact with them.
Mercer 2015	Exploratory qualitative case study	Semi-structured interviews with 3 prisoners and 5 staff members, followed by thematic analysis	Prisoners were able to visit, pet and feed animals in the animal centre which houses chickens, goats, ducks and miniature ponies in addition to two dogs who were free to wander through the complex and be cared for jointly by prisoners and staff.
Neer 1987	Prospective observational study	Systolic blood pressure measurements pre- and post-activity for 3 periods (pre-intervention, initial intervention and intervention after crossover)	Nursing home residents in 2 separate facilities were randomly assigned to the dog therapy and control group (n=20) and activities in 45 minute sessions 3 times a week. In the intervention group, participants could pet, feed or play with the dog, while in the control group activities included games, music, exercise and arts and craft. Attendance at the sessions was recorded as well as participants' blood pressure and other health data and Hamilton Depression Scale was used for psychological evaluation. Attendance rates were compared using a Z test, while other dependant variables were analysed using factoral tests of variance.
Orlandi 2007	Quasi experiment	An A.De.Ss.O (Anxiety, DEpression, Somatic Symptoms, hOstility) test was completed by participants in the experimental AAT (n=89) and control group (n=89) before and after undergoing chemotherapy. Arterial blood pressure, heart rate and arterial oxygen saturation were also recorded	Over a study period of 25 weeks chemotherapy patients were offered a choice between a treatment room where pet therapy took place (experimental area) or use a standard room (control). Pet therapy sessions took place once a week in a group of 8 patients in 3 phases of 20 minutes each. Patients would first observe the dog and join exercises with the trainer before playing with or feeding the dog.
Perelle 1993	Before-after study	Scores on the Patient Social Behavior Scale (12-question likert scale assessing a range of social and self-care behaviours) were assessed before and after the intervention, and one month after the intervention. Results were	Four cats, two small dogs, and a rabbit were taken each week for ten weeks at 2 hours a time. The therapy was provided by student volunteers.

Authors, year	Design	Methods	Intervention details
		analysed with ANOVA	
Rossetti 2008	Qualitative case study	Semi-structured interviews with health staff (N=10)	The behavioural health hospital offers pet-assisted therapy to its residents where dog visits are facilitated by a dog handler and patients may also attend scheduled group therapy sessions.
Savishinsky 1992	Multiple case study	Ethnography Structured interviews Survey Semi-structured interviews	The format of pet visits varied between the 3 nursing homes: While group sessions were held in two homes were residents could interact with volunteers and pets in a common area, the other facility offered a more individual programme where residents were visited by volunteers and their animals.
Sockalingam 2008	Single clinical case study	Recorded patient history, patient self-report, evaluations by nursing staff and doctors	A patient with atypical depression and bipolar disorder was introduced to a pet therapy dog and spent several hours a day with it over a 3 week period. During this time, the patient cared for the dog and took it for walks.
Stasi 2004	Quasi-experiment	Recorded patient history and demographics, questionnaires included the cumulative illness rating scale (CIRS), mini mental state examination (MMSE), geriatric depression scale (GDS), self assessment scale –geriatric (SASG), activities of daily living (ADL), instrumental activities of daily living (IADL)	Participants in the experimental group (n=14) took part in 3 pet therapy sessions per week with a little cat over a period of 6 week. Those in the control group (n=14) participated in standard activities in the nursing home.
Turner 2007	Qualitative interview study	Data collected with a topic guide covering 3 areas (experience of the programme; perceived benefits; perceived impact). Transcriptions were analysed with content analysis	Nonprofit intervention involving six dogs and six trainers. The dogs are trained to complete a wide variety of tasks that can help to assist people with activities of daily living. When the dogs graduate from the program, they are placed with children who have physical disabilities.
Walsh 1994	Pretest-posttest	Coopersmith Self-Esteem Inventory, IPAT Depression Scale	Participating women prisoners initially built kennels and then became responsible for the care and training of 3 dogs each under expert supervision. Training sessions lasted between 4 and 12 weeks in which participants were also responsible for grooming, exercise and play with the animals.
Winkler 1989	Longitudinal case study	Behavioural observations and mapping (6 weeks pre and 6 weeks and 22 weeks postintervention)	A dog was introduced as resident pet in the nursing home and kept on the ground floor and within the garden space where residents could interact with it.

Authors, year	Design	Methods	Intervention details
		Structured interviews	
Zisselman 1996	RCT	Pre- and posttests using Multidimensional Observation Scale for Eldery Subjects (MOSES)	Patients in the pet therapy group received pet therapy sessions with a dog for 1 h a day for 5 consecutive days, while those in the control group engaged in physical exercise.

Supplementary Table S8. Key findings and conclusions (Animal-assisted therapies)

Authors, year	Key findings	Conclusions
Animal-assisted therapies		
Barker 1998	Following the animal therapy sessions, significant pretest-posttest improvements in anxiety were seen in patients with mood disorders ($F^1$6.71, p<.01); psychotic disorders ($F^1$7.62, p<.006) and other disorders ($F^1$5.06, p<.026), though not substance abuse disorders ($F^1$2.66, p=ns). With the exception of mood disorders, these effect sizes were greater than for the 'control' intervention.	Animal therapy may provide benefits in anxiety, particularly among patients with psychotic disorders, by providing a nonthreatening, low-demand mode of therapy.
Barker 2003	Strong correlations between post-test nurse and patient VAS ratings were found (r values, all > 0.64), although pre-test correlations were inconsistent. ANCOVA findings showed a significant reduction in fear between intervention and control conditions (least squares mean = 4.27 vs 6.61, p<.0006), but not for anxiety (5.93 vs 7.13) or depression (6.36 vs 6.56), both, p>.05	The intervention resulted in a reduction in fear, but not anxiety or depression. This may imply the animal-assisted therapy was particularly effective for helping mitigate fear related to a specific stimulus (ECT), rather than trait anxiety.
Beck 1986	Attendance was significantly higher for the bird intervention group (z=2.42, p<0.008) and individuals were more likely to contribute to conversation within the group (M = 2.55, SD=3.21; $F_{1,14}$=4.38, p < 0.05). No significant difference in total score on the Brief Psychiatric Rating scale but scores the hostility subscales were significantly lower in the bird group (M=2.86, SD=0.69 compared to control M=3.78, SD=1.20; $F_{1,13}$=7.97, p < 0.05). No significant differences between the two groups were found on the NOSIE scales.	The presence of animals can increase participation rates, facilitate conversation in therapeutic group meetings and reduce feelings of hostility to create the sense of a safe environment.
Buettner 2011	Of 80 participants, 78.7% indicated they would like to take part in an AAT programme. Perceived potential benefits were "keeping my mind active" (92.3%); pain reduction (81.25%); and feeling more comfortable in the cancer centre (83.8%). A significant difference between genders was found with respect to perceived anxiety reduction (p=.0165, direction of difference NR).	The waiting room is a suitable site for providing AAT to cancer patients.
Chinner 1991	There was a trend toward reduction of patient-patient interactions, and increased patient-staff interactions after the introduction of the dog, although the interactions may have improved	The introduction of a dog may temporarily provide happiness and comfort to hospice

Authors, year	Key findings	Conclusions
	qualitatively. Favourable attitudes towards the dog were correlated positively with tiredness (r=0.88, p<.05); and negatively with isolation (r=-0.93). No significant differences in mood were found between time 1 & time 3.	residents, but patients who already feel isolated were more likely to view the dog unfavourably.
Chu 2009	There were significant improvements in the intervention group for self-esteem (9.68 vs 15.71, p=.025); self-determination (9.96 vs 15.83, p=.02); and reductions in positive symptoms (14.88 vs 8.46, p=.005); and emotional symptoms (15.37 vs 9.75, p=.048). Differences on social support and negative symptoms did not reach significance. There were no significant before-after differences on any measure in the control group.	A short course of animal assisted therapy can deliver short-term psychosocial benefits to patients with schizophrenia.
Coakley 2009	Pretest-posttest comparisons showed a reduction in respiration (t=-3.47, p<.0001) and pain (t=-3.30, p=.001), and an increase in energy (t=3.18, p=.001). There was also a significant reduction in mood disturbance (total POMS score, t=4.24, p<.0001, and all POMS subscales except vigor and confusion)	There are benefits of pet therapy for hospital patients in terms of improved mood and physiological indicators of distress. The authors suggest this may work by providing patients and nurses with different types of social interactions.
Cushing 1995	Providing care for the mustangs allowed inmates to experience a new role as carers providing affection and gentleness. It gave them a new sense of responsibility and autonomy and they enjoyed overcoming the dangers of working with wild horses. Staff also appreciated the meaningful labour they provided, while their presence also reduced the number of disciplinary incidents. 3 out of 4 staff members agreed that the programme raised inmate self-esteem (76%) and increased self-confidence (74%). However, effects on recidivism are inconclusive due to methodological limitations and the absence of a control group, although 14 of the 56 released participants who took part in the programme have since been reincarcerated (25%) at a rate below the state average (38%).	Caring for the mild mustangs was perceived as a meaningful and rewarding experience by both staff and inmates. Participation was linked to a reduction in disciplinary reports, particularly in conjunction with substance abuse counselling which warrants further investigation.
Colombo 2006	Participants given a canary to care for showed significantly greater improvements in several indicators of physical and mental health than those provided with a plant or no intervention. These included BSI subscales for somatisation, obsessive compulsion, depression, anxiety vs the control group. In terms of quality of life, as measured by LEIPAD II-SV, the cognitive functioning subscale improved relative to control.	Caring for an animal appears to have beneficial health effects for institutionalised older people. Studies with larger samples and longer follow-ups are required.
Fourier 2007	ANOVA for human-animal interactions: main effect for Group, (F (1, 46) = 24.1, p < .001, higher in intervention group), and Phase, F (1, 46) = 7.9, p < .01, reflecting an increase in HAI Scale scores from Pretest (M = 23.3) to Posttest (M = 27.9). The number of infarctions in pretest were 7 (treatment) vs 3 (control). Post-intervention, the numbers were 5 (treatment) vs 10 (control) X2 (1, n = 25) = 3.2, p < .10. MANOVA for social skills: Main effect for Phase, F (6, 40) = 2.5, p < .05, and a significant Group x Phase interaction, F (6, 40) = 3.0, p < .05.	The findings supported the hypothesis that a human-animal interaction programme would improve social skills and reduce criminal infarctions among inmates.

Authors, year	Key findings	Conclusions
Flick 1993	Most of the observed behaviours in the care home residents were similar with or without the presence of a dog (nonattentive behaviour, attentive listening, nonattentive listening, nonverbal-person interaction, verbal-animal interaction). Two behaviours were significantly increased with the presence of the dog: verbal-person interactions (F=4.92; p=.03) and nonverbal-animal interactions (F=4.72, p=.033)	The presence of a dog can enhance group therapy sessions by encouraging some types of social interaction and storytelling between participants.
Haughie 1992	The use of independent t tests revealed that there was a significant difference between (i) the baseline and the dog intervention (t = —9.56, d.f. = 304.0, p < — .05, 2-tailed) and (ii) the baseline data and the photographs intervention, (t = -6.46, d.f. = 284.0, p < 0.05, 1-tailed). There was also significant difference in the level of interaction between dog interaction and photographic intervention (t = 2.50, d.f. = 182.0, p < 0.05, 1-tailed) with the presence of the dog having a higher effect.	The presence of a companion pet can increase social interaction among patients themselves and the patients and the staff.
Hoffmann 2009	Mean STAI score before the control session was 50.41 710 and after the control session it was 48.0 79. Mean STAI score was 47.0 711 before the animal-assisted session and 42.2 710 after the session with the dog. After the assisted animal condition, the STAI score was found to be significantly decreased (Z = 2.402; p=0.016) while it remained statistically unchanged in the control session (Z = 0.981; p=0.327)	A 30-minute interaction with a dog was found to significantly decrease anxiety in severely depressed patients. Further studies should examine long-term impacts and physiological and psychosocial processes of therapeutic benefit.
Jasperson 2010	'Tara' had been disengaged with any group therapies before the intervention with the dog. During the intervention, she appeared to increase in her social interactions and comfort talking to other inmates and staff.	Animal assisted therapy is helpful for mental health practitioners in prisons looking for ways to improve inmates' mental health, and coping and social skills.
Johnson 2008	The study found no statistically significant differences within or between groups in mood, sense of coherence or self-perceived health. The dog visit group had numeric increases in their anger (2.30, p=0.60) and hostility scores, slight increases in the depression/dejection subscale (0.70, p=0.82), decreased fatigue scores (-0.20, p=0.74), decreased vigor (-0.12, p=1.0) scores, and increased confusion (0.44, p=0.67) scores post-test, compared with pretest scores, none of which were statistically significant. Only half of the participants (N=10) found the dog visiting sessions helpful but the majority (N=7) would recommend them to other patients.	There is a need for replication with a larger sample size, longer intervention period and identification of actual benefits received by participants. Future studies should also assess the impact of disease progression on test scores during the intervention period.
Katsinas 2000	Programme staff reported benefits of better group interaction and use of the dog for guidance by patients who would wander off from the group. The dog provided a sense of safety for some patients who required less supervision as a result. For withdrawn and disoriented patients, the dog offered helpful stimulation and reorientation to the environment by approaching and nudging patients for a response. The presence of the dog also helped patients with orientation to time as they related its presence to particular days of the week.	The use of a canine was beneficial for both the animal and participants as they formed lasting bonds. The dog facilitated social interaction in the group and offered orientation to dementia patients.
Kovács 2004	On the Independent Living Skills Survey, scores were significantly improved after the 9 month	Animal-assisted therapy had a positive

Authors, year	Key findings	Conclusions
	period for Health (Baseline=0.90 (0.77), 9 month= 0.33 (0.66), p = 0.02), Money management (Baseline= 0.81 (0.80), 9 month= 0.44 (0.86), p = 0.09) and domestic activities (Baseline=0.97 (0.93), 9 month= 0.37 (0.58), p = 0.01).	impact on the living skills of patients with chronic schizophrenia, with significant changes in the activities related to domestic activities and health. Strong human-animal bonds can increase participants' motivation to participate in rehabilitation therapy.
Kumasaka 2012	Following intervention, lower Face Scale Evaluations (indicating increased pleasure) were recorded for all 20 participants with a mean score of 8.10 (SD=3.48) before the activities compared to 2.66 (SD=1.99) after ($p < 0.01$). Patients who had previously owned pets or expressed interest or like for animals in general responded particularly well to the activities.	The animal-assisted activity was shown to be beneficial to patients' mood and the study shows the importance of matching animal interventions with participants' characteristics and previous experience.
Le Roux 2009	No significant differences were found between the animal-assisted activity and the control group pre BDI and BAI mean scores. However, significant differences were found between pre and post BDI mean scores ($Z = -2.385$, $P = 0.017$) for the AAA group.	The introduction of animal-assisted activities can improve depression levels of residents in long-term care facilities.
Lynch 2014	Following intervention, mean scores for depressive symptoms significantly improved (from 10.1 ± 6.3 to 6.3 ± 5.9, $p < 0.0001$) while mean scores of state anxiety also improved (from 44.8 ± 11.7 to 34.5 ± 5.9, $p<0.001$).	The study confirms existing research and concludes that pet therapy is a potentially viable treatment for reducing stress and anxiety in hospitalised high-risk antepartum women. It may also be particularly suited as nonpharmacological treatment for other high risk groups.
Marr, 2000	Results showed that animal-assisted therapy patients interacted more with other patients than the control group patients ($F(1,35)=5.7$, $p=0.022$). They also showed signs of pleasure more often $F(1,35)=5.5$, $p=0.025$) and showed significant improvement over weeks on the measures for socialization ($F(3,105)=2.75$, $p=0.05$), helpfulness ($F(3.105)=7.75$, $p< 0.001$), and cooperativeness ($F(3,105)=3.95$, $p=0.01$). By the end of week 4, patients in the intervention group also were significantly more active [$t(35)=2.09$, $p=0.04$; Mean (Standard Deviation) for AAT=4.02 (1.03); Control=3.14 (1.48)], responsive to surroundings [$t(35)=2.22$, $p=0.03$; AAT=4.33 (0.68); Control=3.49 (1.45)], sociable with others [$t(35)=2.0$, $p=0.05$; AAT 4.08 (1.16); Control=3.18 (1.53)], helpful [$t(35)=2.2$, $p=0.04$; AAT 3.89 (1.07); Control=2.92 (1.59)], likely to interact with other patients [$t(35)=2.8$, $p=0.008$; AAT=4.16 (1.09); Control=2.95 (1.49)] and were more likely to be smiling and indicating pleasure [$t(35)=3.26$, $p=0.003$; AAT=4.15 (0.93); Control=3.01 (1.17)].	Animal-assisted therapy can have significant benefits to prosocial behaviour in psychiatric patients. It can provide a pleasurable activity and increase social interaction between patients.

Authors, year	Key findings	Conclusions
Mercer 2015	Four themes were identified from the interviews: 1) Sense of responsibility (Giving structure to offender's routine, better motivation for self-care), 2) Building trust (Calmness and trust as rewarding experience and basis for therapeutic relationships with staff), 3) Enhanced communication (Facilitated communication between prisoners and interactions with staff) and 4) Impact on mood and behaviour (Stress reduction, happiness and decrease in self-harm).	AAT provided a range of social and health benefits to prisoners and improved their relationship with staff. Findings further suggest great therapeutic potential for improvement of mood and reduction in aggressive and harmful behaviour.
Neer 1987	In both facilities, attendance frequency for dog activities (was higher compared to other activities (Facility 1: 65% compared to 54%, $p<0.01$ and Facility 2: 89% compared to 81%, $p=0.01$). Mean systolic blood pressure was significantly lower ($p<0.02$) after dog activities in facility 2 compared to other activities and means for pre- and postactivity blood pressure were also significantly lower ($p<0.04$) for those who received the dog treatment first. Similar differences were found in facility 1 but these were not statistically significant. There were no statistical differences in recorded pre- and post-activity blood pressures for either group. At both facilities scores on the Hamilton Depression scale indicated reductions to depression but group differences did not reach statistical significance.	The presence of the dog and ability to interact with it was welcomed by residence and resulted in higher attendance rates compared to other activities. The lack of statistical significance for recorded differences in blood pressure between groups warrants further research with increased sample size and longer periods of interaction with the dog.
Orlandi 2007	Patients in the pet therapy group showed a significant reduction in anxiety (mean 1.84 before, 0.48 after, $p<0.001$) and depression (mean 1.84 before, 0.48 after, $p<0.001$) after chemotherapy in the A.De.Ss.O test. In the control group, similar reduction of anxiety (mean 1.63 before, 0.65 after, $p<0.001$) was recorded but depression levels were unchanged. Levels of aggressiveness decreased in both groups following treatment, while those receiving AAT showed a significant increase of arterial oxygen saturation, while it decreased in the control group.	The use of animal-assisted therapy can reduce depression in chemotherapy patients and increase arterial oxygen saturation.
Perelle 1993	Scores on the Patient Social Behaviour Scale increased from pretest (mean 39.14 $\pm$1.623) to midpoint (48.77 $\pm$1.173, $p<.001$) and posttest (53.57 $\pm$1.165, $p<.01$), decreasing slightly at follow-up (47.37 $\pm$1.589, $p<.01$). ANOVAs showed a significant effect of the intervention among men ($F=14.83$, $p<.0001$) and women ($F= 9.87$, $p<.0001$)	The introduction of visiting animals in the nursing home improved participants' self-care and social behaviours.
Rossetti 2008	Interviews with the behavioural health staff revealed 5 main themes: 1) Self-Awareness (Increased self-awareness, relaxation and focus in staff and more holistic approach to treating patients), 2) Morale (Positive work environment), 3) Innovative therapeutic strategies (Improved social interaction between patients and staff, addition of innovative therapies), 4) Challenges (Required animal care and preparation, time commitments, unpredictable dog behaviour)	The use of dogs in the animal-assisted therapy had a positive impact on hospital staff and contributed to a positive work environment and morale.
Savishinsky 1992	Volunteers were more likely to visit and spend more time with residents who were less mobile and required greater care. Through persistent pet visits, volunteers developed deep and intimate relationships with patients which they found gratifying but also burdensome at times. The presence of the pets offered a sense of security to new volunteers but around 30% of all volunteers left the	Pet visits presented valued experiences for both volunteers and residents but many volunteers were not sufficiently trained and prepared for the emotional

Authors, year	Key findings	Conclusions
	programme after only a few weeks due to various difficulties, including emotional demands, burnout or repetitive nature of the sessions.	commitments and challenges in caring for the elderly.
Sockalingam 2008	Following the dog therapy and while receiving antidepressants and mood stabiliser, the patient showed improved mood, outlook on life and spontaneous speech. Anxiety levels and psychomotor agitation were reduced and his quality of sleep and concentration levels had improved. He also benefited from the physical exercise walking the dog and reported improvements to social interaction, as the dog helped him engage with others. By taking responsibility for the dog, he derived higher confidence and motivation allowing to perform daily tasks more independently.	The therapy dog became a valued companion and social facilitator and helped improve the patient's functioning and well-being. Animal-assisted therapy can augment traditional treatments in clinical settings.
Stasi 2004	No significant differences in CIRS, ADL, IADL, MMSE, nutritional status before or after treatment were found between or within both groups. Although depressive symptoms improved in the pet therapy group, these were not statistically significant. Mean systolic blood pressure in the pet therapy group was reduced following intervention (From 151.4, SD=23.6 to 121.4, SD=16.0, $p<0.01$).	Introducing animals to care settings can improve patients' depressive symptoms and significantly reduce their blood pressure.
Turner 2007	Seven themes were identified: 1) Patience; 2) Parenting Skills; 3) Helping Others; 4) Increased Self-Esteem; 5) Social Skills; 6) Normalizing Effect; 7) Calming Effect on the Environment.	The findings suggested the animals had a beneficial effect on offender rehabilitation. Improvements in self-esteem and prosocial views were suggested by the authors to be the most important improvements.
Walsh 1994	Following intervention, a significant increase on the Coopersmith self-esteem inventory was found ($t(7)=1.27$, $p=0.05$) as well as a significant reduction on the IPAT depression scale (tD?(7)=2.93, $p=0.02$). All participants appreciated their involvement in the programme and reported that it provided them with a useful and physically engaging work task away from the main prison population.	The training of animals by women prisoners can improve their self-esteem and reduce levels of depression.
Winkler 1989	Although half of the residents had concerns about introducing a dog before the programme, when questioned again 22 weeks after its arrival, their concerns subsided. While just over half of the residents responded that they liked the dog, one third felt that the dog disliked them. Overall, 13 of the 20 residents saw the dog as beneficial to others. In contrast, 17 of the 18 staff members believed that the dog had made a difference to residents and 15 reported that they themselves had benefited from its presence. 6 weeks after the dog's arrival, residents' solitary behaviours decreased by 9% but returned to original levels after 22 weeks. Likewise, relative frequency of dyadic or group behaviours increased in the initial 6 weeks period (1.9% and 7,3% respectively) but had also dropped again towards the end of observation.	The introduction of the dog to the nursing unit was viewed favourably by both residents and staff, although staff were more likely to report benefits. Despite being a catalyst to social interaction and increasing the frequency of group activities, behavioural changes were not permanent.
Zisselman 1996	No significant changes in Multidimensional Observation Scale for Eldery Subjects (MOSES) subscale scores were found within or between the intervention and control group. However, those receiving	Although no significant treatment difference between pet therapy and

Authors, year	Key findings	Conclusions
	the pet therapy were less likely to show irritable behaviour after the intervention ($p < 0.07$) but ANOVA tests found no relationship between experimental or control group membership and change in irritability score ($F = 0.10$, $P < 0.76$).	exercise was found, improvement in irritable behaviour scores following dog therapy came close to statistical significance, warranting more research.

Supplementary Table S9. Study design, methods, and intervention details (Care farming)

Authors, year	Design	Methods	Intervention details
Care farming			
Berget 2007	Observational study with before-after questionnaires	Video-recorded observations of behaviours with animals, classified as: Physical contact; communication; moving the animals; feeding; go/stand/run; cleaning; milking; receiving instructions; various; threatening behaviour from animals. Five psychiatric instruments were used: STAI; Beck Depression Inventory; General Self-Efficacy; Coping Strategies Scale of the Pressure Management Indicator; Quality of Life Scale (Norwegian). Differences in means were analysed by matched paired t-tests, and correlations between psychiatric instrument scores and behaviours were examined.	Privately owned farms including dairy farms (n=10), meat production (n=2), sheep farms (n=2) or horses (n=1). Participants visited the farms for 3 hours, twice a week, over 12 weeks to assist with farming activities.
Elings 2008	Qualitative, thematic analysis	Eight focus groups on different care farms, involving a total of 42 participants. Topic guide used to structure discussions, thematic analysis.	Various types of care farms in the Netherlands.
Ellingsen-Dalskau 2015	Qualitative, hermeneutic phenomenology	Semi-structured interviews (N=10, 26 to 65 minutes) with people who were out of paid work, and had been working on care farms for >1 month. Self-determination theory was used in the analysis. Transcribed interviews were stored on Nvivo and analysed using	'Green work' pre-vocational training provided by the Norwegian Labour and Welfare Administration. Commercial farming activities designed to support mental health.

Authors, year	Design	Methods	Intervention details
		Giorgi's method of systematic text condensation.	
Hassink 2010	Qualitative, thematic analysis	Semi-structured interviews with care farmers, other farm workers, and clients. Thematic analysis and comparison of themes between the above groups.	Care farms supporting people with mental illness (n=12); youth (n=11) and frail elderly people (n=10). The farms offered a variety of day care or 24 hour programmes,
Hine 2008	Survey of UK care farm facilities and before-after study of seven care farms	The survey was designed to elicit characteristics of care farms in the UK. A mixed-method, before-after study of care farm clients was also undertaken, comparing before-after scores on mood disturbance and self-esteem (RSE). Qualitative data was collected on what participants enjoyed the most about the care farms.	7 care farms around the UK, with various farming activities for people recovering from drug use, ex-offenders, unemployed, homeless, or recovering from illness.
Iancu 2014	Qualitative, thematic analysis	Semi-structured interviews with care farm users recruited through purposive, maximum variation sampling. Interview guide covered reasons for attending, changes they hoped to achieve, and experiences with the services. Transcripts were entered in ATLAS.ti software and subject to open coding, axial coding, and selective coding.	13 care farms in two provinces in the Netherlands. One was owned by a mental health organisation, the remaining 12 were privately owned. The main activities were agricultural production (n=9), training and preparation for the labour market (n=2), and daytime activities for supported housing residents (n=1). The comparator intervention was 6 day centres offering a range of work and creative projects.
Pedersen 2012	Qualitative case study	Semi-structured interviews (N=8) Thematic analysis	Over a 12 week period, participants engaged in a range of activities on the dairy farm twice a week in close contact with the farm animals, including grooming, mucking, feeding, taking care of the calves and milking.
Pedersen 2011	Pretest-posttest	Video recordings Questionnaires: Beck Depression Inventory (BDI-IA), State-Trait Anxiety Inventory-State Subscale (STAI-SS), Generalized Self-Efficacy Scale (GSE)	Over a 12 week period, participants worked at dairy farms in close contact with the farm animals in sessions lasting between 1.5 and 3 hours twice a week. Activities included fetching feed, cleaning, milking, feeding and talking to animals and farmers.

Supplementary Table S10. Key findings and conclusions (Care farming).

Authors, year	Key findings	Conclusions
Care farming		
Berget 2007	Analysis of video recordings of participants' work intensity and exactness when working with animals both increased by the end of the intervention (both, p<.0001). Work intensity correlated with increased self-efficacy (r-0.82, p<.01) and decreased anxiety (r-0.7, p<.05)	Occupational therapy with farm animals may be beneficial to some people with psychiatric disorders.
Elings 2008	Participants appreciated their stay on the farm in terms of social contact, freedom/ space, and the experience of useful activities. The daily routine of the care farm gave participants a 'rhythm', and helped them stay away from areas where they were tempted by drugs and alcohol. However, they still had difficulties formulating longer-term occupational plans.	Care farms are valued by people with psychiatric illness and drug and alcohol problems; however, they have limited effect in helping longer-term occupational change.
Ellingsen-Dalskau 2015	Five themes were derived: 1. Structure and flexibility; 2. Understanding and acknowledgment; 3. Guidance and positive feedback; 4. Nature and animals; and 5. Reflections on personal functioning and the future.	The daily routines of the care farm, and engagement with nature, can promote autonomy and support people's transition back into work.
Hassink 2010	Participants across a range of care farm types valued: The sense of community on the farms; the attitude of the farmers (being treated as equals and as 'normal' people); being able to challenge their capabilities; the quietness; and the distance from everyday life.	The components of the green farm leading to therapeutic benefits are reiterated. Care farms focus on the empowerment of clients.
Iancu 2014	The transition from past to current lives, and the recovery process, was described by examining life before the care farm (occupational disruption, isolation, lack of activiites, preoccupation with disorder, disorganised lives), goals (occupational functioning, participation, interpersonal functioning, managing one's symptoms, being in nature), and life after the care farm (a nonlinear process of finding internal motivation, and undertaking social roles).	Care farms are a viable way to help pepe with mental health difficulties to find meaning and become accepted in a community of peers.
Pedersen 2012	All participants described the farming experience as positive, and 3 even described it as turning point in their recovery. 4 major themes emerged in the interviews with several subthemes: 1) Ordinary life (Intervention provided sense of normal working life), 1.1) Ordinary work (Experience of work setting and routine), 1.2) Being appreciated (Feeling appreciated by animals and farmers), 1.3) Being a colleague (Feeling included and respected by co-workers), 2) Being sick (Recognition of needs and distraction), 2.1) Considerate relations (Close and open relationship with farmers), 2.2) Closeness, warmth and calmness (Physical contact with animals), 2.3) Forget my difficulties (Distraction from illness and pain), 2.4) Kept me going (Improved resilience and coping), 3) Flexibility (Adjustments of work according to needs), 4) Coping (Sense of accomplishment, independence and new skills),	Flexibility around work activities and attention to individual needs were central to successful mental health rehabilitation at the care farm. Participants particularly appreciated contact with farm animals and working in a stress-free environment can give a sense of ordinary life and improve mental wellbeing.
Pedersen 2011	Compared to the start of the intervention, participants spent more time working with the animals in the final 2 weeks (work total of 67.4%, SE=7.32 in early phase and 75.1%, SE=6.22 in late phase), while inactivity (15.5%, SE=4.88 in early phase and 11.9%, SE=3.72) and dialog with farmer (29.1%,	Performing challenging and complex work tasks at the dairy farm can result in a decline in depression, and state-anxiety

Authors, year	Key findings	Conclusions
	SE=6.2 in early phase and 19.0%, SE=2.73 in late phase) decreased. Depression scores on the BDI-IA scale decreased from 25.9 (SE=2.8) at the start of intervention to 19.1 (SE=3.9) at the end, while anxiety levels also decreased by 5.7 points and generalized self-efficacy scores were improved from 22.3 (SE=1.6) to 25.6 (SE=2.1). There were significant negative correlations between anxiety and milking procedures (r = –0.62, p = 0.02) and moving animals (r = –0.58, p = 0.03). Pure animal contact however was positively correlated with depression levels, although not quite statistically significant (r = 0.50, p = 0.07).	symptoms, whereas work-unrelated animal contact and beginners' activities did not result in the same benefits. Close contact and dialogue with the farmers can also improve anxiety and depression and help participants develop new skills.

BDI, Beck Depression Inventory; BSI, Brief Symptom Inventory; CMAI, Cohen-Mansfield Agitation Inventory

Supplementary Table S11. Study design, methods, and intervention details (Virtual reality-based)

Authors, year	Design	Methods	Intervention details
Virtual reality-based			
Alvarsson 2010	Pretest-posttest	Skin conductance level (SCL) was used to index sympathetic activation, and high frequency heart rate variability (HF HRV) was used to index parasympathetic activation.	After an arithmetic stress test, participants were exposed to one of 4 noises: 1) Nature sound, 2) High noise, 3) Low noise, 4) Ambient noise
Annerstedt 2013	Experimental, lab-based study	Comparison of two VR-based natural environments (with or without natural sounds) and one control condition. Stress-related outcomes (cortisol, heart rate, T-wave amplitude, heart rate variability) compared with ANOVA	Virtual reality environment including trees in a forest surrounding a path leading to a stream of water, reminiscent of a natural setting in Scandinavia
de Kort 2006	Pretest-posttest	Measurement of self-reported affect and presence using the ITC-Sense of Presence	Participants were seated in the lab room, completed the stress test (MPATest) and were then shown a nature-based

Authors, year	Design	Methods	Intervention details
		Questionnaire and heart period and skin conductance level	film for 10mins on either a large 72" screen (high immersion) or small 31" screen (low immersion).

Supplementary Table S12. Key findings and conclusions (Virtual reality-based).

Authors, year	Key findings	Conclusions
Care farming		
Alvarsson 2010	Participants perceived nature sounds as more pleasant than the noises and recovery of skin conductance level (SCL) was faster during exposure to the nature sound than to the three noise conditions. Pairwise comparisons (t-tests) showed that mean SCL was lower for Nature than High noise ($p = 0.045$); however, the differences between Nature and the other two noise conditions did not reach significance ($p > 0.05$). Average Heart rate variability (HRV) values were not higher for nature sound than for the other sounds, and HF HRV for the high noise was not substantially lower than for the other sounds.	Nature sounds may enable faster recovery of the sympathetic nervous system compared to less pleasant noise of lower, similar, or higher sound pressure level.
Annerstedt 2013	ANOVA results showed a main effect of condition (control, VR forest – sound; VR forest + sound) on stress as measured by cortisol ($F(2.54) = 53.22$, $p<.001$)	Stress recovery can be facilitated by the addition of sounds of nature to a virtual green environment in a lab setting
de Kort 2006	Both physiological measurements showed that immersion enhances restorative effects of a virtual natural environment. No significant differences in recovery of affect appeared between the two immersion conditions. An interaction was found between screen size and restorative phase on heart period and skin conductance level, indicating stronger restoration for the immersive screen condition over time.	Immersion enhances restorative potential of a mediated natural environment.

Appendix 1. Search history

DATABASE	KEYWORDS	HITS
CINAHL	Limiters: English Language, Academic journals (well?being or "quality of life" or mental health or anxiety or stress or depression or proms) OR ("social skills" or social development or social interaction or sociab*) OR ("group activit*" or employab* or recidivism) OR horticult* OR "Therapeutic landscap*" OR ecotherapy OR "natural environment" OR "green W3 environment" OR "Conservation* activit*" OR Litter OR Garden* OR "Green care" OR Plant* OR Forest* OR "Green gym" OR Nature?assisted OR nature?based OR "green environment" OR "green space" OR parks OR outdoor OR biophilia OR Animal?assisted OR "pet therapy" OR "prison?based animal" OR pet?facilitated OR "care farm*" OR Livestock OR Wildlife AND (well?being or "quality of life" or mental health or anxiety or stress or depression or proms) OR ("social skills" or social development or social interaction or sociab*) OR ("group activit*" or employab* or recidivism) AND Prison* OR inmates OR incarcer* OR offend* OR (correction* or penal or detention* or penitentiary or jail or parole) OR ("community service" or rehab* or referral) OR school* OR (university or college or campus) OR (pupils or students or children) OR institution* OR hospital OR patient	**377**
Medline (via CINAHL)	Limiters: English Language, Academic journals, Subject Headings Narrow by SubjectMajor: - occupational health services Narrow by SubjectMajor: - mental health services Narrow by SubjectMajor: - environment Narrow by SubjectMajor: - dementia Narrow by SubjectMajor: - cognition disorders Narrow by SubjectMajor: - community mental health services Narrow by SubjectMajor: - stress, physiological Narrow by SubjectMajor: - substance-related disorders Narrow by SubjectMajor: - employment Narrow by SubjectMajor: - pain Narrow by SubjectMajor: - stroke rehabilitation Narrow by SubjectMajor: - stress, psychological	**842**

	Narrow by SubjectMajor: - health promotion Narrow by SubjectMajor: - depression Narrow by SubjectMajor: - phytotherapy Narrow by SubjectMajor: - disabled persons Narrow by SubjectMajor: - activities of daily living Narrow by SubjectMajor: - conservation of natural resources Narrow by SubjectMajor: - walking Narrow by SubjectMajor: - occupational diseases Narrow by SubjectMajor: - mental disorders Narrow by SubjectMajor: - quality of life (well?being or "quality of life" or mental health or anxiety or stress or depression or proms) OR ("social skills" or social development or social interaction or sociab*) OR ("group activit*" or employab* or recidivism) OR horticult* OR "Therapeutic landscap*" OR ecotherapy OR "natural environment" OR "green W3 environment" OR "Conservation* activit*" OR Litter OR Garden* OR "Green care" OR Plant* OR Forest* OR "Green gym" OR Nature?assisted OR nature?based OR "green environment" OR "green space" OR parks OR outdoor OR biophilia OR Animal?assisted OR "pet therapy" OR "prison?based animal" OR pet?facilitated OR "care farm*" OR Livestock OR Wildlife AND (well?being or "quality of life" or mental health or anxiety or stress or depression or proms) OR ("social skills" or social development or social interaction or sociab*) OR ("group activit*" or employab* or recidivism) AND Prison* OR inmates OR incarcer* OR offend* OR (correction* or penal or detention* or penitentiary or jail or parole) OR ("community service" or rehab* or referral) OR school* OR (university or college or campus) OR (pupils or students or children) OR institution* OR hospital OR patient	

Criminal Justice Abstracts	Limiters: English Language ((Prison* OR hospital OR institution* OR inmates OR incarcer* OR offend* OR (correction* OR penal OR detention* OR penitentiary OR jail OR parole) OR ("community service" OR rehab* OR referral)) AND ((horticult* OR ("Therapeutic landscap*" OR ecotherapy OR "natural environment" OR "green W3 environment" OR "Conservation* activit*" OR Litter) OR (Garden* OR "Green care" OR Plant* OR Forest* OR "Green gym") OR (Nature?assisted OR nature?based OR "green environment" OR "green space" OR parks OR outdoor OR biophilia) OR (Animal?assisted OR "pet therapy" OR "prison?based animal" OR pet?facilitated OR "care farm*" OR Livestock OR Wildlife)) AND (Prison* OR hospital OR institution* OR inmates OR incarcer* OR offend* OR (correction* OR penal or detention* or penitentiary or jail or parole) OR (“community service” or rehab* or referral) AND (well?being or "quality of life" or mental health or anxiety or stress or depression or proms) OR ("social skills" or social development or social interaction or sociab*) OR ("group activit*" or employab* or recidivism)	**686**
PsycINFO	((horticult* OR "therapeutic landscap*" OR ecotherapy OR "natural environment" OR "green care" OR garden* OR "green gym" OR Nature?assisted OR nature?based OR "green environment" OR "green space" OR biophilia OR Animal?assisted OR "prison?based animal" OR "pet therapy" OR pet?facilitated OR wildlife OR livestock) AND peer(yes)) AND ((Prison* OR institution* OR inmates OR incarcer* OR offend* OR correction* OR penal OR detention* OR penitentiary OR jail OR parole OR "community service" OR rehab* OR referral) AND peer(yes))	**426**

SCOPUS	(TITLE-ABS-KEY ((well?being OR "quality of life" OR mental AND health OR anxiety OR stress OR depression OR proms) OR ("social skills" OR social AND development OR social AND interaction OR sociab*) OR ("group activit*" OR employab* OR recidivism))) AND ((TITLE-ABS-KEY (prison* OR hospital OR institution* OR inmates OR incarcer* OR offend* OR (correction* OR penal OR detention* OR penitentiary OR jail OR parole) OR ("community service" OR rehab* OR referral))) AND ((TITLE-ABS-KEY (horticult*) OR TITLE-ABS-KEY ("Therapeutic landscap*" OR ecotherapy OR "natural environment" OR "green environment" OR "Conservation* activit*" OR litter) OR TITLE-ABS-KEY (garden* OR "Green care" OR plant* OR forest* OR "Green gym") OR TITLE-ABS-KEY (nature?assisted OR nature?based OR "green environment" OR "green space" OR parks OR outdoor OR biophilia) OR TITLE-ABS-KEY (animal?assisted OR "pet therapy" OR "prison?based animal" OR pet?facilitated OR "care farm*" OR livestock OR wildlife)))) AND (LIMIT-TO (DOCTYPE , "ar"))	**1043**
Social Care Online	AllFields:'horticult* or "therapeutic landscap*" or ecotherapy or "natural environment" or "green care" or garden* or "green gym" or nature-assisted or nature-based or "green environment" or "green space" or biophilia or animal-assisted or "prison-based animal" or "pet therapy" or pet-facilitated or wildlife or livestock' - AND AllFields:'prison* or institution* or inmates or incarcer* or offend* or correction* or penal or detention* or penitentiary or jail or parole or "community service" or rehab* or referral']	**177**

Cochrane CENTRAL	'horticult* OR "therapeutic landscap*" OR ecotherapy OR "natural environment" OR "green care" OR garden* OR "green gym" OR Nature?assisted OR nature?based OR "green environment" OR "green space" OR biophilia OR Animal?assisted OR "prison?based animal" OR "pet therapy" OR pet?facilitated OR wildlife OR livestock in Title, Abstract, Keywords and Prison* OR institution* OR inmates OR incarcer* OR offend* OR correction* or penal or detention* or penitentiary or jail or parole OR "community service" or rehab* or referral in Title, Abstract, Keywords and well?being or "quality of life" or mental health or anxiety or stress or depression or proms OR "social skills" or "social development" or "social interaction" or sociab* OR "group activit*" or employab* or recidivism in Title, Abstract, Keywords in Trials'	**89**
	Total	**3640**
	Duplicates removed (Endnote/Covidence)	**304**
	Covidence import for screening at Title/Abstract	**3336**

Other reviews

DATABASE	KEYWORDS	HITS

Cochrane Library	'horticult* OR "therapeutic landscap*" OR ecotherapy OR "natural environment" OR "green care" OR garden* OR "green gym" OR Nature?assisted OR nature?based OR "green environment" OR "green space" OR biophilia OR Animal?assisted OR "prison?based animal" OR "pet therapy" OR pet?facilitated in Title, Abstract, Keywords	**507** **Of which:** **96 Cochrane reviews (2 relevant)** **311 other reviews (9 relevant)**
Manual searches	Reference lists, internet searchers	**5**

Manual searches

SOURCE	HITS
Reference lists (n=69)	**21**