Horticultural therapy: the ‘healing garden’
and gardening in rehabilitation measures
at Danderyd Hospital Rehabilitation
Clinic, Sweden

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Accepted for publication: 15 January 2004

Keywords Garden, gardening, healing, neurological diseases, occupational therapy

Summary

Objectives: Objectives were to review the literature on horticultural therapy and describe the Danderyd Hospital Horticultural Therapy Garden and its associated horticultural therapy programme.

Design: The literature review is based on the search words ‘gardening’, ‘healing garden’ and ‘horticultural therapy’. The description is based on the second author’s personal knowledge and popular-scientific articles initiated by her. The material has been integrated with acknowledged occupational therapy literature.

Setting: The setting was the Danderyd Hospital Rehabilitation Clinic, Sweden, Horticultural Therapy Garden.

Participants: Forty-six patients with brain damage participated in group horticultural therapy.

Results: Horticulture therapy included the following forms: imagining nature, viewing nature, visiting a hospital healing garden and, most important, actual gardening. It was expected to influence healing, alleviate stress, increase well-being and promote participation in social life and re-employment for people with mental or physical illness. The Horticultural Therapy Garden was described regarding the design of the outdoor environment, adaptations of garden tools, cultivation methods and plant material. This therapy programme for mediating mental healing, recreation, social interaction, sensory stimulation, cognitive re-organization and training of sensory motor function is outlined and pre-vocational skills and the teaching of ergonomic body positions are assessed.

Conclusion: This study gives a broad historic survey and a systematic description of horticultural therapy with emphasis on its use in rehabilitation following brain damage. Horticulture therapy mediates emotional, cognitive and/or sensory motor functional improvement, increased social participation, health, well-being and life satisfaction. However, the effectiveness, especially of the interacting and acting forms, needs investigation.

Introduction

The value of horticulture therapy is witnessed by the fact that, for their very survival, humans have sought aspects of nature such as open views, closeness to water and a place of refuge over the past 40 000 years at least. Horticultural therapy includes interventions mediated by nature-oriented views and spaces such as gardens and everything associated with them, the plants and material related to them, garden tools and garden occupations performed among disabled people [1–3] for healing and for restoring or improving health and well-being or for rehabilitation or simply for general benefit.

The benefits of using horticulture therapy are that (a) patients may be able to continue the occupations at home using adaptations learned during therapy sessions at a hospital; and (b) such therapeutic sessions are
describe hospital therapeutic (healing) garden design

A hospital healing garden or therapeutic garden is a nature-oriented space, indoors or outdoors, with a therapeutic or rehabilitative potential [4]. It is a place of sanctuary where the basic urge for contact with nature can be met [5]. A healing garden seeks to provide maximum influence on health. It should be designed with a plentiful variety of plant materials that flower in different seasons, attract birds and butterflies, with leaves or grass that move with a light breeze, pools that reflect the sky and provide a home for fish. Sculptures and other designs should be unambiguously positive. The design should facilitate visibility (the garden should invite one to visit it), security and physical comfort. The garden should be open to all and give a sense of familiarity. It should be calm and quiet so that its voices (water-splash, birdsong) can be heard [6]. Optimally designed, the gardens facilitate non-discrimination of the participants’ age, genus, class, previous occupation, cultural heritage or ethnicity. In addition, at its best, the gardening facilitates social interaction in terms of previous experience of gardens and gardening or of disablement. This may provide a common subject for discussion and may help participants to find new friends.

A further justification for healing gardens is that the quality of a hospital’s physical environment affects patients’ medical outcomes and care quality [7]. In the USA, for example, paediatric and long-stay hospitals are expected to have access to grounds, parks and playgrounds and adjacent countryside [6, 8].

A healing hospital garden involves patients, friends, relatives and staff participating in, for example, planning plant-beds, sowing, tending and watering the plants, harvesting, communicating, etc.

The literature shows that therapeutic gardening has been used for (a) changing mood positively [e.g., 6, 9], (b) influencing health and well-being by viewing photographs, slides, videos of outdoor nature and garden scenes [e.g., 10, 11] and (c) reaching solace or relief by envisaging natural scenes of grass, trees, water, sky, rocks, flowers, and so on [7, 12, 13].

The general objective of this study was to examine the rarely-documented descriptions of how gardening mediates health, well-being and function among people suffering from neurological [14–17] or musculoskeletal diseases.

More specific aims were (a) to briefly review historic aspects of horticultural therapy and its use among disabled people for care or rehabilitation and (b) to describe hospital therapeutic (healing) garden design and to summarize experience of its use and of gardening among patients with neurological and/or musculoskeletal diseases from 1983 to the present, with emphasis on horticultural therapy at Danderyd Hospital Rehabilitation Clinic.

Method

For the review part of this study, literature searches were performed in the Allied and Complimentary Medicine (AMED) [18] database, the Cumulative Index to Nursing & Allied Health Literature® (CINHAL) [19] database, in MEDLINE [20] and among Internet information from the American Horticulture Therapy Association [21] and the ‘Lucas’ library of the Swedish Agricultural University, Alnarp [22]. The search words ‘gardening’, ‘healing garden’ and ‘horticulture therapy’ were used. The CINAHL search resulted in 87 hits for ‘gardening’. These hits were restarted by the search words ‘gardening or horticulture’, resulting in 21 hits. A primary selection suitng the present study subject from the two searches gave 39 articles. The MEDLINE search added one relevant hit, while the AMED search gave 324 hits for ‘gardening’. The searches were then restricted to publications after 1990, giving an additional 20 Hits. Only five more publications were found, most information overlapping with the CINAHL database. The search in the American Horticulture Therapy Association gave 52 hits, of which 15 were judged to suit the present subject. Four hits were added from the ‘Lucas’ search. The articles finally used are marked in the reference list with an *. The references from selected literature judged as most important were further scrutinized, forming a selection of the most cited literature and authors.

The description of the Danderyd Hospital Rehabilitation Clinic horticultural therapy measures is based mainly on the second author’s (MS) clinical experience as initiator of horticultural therapy in rehabilitation in Sweden. Her oral information was supplemented by popular-scientific publications in Swedish [23–28], originating from her instructs, plus candidate’s theses [e.g., 29] and master’s theses [e.g., 30] published between 1989–2000. A short version of the present report was presented during the Brain Injury Conference in Stockholm, Sweden, in May 2003 and an abstract was published [31].

Retrospective data from the medical records of the Danderyd Hospital Rehabilitation Clinic were used to describe the horticultural therapy gardening groups.
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Results

LITERATURE REVIEW

The origins of the healing garden and gardening

The use of the natural environment has varied through the centuries and reflected each culture’s beliefs and values. Nature, the green landscape, sunlight and fresh air were from the latter 17th century until the middle of the 20th century an essential component of the healing process in various hospital settings, such as sanatorium parks [6, 32, 33].

Mental-hospital aspects of the healing garden and gardening

Starting with the idea that visiting nature and gardens for sitting, working and talking about the world beneficially influences people’s health, gardening was a prescribed intervention in mental hospitals from the early 20th century [24, 33]. The notion originated from the Moral Treatment Movement [34]. Patients with mental illness were scheduled to perform occupations such as sewing, weaving and woodwork. Being occupied was supposed to promote patients’ establishment of concepts of time, work and cultural value. Moreover, such occupation was expected to control inactivity and anxiety [34]. The American psychiatrist and neurobiologist Adolf Mayer stated that ‘man learns to organize time and he does it in terms of doing things’ [34, 35]. Performance of these occupations resulted in mental hospitals becoming self-sufficient communities.

As the concept of humanism permeated to German psychiatric care in the 1920s, this idea of supplying patients with occupation spread over the industrial world. On the premises of mental hospitals, large parks and vegetable and flower gardens were created and maintained by the patients, gardening being performed by the patients with a disturbed sense of time and reality. The patients did necessary daily garden work such as digging, sowing, weeding, harvesting, etc. There existed the empirical experience that garden work helped patients to feel the rhythm of each day and understand how the garden and gardening shifted during the seasons. This idea was adopted in Swedish mental hospitals during the 1940s [32].

The notion that the mentally-ill could become organized by doing gardening was more or less abandoned between 1960–1980. A closeness to nature was lost and participation in the natural cycle and absolute human dependence on nature was obscured. Further, as psychopharmacology entered mental hospitals, therapeutic effects on patients were achieved without outdoor activities. Patient labour was no longer considered necessary or desirable. Food was prepared in large central kitchens, so that patients no longer participated in the handling of natural raw ingredients from the garden. Finally, the institutional mental hospital settings were dismantled. The beautiful hospital parks and gardens became mostly a memory, although some parks still exist to provide recreation [32].

However, the idea that environmental design affects medical outcomes has been regaining popularity, since the 1960s [7, 36].

Rehabilitative aspects of the healing garden and gardening

In the 1950s, after the two World Wars, the return home of mentally and physically wounded soldiers increased the demand for rehabilitation. A more active form of medical rehabilitation started to evolve. Rehabilitative centres began to use elements of nature as therapy in physical, occupational and speech programmes [32]. The therapeutic value of gardening and its place in a rehabilitation plan were described in 1957 [37, ibid. 38].

In England in the mid-1960s, hospital gardens were created for teaching purposes and were used by organizations for advisory services, and for demonstrating the adaptation of gardening tools [39] and how a good garden design should be accessible to people with disabilities [40]. Interestingly, these services can nowadays be incorporated in an interactive multimedia learning environment, e.g. using the ‘Greenhat Design Guidelines’ which seek to mediate social interaction and employment-related skills [41].

The hospital gardens in Oxford and Northwood, Middlesex, were designed for research into the feasibility of using gardening for rehabilitation for ambulant, but crutch-dependent, patients or wheelchair users [40].

The therapeutic garden at Mary Marlborough Lodge, England was used by 5–12 year-old disabled children who were wheelchair users or born with congenital upper-limb malformations. The garden was initially intended for relaxation therapy, but soon became a very suitable hobby area for these children and used for training in the use of their prostheses [42].

In the 1970s, in England, the view that gardening mediates rehabilitative intervention was expanded for use among patients with rheumatoid arthritis for example or following hand surgery. Particularly for patients with hemiplegia, garden tools were adapted for use with one hand [17]. Gardening was expanded...
to indoor activities and a choice of suitable plants was described [43]. During the 1971 Chelsea Flower Show, the garden accessible for handicapped people was a prominent theme [32]. In 1973, in the USA, horticulture was an accepted part of rehabilitation through the National Council for Therapy and Rehabilitation [38].

Studies during the 1970s seem mainly to describe the garden design to facilitate patients’ increasing participation in gardening and maintenance of interest in the activity. However, gardening was now not only a practicable occupation, but also related to therapy. The therapeutic use of gardening was expanded to embrace an activity in which patients could engage [44] and a form of relaxation therapy. Kaplan [ibid. 38, 45], in 1972, made a scientific psychological analysis of the benefits of participating in gardening. The experience of plants growing gave the participant satisfaction and maintained interest in gardening. The analysis was based on the statement that ‘humans need a comfortable and stimulating environment to visit’ [38, 45]. Moreover, gardening was adopted in nursing homes for geriatric patients with decrepitude. In 1979, one of the first more regular scientific evaluations of horticultural therapy was conducted. This was a direct-observation (n = 29 experimental group), experimental evaluation study of non-engagement or engagement in indoor gardening among 32 physically impaired residents of a nursing home, with a mean age of 81 years. The study outcomes were engagement accounted for in terms of performing daily living activities or using recreational material or getting around or interacting with other residents. Those residents who participated in weekly gardening sessions were engaged more than 90% of the observed time, while non-participating residents were engaged less than 40% of the observed time. It might be concluded that doing gardening overflowed into social and occupational engagement in daily activities among older residents [44].

In the 1980s, the value of gardening as therapy was expanded to include programmes for re-employment among people with disabilities. Relf [ibid. 38, 46, 47] emphasized ‘the potential benefits in self-concept, social interaction, work habits, academic-skill development, and physical abilities among handicapped individuals’ who participated in a horticultural pre- or vocational training programme. In the same spirit, the purposes of gardening were discussed for use in occupational therapy. Here, gardening was advocated as a tool for observing and assessing the patients’ employment abilities. The people were asked to do garden tasks that required physical activity such as climbing steps, slopes, walking or otherwise transporting themselves on various surfaces, bending, lifting and carrying and handling garden material. The therapeutic approach to using gardening was also suggested for functional motor improvement of limbs. Finally, gardening was a rehabilitation-supported activity for patients with disabilities seeking new recreational hobbies after discharge or a way of enabling them to achieve greater self sufficiency [48]. The first Swedish healing garden was created at Danderyd Hospital Rehabilitation Clinic.

The term horticultural therapy became common in the health sciences during the 1980s and all forms of activity connected with nature, e.g. viewing photos with natural scenes [12] or visiting (healing) gardens, were included in the therapy sessions. The philosophy was based on the evolutionary belief that human survival and ability to thrive and gain fulfilment depend upon one’s relationship with nature. This—the biophilia framework—created by the biologist E. O. Wilson [49] mentions ‘the innately emotional affiliation of human beings to other living organisms’ [ibid. 50]. Several scientists have adopted the biophilia theory for demonstrating human [51] interaction with the environment.

As one example, physiological reactions to the creative and less creative environment were studied for 6 months among elderly people in a service home. The experimental group studied gardening during the winter and practiced it during summer. Coping and signs of self-esteem improved significantly among the experimental group [10, 11].

Another example was people suffering from Alzheimer’s disease who had access to a healing garden designed according to the Environment-Behaviour criteria, that is to give a sense of nature, weather and plants, reducing fear and promoting security. The residents enjoyed being outdoors and a relaxing effect on health and well-being was observed in terms of decreased anxiety and aggression [9]. The outcome of horticulture as a recreation appeared to have beneficial effects on wellbeing [12, 52].

The use of horticultural therapy for children with various impairments was extensively described in the 1980s. The therapy was used in a transitional employment programme for adolescents with developmental disabilities [1] or for children with exceptional [53], cerebral-palsy [54] or behavioural disorders [55]. A therapeutic gardening programme for children hospitalized with behavioural disorder emphasized both a discussion group and an active performing group. Obese children did gardening (cultivating, planting, maintenance and harvesting) for 30–45 minutes per day during a summer with the aim of increasing their
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physical activity [56]. The pre-school children’s involvement in plant-stimulated discovery activities [57, 58] was considered. Williams and Mattson [59] showed, during a 5-month study, that children participating in a professionally supervised gardening programme increased their self-esteem and horticultural knowledge and that the garden looked better than that tended by unsupervised participants.

In the 1990s, the trend was [60, 61] to bring nature back into urban environments. Landscape architects promoted the building of parks and public gardens, lined streets with trees and created indoor environments using plants, flowers and water effects [62]. Aesthetic hospital environments were promoted [63]. The purposes were to facilitate life in a healthy and recreational environment, helping people to recover from unhealthy stress [64]. Thus, the research focused on the interaction between the natural environment and human health [5, 36]. The meaning that green areas and urban parks connected to institutions and playgrounds has for children and adults was observed. People with access to this kind of facility spent more time outdoors, increased their concentration and slept better than those without this possibility [65, 66].

Theoretical explanations of why people in a nature environment experience relief of stress release and healing were further developed, enriched, debated and tested during the 1990s. Relf [67] states that the positive emotional effect of participation in nature or a nature-related environment was explained by several underpinning theories, as follows:

(a) Kaplan’s [68] ‘evolutionary theory’ states that: ‘visual patterns of the natural environment are easiest to interpret because a human uses his involuntary attention’. This form of attention is preferable and may release negative stress. This assumption is explained by the brain’s pre-programmed preparedness to sort out different stimuli in a natural environment, where man was originally meant to live. The opposite is directed attention, which occurs when humans are bombarded by information from the urban, artificial, environment which has to be sorted out. This attention requires much energy leading to overloading and negative stress, i.e. easy distraction, difficulties in planning and implementing and to feelings of impatience and irritability [33]. Kaplan’s theory shows that natural environments have a positive influence on the participants’ ability to concentrate.

(b) Ulrich et al.’s [13] ‘psycho-evolutionary theory’ states that: ‘humans have long adapted positively to nature for survival and therefore react with positive emotional physiological responses when in natural or nature-related environments which influence intellect, meaning and behaviour’ (present author’s translation). This theory has been proved acceptable through several studies [12, 13, 52, 69, 70].

(c) According to Relf’s [67] ‘cultural learning theory’, ‘a human adapts to the natural environment where he or she developed, and which led to a preference for familiar trees and flowers’. This statement contributed to the formulation of the theory of ‘the living environment’ [65]. This theory prompted the suggestion that environments should be created to facilitate memories of competence and experience among people with dementia. Noteworthy is the study by Ottosson [16]. He himself suffered from brain damage which caused aphasia (inability to read and write), spatial dysgnosia (difficulties in orientation in the near environment) and lack of control over life. Using an introspective self-study method he investigated the importance of visiting nature, which influenced all his senses, gave him feelings of well-being and helped him to overcome his life-crisis.

Originating with Smith [71], the idea of using horticultural therapy as a stress management programme for emotional relief was transferred to rehabilitation programmes in Sweden for people suffering from burnout [72].

The restorative value of participation in nature was examined with the keywords; (a) being away—from an urban stressful environment to spend time in natural surroundings, (b) extent—the environment absorbs humans mentally and physically and, therefore, the environment visited should include some new things to explore and discover, (c) fascinating—the environment should include stimuli that fascinate the visitor and encourage attention and concentration, and (d) compatibility—the environment meets the individual’s goal [33, 67, 73].

Research also emphasized the design of a healing garden [74–76] and the concept of horticulture therapy was scientifically evaluated according to theory. It has been recommended that the physical design of a healing garden should be according to the ‘theory of supportive health care design’ [69]. This theory stresses the environmental characteristics that support or facilitate coping and restoration following illness and hospitalization.
A supportive health care physical environment should facilitate privacy, promote social support and natural distractions, give opportunities for physical movement and provide involvement with nature. Patients' outcome in terms of health and wellbeing has been proved to be positively influenced if they can see or have access to natural surroundings (trees, flowers and water) or regularly spend time in healing hospital therapeutic gardens [65, 69]. Further research results show a very high likelihood of reduced stress and anxiety, improvement of patient satisfaction, a high likelihood of sleep improvement and a moderate likelihood of pain reduction and infection occurrence [6, 7, 11, 70]. The emotional healing effect of horticultural therapy was further investigated by Barnes [64]. Even a low degree of 'passive' participation in the nature environment may influence emotional restoration [64].

Moreover, horticultural therapy is world-wide [77] in varying health care and hospital settings, for example acute care [4] and hospice care [78], and is being extensively studied among adults with visual disabilities [79], elderly people with diagnosed dementia [80, 81] and people with autism [82] or sensory deficits [83].

From 2000 until the present (2004), the same trends in horticultural therapy continue. How hospital healing (therapeutic) gardens should be designed has been further investigated [7, 70]. Whether or not participants are disabled (e.g. frail elderly people [84] or AIDS sufferers [85]), their perception of experience [86] and meaning [51, 87, 88] in terms of health benefits [89, 90], wellbeing [91], reduced stress [92, 93] or improved quality of life [94] are described. Studies of horticultural therapy for people with neurological diseases are still rare [14–16]. However, Sarno and Chambers [15] have outlined a horticultural therapy programme for individuals with aphasia.

In Sweden, in day nursery homes and primary schools, children with physical disabilities (walking with sticks, wheelchair users, the visually impaired) or mental retardation are integrated with 'normal' children. This raises issues of legitimate claims upon accessible playgrounds and school yards [95]. An outdoor pathway in a wood passing through a whale, a pergola and a dinosaur bridge have been laid out in connection with Bräcke Östergård, a children's hospital in Göteborg, Sweden. Here the children can drive their Permobile™ (electric wheelchairs) themselves because a light-beam sensor under the wheelchair corresponds to a reflector at the edge of the pathway [96].

**THE HEALING HOSPITAL GARDEN AND THE USE OF HORTICULTURAL THERAPY AT DANDERDYD HOSPITAL REHABILITATION CLINIC**

**Background**

Organized by the occupational therapy department of the Rehabilitation Clinic, Danderyd Hospital, the first Swedish Horticulture Therapeutic Garden (DHHTG) was opened in 1986. The DHHTG was designed for patients with physical disabilities, mainly following cognitive and/or musculoskeletal impairments. This garden and its associated activities constituted a supplementary activity among others of daily life and handicraft which mediated the patients' rehabilitation.

**Purposes of the DHHTG**

The purposes of the DHHTG concept were (a) therapeutic; as a meeting point for relaxation, relief and rehabilitation and (b) for training team members in horticultural therapy.

Several requirements for use of the garden were:
- accessible for visiting and gardening apart from disability,
- adaptation of garden tools for use among patients,
- visitors offered a non-demanding, calm and silent natural environment,
- gardening as a leisure activity preserved or encouraged as a new leisure interest with the intention of being continued after discharge,
- gardening mediating occupational therapy, and
- as a centre for education in concept of healing therapeutic garden [25, 28, 97] for, among others, patients and rehabilitation teams in Sweden.

**Design of the DHHTG**

Landscape architect Gustav Alm designed the DHHTG as a result of close team work with the relevant staff of the Danderyd Hospital Rehabilitation Clinic. The DHHTG has been improved over the years in step with increased experience of horticultural therapy. The DHHTG is situated in a north–south orientation between two blocks of Danderyd Hospital. It measures 20 × 30 metres (figure 1).

The garden has extensive access to sunlight and is sheltered from severe winds. The ground is accessible for wheelchair users and for people using walking aids, according to the principles that (a) all differences in levels are avoided or clearly marked and with guardrails, (b) the walkways are paved with concrete slabs.
Figure 1 The Danderyd Hospital Horticultural Therapy Garden (DHHTG). A—H are plant-grounds with various heights; A = ground level, B = variable level 20–75 cm, C = 68 cm, D = 60 cm, E = 40 cm, G = 85 cm, H = 70 cm, I = water pond with a waterfall, J = a garden tool shed, K = 15 m² greenhouse and L = water reservoir.
and are slightly inclined to avoid slippery surfaces, (c) there is enough space between the plant beds to allow two wheelchairs to meet easily.

In one corner of the garden is a long, 108-square-foot tool-shed with a sedum covered roof and two compost bins. The tool-sheds are well stocked with gardening tools and other material. The placing of each tool is marked with symbols, for easy finding and replacement, and at a height reachable by all users. The hooks for hanging the tools on are designed for ease of handling.

Another part of the garden is screened off by a robust, 2 metre-high, 6 metre long trellis, serving as an aid to standing. A 160-square-foot round greenhouse allows cultivation experiments protected from the Nordic climate. A pond and a waterfall heighten the natural impression. Nearby garden furniture invites one to relax, calm down and be sociable. A boule track encourages activity.

The bedding areas and flowerbeds have five different working heights allowing various working positions (e.g. standing up, bending or sitting). The highest bedding areas are tables, which a wheelchair user can drive beneath and round. A wooden bench for sitting and resting and for putting material down on surrounds the larger bedding areas. There is an electric point on the shed wall. Watering is performed from a tap on the shed or from a covered water tank with a tap.

Design of gardening tools for the DHHTG

Ergonomically [98], the DHHTG seeks (a) to use the most ergonomical garden tools for the various elements: digging, cultivating, sowing, planting, watering, raking, loosening or breaking up weeds, trimming or cutting, cutting faded or fresh flowers and vegetables, mowing grass, moving garden material, tools and oneself about, covering new plants [25] and (b) the most appropriate ergonomical body positions.

Most DHHTG garden tools (the plant/beds out, try or tables, mini-garden-house-boxes; watering cans, various types of spade, rake, pitchfork, pruning shears, wheelbarrow, carts or baskets and/or aprons with big pockets for tools and material and for protection gloves) were available on the market. However, the selections were based on principles of occupational-therapy ergonomics [98] and adapted for use among patients with neuromusculoskeletal and movement-related impairments.

The ergonomics included the principles that [24, 28]:
(a) all tools were as light as possible (figure 2a),
(b) tools with separate handles are used to facilitate the adaptation of exchangeable handles. This allows adaptation to the individual patient’s need for purposeful training (figure 2b),
(c) the tool allows optimal biomechanical body positions (e.g. suitable handle lengths for sitting or standing working positions) (figure 2c),
(d) the design permits the lowest possible workload (e.g. less muscle strength is required when both hands and one foot are used for making holes in hard earth and with a curved rake handle) (figure 2d),
(e) the tools useable with a two-hand-grip by people with a weak or paretic arm and hand (figure 2e),
(f) the angle between the tool head, e.g. spade and handle allows optimal work functions—a neutral body position in the forearm when gripping (figure 2f), and
(g) wooden tool-handles designed to suit various grip functions and functional use and in neutral hand positions (figure 2g).

Cultivating in the DHHTG

Different methods and materials are used for cultivating, where possible at different heights and reachable from some distance. Examples are (a) the use of raised cultivation beds, (b) movable mini-hot-houses and hot-beds, (c) square-foot cultivation in frames or (d) cultivation directly in a sack at ground level near the trellis, (e) in a box, (f) in pots arranged in a rotation system or (g) in a hanging pipe or basket [28].

Seeds for the DHHTG

Seeds and plants were chosen to reflect the various therapeutic approaches described in table 1.

Participants in and organization of DHHTG gardening

Participants. The patients, aged 18–65 years, taking part in the Danderyd hospital horticultural therapy rehabilitation suffered from pain- or movement-related impairments (hemiparesis or paraplegia) and/or cognitive (speaking, reading spatial orientation, memory dysfunction, attention, concentration and logical reasoning difficulties) and/or were depressed. Disabilities ranged from major to minor insufficiency. Thus, some patients were wheelchair users, but others had a major memory disability with no movement-related disability. Patients’ families and friends and staff were also welcome to participate.
Organization. The patients gardened as one of several self-chosen activities during the sessions. These were organized in groups whose composition changed at intervals during the term. The organization and participants are shown in table 2. From February to mid-November 2003, 72 patients (23 men) suffering from brain damage (e.g. stroke, haemorrhage, brain trauma), aged 18–65 years, participated in one of three gardening groups. Each patient participated as a group member, but was prescribed individual gardening work: his or her ‘therapeutic tonic’. This individual work was intended to be done at other times than the group meetings.

All the gardening tasks were performed in a neutral way. They were graded from easiest to most difficult. For example, the patient was asked to plan a flowerbed with only one plant species. The degree of difficulty of this activity increased when the same flowerbed was to be planned for year-round flowering with spring tulips, early summer herbs, summer flowers and finally autumn flowers for drying.

Therapeutic use of the DHHTG. As indicated above, the DHHTG gardening concept was used as a tonic. The therapeutic purposes were individualised to one or a combination of (a) mental healing, (b) recreation, (c) social interaction, (d) sensory stimulation, (e) cognitive re-organization, (f) sensorymotor function, (g) assessment of pre-vocational skills and (h) teaching of ergonomical body positions.

The DHHTG as a place for mental healing. It was presumed that time regularly spent in the DHHTG may positively influence visitors’ minds and may cure or alleviate physical illness [99], especially among those with severe brain damage. The DHHTG was a favourable place frequently visited for resting, meditation and relaxing relief; or for meeting family and friends in a non-hospital environment. There are many fragrances in a garden regardless of season, affording topics for conversation and prompting memories. Grass and dew, flowers and berries, these things are...
often connected to events of long ago. For a while these environmental perceptions may help the patients to forget his/her disabilities and concern about the future.

The DHHTG garden and gardening for recreation.

These were used for patients undergoing a transition from working life to a life with decreased opportunities to carry on with previous leisure activities. Gardening was presented as a new leisure activity, available despite present disabilities. Any gardening-associated activity was counted, such as sitting and looking, walking, eating, talking, sunbathing, reading, listen to music, playing games in the garden, which the patients did for pleasure [3, 100]. It was presumed that the patients’ participation in gardening would

Table 1 Examples of the DHHTG seed or plant material, its purposes and main therapeutic usefulness

<table>
<thead>
<tr>
<th>Main therapeutic use</th>
<th>Purposes of the seed or plant material</th>
<th>Examples of seed or plant material used (Latin names)</th>
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<tbody>
<tr>
<td>Mental healing, recreation, cognitive re-organization</td>
<td>Good germinativeness</td>
<td>Calendula officinalis</td>
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<td></td>
<td>Suitable hardness for the climate zone</td>
<td>Tagetes</td>
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<td></td>
<td>Well-known and therefore enables patients to recognize the plants and flowers used for square cultivation</td>
<td>Impatiens walleriania</td>
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<tr>
<td>Cognitive re-organization; memory stimulation</td>
<td>Arouse childhood memories</td>
<td>Tropaeolum perennatum</td>
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<tr>
<td>Mental healing, recreation, social interaction</td>
<td>Beautiful colour</td>
<td>Antirrhinum majus</td>
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<td>Sensory stimulation</td>
<td>Wonderful scent</td>
<td>Raphanus sativus</td>
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<td></td>
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<td>Impatiens hawkeri (red, pink, white, violet)</td>
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<td>Lathrus adoratus</td>
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<td>Heliotropium arborescens</td>
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<td>Nicotiana sylvestris</td>
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<td>Matthiola</td>
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<td>Teaching of ergonomic body positions</td>
<td>Climbing plants and low height placing allows work with different body positions at the same time</td>
<td>Nicotiana sylvestris</td>
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<td>Ipomea tricolor</td>
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<td>Cosmos bipinnatus</td>
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<td>Helianthus annuus</td>
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<td>Anethum gravealen</td>
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<tr>
<td>Social interaction, cognitive re-organization, training of sensory-motor function, teaching of ergonomical body positions</td>
<td>Vegetables for use in the kitchen designed for ADL training</td>
<td>Petrose linum (Crispum)</td>
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<td></td>
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<td>Lactuca (sativa)</td>
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<td></td>
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<td>Beta vulgaris</td>
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<td>Pelargonium × hortorum</td>
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<td></td>
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<td>Senecio sineraria</td>
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<td></td>
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<td>Tropaeolum</td>
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<tr>
<td>Social interaction, pre-vocational skills assessment</td>
<td>Fast-germinating seed for a new collection every autumn</td>
<td>Calendula officinalis</td>
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<td></td>
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<td>Phaseolus occineus</td>
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<td></td>
<td>Tagetes ‘Silvia’</td>
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<td></td>
<td></td>
<td>Physalis perianiana</td>
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<tr>
<td>Non-specific</td>
<td>Seeds from exotic plants for use in the garden house</td>
<td>Nicotiana sylvestris</td>
</tr>
<tr>
<td>Non-specific</td>
<td></td>
<td>Ipomea tricolor</td>
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<tr>
<td>Recreation, leisure activity</td>
<td>According to patient’s wishes</td>
<td>Cosmos bipinnatus</td>
</tr>
<tr>
<td>Cognitive re-organisation</td>
<td>Reading instructions and interpreting the pictures on seed packets</td>
<td>Pelargonium × hortorum</td>
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<td>Senecio sineraria</td>
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<td>Anethum gravealen</td>
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<td>Physalis perianiana</td>
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</table>

Table 2 Organization of the DHHTG during a year (2003)

<table>
<thead>
<tr>
<th>Time</th>
<th>Group</th>
<th>Participants</th>
<th>Meetings per week</th>
<th>Total number of meetings</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 February–15 November 2003</td>
<td>Morning group</td>
<td>12 men, 12 women (wheelchair users = 3)</td>
<td>One per week</td>
<td>30</td>
</tr>
<tr>
<td>16 April–27 August 2003</td>
<td>Afternoon group</td>
<td>7 men, 5 women (wheelchair users = 0)</td>
<td>One per week</td>
<td>13</td>
</tr>
<tr>
<td>30 June–15 August 2003</td>
<td>Summer group</td>
<td>7 men, 3 women (wheelchair users = 1)</td>
<td>Three per week</td>
<td>21</td>
</tr>
</tbody>
</table>
Horticultural therapy

involve, amuse and satisfy them, give them pleasure and promote their creativity and wellbeing. In addition, the garden flowers may inspire patients to try other leisure activities such as painting or painting therapy. Other patient groups aimed for transition of new leisure activities using the flowers and harvest for floral decoration and cooking.

**DHHTG gardening for social interaction.** Participation in a gardening group was also prescribed for its associated psychosocial benefits. It was presumed that patients’ interpersonal relations would be strengthened through mutual communication about the DHHTG work and observable in an increased sense of self-worth, the release of hostility and aggression, shared control of self and environment, the experience of choice, increased socialization, practice in coping skills, increased tolerance of other group members, conscious intellectual stimulation [100], feelings of togetherness and teamwork. For example, the therapist gives the group members ‘garden-related homework’ to be performed. This task was often used for patients with aphasia encouraging them to talk and continue their interaction.

**DHHTG gardening for sensory stimulation or integration.** Patients with severe brain damage and decreased awareness were presumed to receive sensory stimulation [101] through the reticular activating system, via responses to different plant material [80, 83]. Sensory stimulation was performed in a systematic way. The therapist asked the patient questions related to the plant material and the garden environment. The patients’ tasks were to compare or identify variations of the material. The flowers offered opportunities for stimulation through smelling and seeing. Memories connected to the sense of smell would increase arousal. Butterflies and insects would trigger eyes to follow them. Vegetables and spices grown in the garden would stimulate taste. Leaves from different species, with rough or smooth or hairy surfaces would stimulate touch in the hand. Sand, soil and water would stimulate sensations in bare feet. Water, birds, bumblebees and soils make sounds that stimulate hearing and sound orientation. Bamboo and reeds moving in the wind make music that may stimulate auditive perception.

The **DHHTG gardening for cognitive re-organization.** Different gardening activities such as planning a flowerbed, calculating the depth and distance between plants, reading instructions on the seed packages or listening to oral or written instructions for doing gardening were used for patients’ cognitive re-organization therapy of attention, spatial, verbal, numerical, praxis, memory and logical impairments. In this therapeutic approach, the patients systematically learn strategies for a new way of performing the activity [102]. For example, special education strategies for planning the growing process in a flower bed gives opportunities for the patient suffering from frontal brain damage to re-organize his logical order ability.

The **DHHTG gardening for training of sensory-motor functions.** The various elements of gardening, used in a neutral way and with increasing efforts, were presumed suitable for training and improvement of mobility, muscle strength and balance, fine, gross, bilateral and eye-hand motor co-ordination, plus range of motion. For example, a patient with a right hemiparesis may overcome and possibly improve muscle weakness of arm and hand by using a high-gear pair of pruning shears when harvesting tomatoes. In addition, for patients with a hemiparesis, gardening activities were used with the traditional sensorimotor treatment strategies which are presumed to develop the motor function and motor control, including the application of sensory stimulation to muscles and joints which would facilitate specific motor responses [103]. For example, the patients stand and balance when removing faded leaves from the climbing plants, whereas the trellis give support and safety.

The patients had the opportunity to practice ways of using adaptations and coping behaviour for performing of the gardening elements [98]. These adaptations were both physical and mental. For example, the next group meeting was planned such that all group members were involved and all were responsible for a task which was compatible with their ability.

The **DHHTG gardening for assessment of pre-vocational skills and or pre-vocational training.** Gardening was prescribed as a part of establishing the patients’, with pain-related impairments, work tolerance. The patients’ ability to perform gardening elements including lifting, reaching, carrying, pushing, pulling, sitting and standing and work tolerance was observed [98]. With these purposes, digging, re-construction and repairing of paving, drawing the lawn mower, moving or mounting shelves, carrying boxes and moving sacks with soil were common work
tasks. The observed results were presumed to contribute to defining the individual patient’s capability [104] to perform employed work.

**DHHTG gardening for teaching ergonomic body positions.** The various gardening occupations were used for work-tolerance training. However, the emphasis here was on the most appropriate ergonomic body position and use of garden tools following anthropometric principles. For example, during gardening, the joints were in neutral positions; the gardener directly facing the job without twisting his or her body, back, neck or hips. The knees were preferably bent (when possible) when picking up items from the ground [98]. Kneeling was avoided with the use of raised plant-beds and a garden stool. Further, the gardeners were taught to work in the most comfortable way [24]. It was presumed that this ergonomic approach would prevent injuries to muscles and bones and might afford pain relief. Teaching ergonomic body positions was used for 45 minutes once a week individually or to groups. The patients with Rheumatoid Arthritis and Chronic Obstructive Lung Disease were given information about suitable tools and working methods but did not do gardening.

**Educational use of the DHHTG**

During a 3-day seminar, rehabilitation team staff were taught about gardening and the design of a garden for horticultural therapy. The members of these teams were interested in starting their own horticultural therapeutic gardening programmes. The results of this training contributed to the introduction of ~300 horticultural-therapeutic gardens throughout Sweden today. The concept of **DHHTG** horticultural therapy has spread and is now in use in nursing homes, rehabilitation clinics and acute care among people with infirmities, mental retardation, mental illness, neurological diseases such as dementia, multiple sclerosis, stroke and brain damage and musculoskeletal diseases such as rheumatoid arthritis [24]. **DHHTG** has been further adapted by agricultural training establishments in Sweden. The ALNARP campus of the Swedish University of Agricultural Sciences offers a half-term university course ‘Trädgård och park som rehabilitering’ (Gardens and Parks as Rehabilitation) (http://www.movium.slu.se) and the ULTUNA campus in Uppsala a quarter-term course in ‘Skolträdgårdskurs’ (Gardens in the Swedish School System).

**Discussion**

Restrictions in the literature search and the literature available in the databases used made it difficult to detect past and present trends in horticultural therapy. However, the results of this historic review indicated four different intervention approaches: (a) ‘Virtual’ elements from nature in the form of pictures, reading or discussion [10], (b) viewing nature through films or windows [12, 13], (c) interacting, i.e. visiting a hospital healing garden and receiving impressions and experience [44, 80, 94], and (d) action through doing gardening jobs [87, 94]. The latter approach was strongly suggested [4, 87, 92, 105–107], but its use was sparsely demonstrated, which justifies this description of gardening in **DHHTG** related mainly to patients suffering from brain damage. The literature suggests or describes horticultural therapy as a mediator intended to affect patients’ (a) emotional functions such as stress [75, 84, 93], increasing wellbeing [87, 91] or influencing healing [4], (b) sensory-motor functions and activities [48, 80, 83], (c) cognitive functions and activities [14] and (d) promoting participation in social life, such as prevocational training [14] or the avoidance of social isolation [10] or the promotion of human habits [108]. The descriptions concerned people with mental [94, 106, 107, 109] or physical illness requiring vocational training [1, 14, 46].

However, there were very few descriptions of how horticulture therapy has been used for people with brain damage. Consequently, the present study may contribute with its description of how horticultural therapies are being organized at Danderyd Rehabilitation Clinic. The patients with brain damage interacted in the garden, mediating healing and social interactions. They interacted by doing gardening jobs, mediating in reaction the training of sensory stimulation, cognitive re-organization, sensory-motor functions and prevocational skills. The presentation is based on personal communication and popular-science articles [23, 24, 26–28] in Swedish, combined with acknowledged occupational therapy literature. However, it would have been desirable to use direct observation or medical records for analysis. Therefore, even if full identification of this horticultural-therapeutic approach and its effectiveness is still incomplete, it may be helpful to plan and conduct such direct studies.

Many of the articles reviewed include recommendations for planning horticultural therapy [110], the designing of a hospital healing garden [6, 75] in the form of herb [111] or hospice [78] gardens, suggestions for suitable plant material [112], methods and tools...
adapted for people with various disabilities [113] and, finally, exploration of the importance of special landscapes (adventure playgrounds, children’s farms, ecological parks or landscaped school grounds) to facilitate children’s learning [114].

Another value of the DHHTG was its use for training in horticultural therapy for rehabilitation team members. This has resulted in the establishment of new hospital gardens in Sweden. A similar process has been going on over the past 16 years in the UK, where the project strongly promotes its health benefits [115].

The articles used in this study for reviewing the literature of horticultural therapy represent several different disciplines: anthropology, environmental psychology, horticulture, landscape architecture, medicine [67] and occupational therapy. This in turn may have influenced the selection of articles and restricted the review. However, the findings presented above are comparable to those of an integrative literature review by Jones and Haight [108] published in 2002. These authors reviewed 24 articles on the use of the natural environment in the form of plants or plant material as therapeutic interventions, either virtually or actually, among resident patients with altered mental health status or learning disabilities: older adults with altered levels of impairment.

Although horticulture therapy was strongly advocated, its effects were less established, except for the *envisaging and viewing* aspects. It was suggested that the envisaging and viewing form of horticultural therapy, based on the hypothesis of a beneficial relationship between humans and the natural environment positively affects mood and provides mental restoration. This tallies with Relf’s [67] review (see above) that ‘views of nature have positive, psychological responses, physiological impacts (lower blood pressure, reduced muscle tension), and a reduced need for medical treatment occurs’.

The *interacting* form of horticulture was evaluated [115] among 22 patients on a geriatric ward who had access to an indoor conservatory garden connected with an outdoor garden. The patients’ behaviour was observed regarding their movements on the ward 1 month before the gardens were installed and 1 and 6 months thereafter. The results demonstrated positive reactions and increased the number of visits to the outdoor garden following installation of the indoor conservatory.

Elderly people’s (*n* = 24) *action* was assessed during a 3-month structured gardening intervention, showing a significant improvement (*p* < 0.000) in wellbeing [87].

A study with an *hermeneutic phenomenological* research approach [94] was conducted among people with chronic mental illness (*n* = 10) who were members of a club. The aims were to explore the participants’ experiences of gardening.

When horticulture was used in this group-based setting immediate and positive effects were observed in terms of quality of life, well being and self-concept.

**Summary**

This article (a) gives a broad historic overview of how horticultural therapy has been used; (b) describes the design and organization of Danderyd Hospital Horticultural Therapeutic Garden and (c) for patients’ with brain injuries, outlines how gardening as a tonic offers a supplement to their rehabilitation, in terms of mental healing, recreation, social interaction, sensory stimulation, cognitive reorganization, training of sensorimotor function, pre-vocational assessment and the teaching of ergonomics. However, the effectiveness of these intervention approaches remains to be proved.

**Acknowledgements**

Our deep thanks for financial support are due to the Rehabilitation Clinic, Danderyd Hospital and to Stiftelsen Oskar Hirsch Minne (The Oskar Hirsch Memorial Foundation).

**References**


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