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# Horticultural therapy impact on people with dementia

Adi Vitman-Schorr<sup>1\*</sup>, Moran Chen<sup>2</sup>, Ayelet Naveh<sup>3</sup>, Tamar Hirshenzon Peiper<sup>4</sup> and Orly Ganany Dagan<sup>5</sup>

## Abstract

**Background** Dementia is a progressive disease, and as the disease progresses, many families seek help through activities and therapies. In contrast to some other therapies, horticultural therapy (HT) is widely accepted by most people with dementia (PWD) because it invites them to the natural world.

**Objectives** To explore whether HT emotional and communication measures (i.e. appropriate expression of emotions, ability to communicate with others) are higher than in other activities offered to PWD in adult day care centers (ADCC) and continuing care retirement community (CCRC), and whether there is a difference between the impact of HT on the number of “positive actions” (communication actions and actions that fit the guided activity) vs. the other activities.

**Research design and methods** Fifty-one PWD attending ADCCs and living in one CCRC were recruited to a structured HT activity and other activities that took place in the ADCCs and CCRC. The activity took place over 10 weeks. The effects were assessed using Dementia Care Mapping (DCM) and questionnaires.

**Results** Paired t-tests found that higher levels of mood and behavior were observed during HT activities compared to the other activities. Also, communication and function actions were higher in the HT activities as compared to the other activities.

**Discussion and implications** This study adds to the growing evidence of the benefits of HT for PWD regardless of past experience in gardening/agriculture. HT seems to provide high therapeutic benefits and should be more prevalent in centers caring for PWD.

**Keywords** Horticultural therapy, Dementia, Dementia care mapping, Intervention program

## Background

Dementia is a neurodegenerative disease characterized by a steadily worsening decline in cognitive function, leading to reduced ability to care for oneself. In 2012, the World Health Organization recognized dementia as a significant public health concern [1]. Estimates currently show that about 60 million people worldwide are living with this condition, and this figure could double by 2030 and triple by 2050 [2].

The behavioral and psychological symptoms of dementia (BPSD) are strongly linked to negative clinical outcomes in people with dementia (PWD) [3]. Psychiatric

<sup>†</sup>Adi Vitman-Schorr and Moran Chen contributed equally to this work.

\*Correspondence:

Adi Vitman-Schorr  
adivitman@gmail.com

<sup>1</sup>Social Work Department and The Research Centre for Innovation in Social Work, Tel Hai College, Qiryat Shemona, Israel

<sup>2</sup>Oranim College, Kiryat Tiv'on, Israel

<sup>3</sup>The Hebrew University, Jerusalem, Israel

<sup>4</sup>Elah Center for Coping with Loss, Tel Aviv, Israel

<sup>5</sup>Tel Hai College, Qiryat Shemona, Israel



symptoms such as hallucinations, delusions, agitation, and repetitive questioning [4] significantly diminish quality of life for both those affected and their families, leading to considerable caregiving burden. The leading approach to managing these symptoms is the person-centered care approach whose goal is to respect personhood and in so doing, optimize the quality of life for the PWD despite the consequences of neurological impairment. This approach promotes personal treatment and tailored activity for PWD in very small groups [5].

Pharmacological advances have proved valuable in the arena of dementia care, but there has been a tendency to over-rely on their use in practice [6]. As a result of these currently-advocated practices, emphasis is now placed on approaches which are nonpharmacological in orientation [7–12].

Numerous studies have shown that nonpharmacological treatment for BPSD is beneficial in reducing neuropsychiatric symptoms such as agitation, physical aggression, and disruptive behavior, without causing side effects [13, 14]. Moreover, nonpharmacological therapies have the potential for cognitive stimulation and strengthening functional abilities, for reducing restlessness, increasing belonging, reducing the feeling of loneliness and causing enjoyment from significant creative activity [15]. Over the past few decades, there has been increasing evidence supporting the role of various nonpharmacological interventions in enhancing the well-being and quality of life for PWD [16], among them music therapy [17], light therapy [18], reminiscence therapy [19], and horticultural therapy.

Furthermore, along with the shift to nonpharmacological therapies, there has been a shift away from institutional care in favor of community and home-based care over the past few decades [20].

As the disease progresses, many families seek the help of adult day care centers (ADCC) or continuing care retirement community (CCRC) to not only offer respite to caregivers but also provide a variety of activities to keep the PWD actively engaged [21] while helping to decrease challenging responsive behaviors [22]. Dementia care guidelines have been developed that emphasize the importance of individuals keeping physically fit, mentally active and socially engaged [23]. Engagement, the act of being occupied or involved with external stimuli [24], has been associated with decreased levels of boredom, increased alertness [25], improved positive affect [26], enhanced function in activities of daily living [24] and reduced agitation in PWD [27]. Participation in meaningful recreation activities, for example, has been shown to improve individuals' mental state (and reduce depression), decrease responsive behaviors, and enhance the quality of life for this population [28].

Unlike some other therapies, horticultural therapy (HT) is generally well-received by most people with dementia (PWD) as it encourages them to engage with the natural world through observation, touch, and interaction.

Studies have shown HT to have psychological benefits by reducing depression, anxiety and anger in patients with dementia, encouraging them to maintain independence by establishing creative and regular life patterns, and bringing positive change that improves self-esteem and quality of life [19].

According to the American Horticultural Therapy Association [29], "horticultural therapy is the participation in horticultural activities facilitated by a registered horticultural therapist to achieve specific goals within an established treatment, rehabilitation, or vocational plan." Another definition refers to a process, either active or passive, of purposefully using plants and gardens designed to positively affect a set of defined health outcomes for individuals (e.g., improved mood, improved self-esteem, enhanced social interaction) [30].

There are two types of HT [31]: participatory HT, involving cultivating, trimming, weeding and floriculture; and ornamental HT, which is garden touring and viewing pictures of nature. During the process of HT, the appearance, color, posture and smell of plants provide multisensory stimulation [32].

Recent studies have maintained that HT may stimulate memory and basic psychosocial functions because it motivates PWD to contact with nature as well as with other group members.

Integrating horticultural therapy (HT) into the daily routines of PWD has proven highly effective in decreasing agitation, stabilizing emotions, and enhancing social interaction. It offers multisensory stimulation while fostering a sense of responsibility and accomplishment [33–35].

The literature is replete with positive outcomes associated with therapeutic gardening, including benefits related to providing exercise and improving stamina, decreasing agitation, and improving sleep and cognition [36–38]. Compared to traditional everyday activities, gardening has also been shown to be associated with fewer falls [39], enhance social interaction [40] and improve mood, affect, the ability to reminisce, and quality of life in individuals with dementia [41, 33].

Engagement in gardening activities is also well aligned with the theory of personhood in dementia as outlined by Kitwood and Bredin [42], which emphasizes the importance of supporting well-being in the 'here and now' world of the PWD [43].

Hall et al. [44] mixed-methods study found higher levels of well-being for 14 people in the early stages of dementia attending an adult day program of therapeutic

gardening in Southwest Ontario, Canada. Specifically, participants in the 10-week gardening program showed higher scores of well-being and engagement compared to participants engaged in music and game programs. Their findings suggested that gardening can be beneficial whether provided through structured or unstructured activity (carer-led or self-led). Participant engagement and well-being was sustained until program completion [44].

The current research aims were to explore whether HT emotional and communication measures (noted in the research as mood and behavior level) are higher compared to other activities (discourse, yoga and sport, table games, singing, dog handling, journalism) facilitating in ADCCs and CCRC dedicated to PWD, and whether there is a difference between the impact of the HT on the number of “positive actions” (communication and functioning-action categories (actions that fit the guided activity such as sewing, painting, planting, etc.)) vs. the other activities.

## Background

### Study design

An intervention, within-subjects study, comparing different activities related to HT was used to test study objectives.

### Procedure

All the ADCCs and CCDC employed a uniform HT activity which was implemented and delivered by qualified HT therapists who completed a dedicated course and had a number of years' experience working in HT with PWD. The activity was held in a group of up to 8 older adults for one hour weekly in the morning for 10 consecutive weeks, in order to compare the HT to a variety of different activities and to avoid spot effects on the participants.

The HT activity was built on the basis of recommendations and advice from the Israeli association “Adam Tsome'ach”, which coordinates all issues related to HT in Israel, and in accordance with the relevant literature in the field [45].

The HT group sessions incorporate key elements that establish the context of the activity. Participants are arranged in a circle around a large garden table, ensuring visibility among all attendees and the therapeutic practitioner. Central to each session are basic gardening activities. Every meeting commences with a structured discussion, fostering enhanced communication skills and facilitating essential interactions among participants. Each session concludes with a similar reflective exchange [45].

The HT activities included 10 structured activities; each one had its emotional and/ or physical purpose- hand-eye

coordination, finger grip practice, repetitive work, visual diagnosis at different levels, sequence of actions at adapted levels according to Table 1:

The activities which were compared to HT in the ADCCs and CCRC were structured similarly to the HT activities (regarding settings, instructor and purpose) and took place before or after the HT activity (with half an hour break between the activities). The activities included a variety of standard activities in three main areas: physical exercise, singing and guided conversation on a variety of topics (the specific non-HT activities are detailed in Tables 2, 3, 4 and 5; they varied from one ADCC/ CCRC to another, but remained in these three areas). All these activities were delivered by instructors (employment guide) at the ADCCs and CCRC and were also conducted in groups for one hour per week every week.

The same group of participants who participated in the HT activity also participated in the other activities.

In order to determine the emotional and behavioral state of the PWD as they engaged in the different activities, a validated and published observational tool was utilized [46]. This observational tool, ‘dementia care mapping’ (version 8), allows researchers to assess apparent wellbeing and engagement in PWD [46, 47]. Assessment is achieved by recording a mood and behavior codes and a score every five minutes between +5 (very happy, cheerful, highly-positive mood) and -5 (very distressed, intensified signs of a negative mood) with middle scores of +3 (content, happy, relaxed, fairly positive mood), +1 (neutral, absence of overt signs of positive or negative mood), -1 (minor signs of negative mood), -3 (considerable signs of negative mood) for the person's level of wellbeing and engagement [48, 49]. The most frequent mood codes were +1 and +3.

In the current study, observations were structured and recorded every five minutes per participant for two hours while participants were involved in HT and the activity that took place before or after the HT activity. The rationale for this choice of tool was to determine what types of behavior occurred most often during HT and the other activities and to what extent the participants appeared to be involved in the sessions. The dementia care mapping was carried out by the same observation team in the different facilities. The observation team, composed of HT students and an HT therapist (who were not the HT therapists who delivered the activities, and had no personal or professional contact with them). The observation team underwent training and simulations relating to the different activities in order to have high inter-rater reliability and to check bias towards the HT activities. The inter-rater reliability was between 90 and 95% across the simulations.

Since the behavior of PWD is not always appropriate for the place or situation at that particular moment

**Table 1** HT activities during the intervention

Week no.	Activity	Purpose
1	Making scent bags from lavender flowers/myrtle leaves/ rosemary.	Creating a gift that symbolizes pleasantness for myself and the person of my choice.
2	Preparation of sharp pelargonium cuttings in pots. Later, the seedlings will be transplanted to a larger container	Experience gardening success, hand-eye coordination, finger grip practice, sensory stimulation
3	Sowing edible summer seeds in the germination surfaces (types of beans, corn, sunflower). The seedlings will later be transplanted into large containers, to obtain an edible product.	Sowing skill, finger grip, repetitive work. (Using stages according to ability). Bringing up memories of personal growth from the past, exciting beginnings, inhibiting patterns.
4	Citrus fruits - sorting and distinguishing, peeling, tasting, smelling	Talk about feelings “here and now”, delicious? sour? sweet? A pleasant smell?
5	Flower arrangements - to decorate the house or center	Strengthening the feeling of the ability to give, enhancing of self-image
6	Making masks from palm leaves	Fine motor skills, giving, emotional discourse about the need for a mask sometimes, its role in culture. Knowledge about the date, and bringing up memories. Cognitive work of face creation, adapted to the PWD. Visual diagnosis.
7	Planting flower seedlings - The flowers can then be used to decorate the common space, to dry for creative activities such as bookmarks, greetings, etc.	Each participant tells why he chose the flower he chose. What did he like about the flower? What does the flower remind him of? Maybe because of the color? the shape? smell? Which sense affects him in particular?
8	Creating a mandala from different seeds- Experience certain success while preventing frustration to encourage action. Any form of placing the seeds on the cardboard or plastic in a circular shape will yield results.	Encouragement for an emotional discourse on the topic of internal forces and/or the importance of transience in our lives. Repetitive work to practice short-term memory.
9	Making incense from sage branches (or lavender flowers and leaves)	Fine motor skills of wrapping work using both hands. Sensory appeal - the smell of sage, its velvety texture. An emotional discourse about what I would like to “purify”, to clean. Can be linked to Pesach.
10	Potato- If you plant the potatoes ahead of time, you will experience the discovery of the potatoes in the soil.	In the motor and sensory field: hand-eye coordination in the operation of cutting the potatoes and practice and use of the hand and fingers in the operation of cutting. Encouragement for an emotional conversation on the topic of what are the things that are important to us that we save for when needed?

**Table 2** Activities in site SA (N= 22)

Site	behavior and mood scores					
	HT	conversation	yoga	physical exercise	table games	
SA						
	M	98.43	72.88	53.38	42.50	48.56
	SD	67.97	26.33	34.47	38.23	18.81

**Table 3** Activities in site AH (N= 10)

Site	behavior and mood scores			
	HT	conversation	singing	
AH				
	M	90.60	38.10	30.40
	SD	33.21	21.49	18.55

**Table 4** Activities in site RE (N= 7)

Site	behavior and mood scores				
	HT	physical exercise	Dog handling	journalism	
RE					
	M	235.57	168.29	72.29	12.0
	SD	47.38	29.56	24.26	6.57

**Table 5** Activities in site BH (N= 10)

Site	behavior and mood scores		
	HT	physical exercise	
BH			
	M	92.91	67.70
	SD	88.63	58.71

nor suited to the activity in which they are engaging, it is important to understand and document their behavior during each of the activities and understand which activity motivates communication and more fitted behavior.

In order to report what types of behaviors participants exhibited while engaging in the different activities, in addition to the mood code, the dementia care mapping contains recording the behavior of the participants, that is, what the participants did while the activity took place (examples of behavior- snoozing, stimulation, vocational, borderline, talking to him/herself, expression, articulation) by behavioral category codes, the DCM tool includes letters (implemented with Hebrew letters comparable in meaning to those of the DCM in English and emoji signs reflecting the meaning of the letter, in order to make it easier to find while observing the group). Since the activities are varied and wide-ranging, not all behaviors occurred in each activity. This is important since it enables understanding of what type of activity (HT or

any other activity) encourages actions such as functioning or communication with others. The most frequent behavior category was expressive, borderline, vocational, articulation.

The final group of data collected was through administration of a questionnaire to the participants' caregivers that revealed socio-economic details and details concerning the occurrence of dementia (according to the center's registrations).

Prior to recruitment, this study received ethics approval from the research ethics board at the principal investigator's home institution (the process for obtaining consent is described in the following section).

### Sample

The research took place in Israel in three ADCCs - SA, AH and RE - and one CCRC - BH, all providing support to PWD. ADCCs are a care alternative for older adults who experience functional impairments [50] and are currently funded in Israel by the Long-Term Care Insurance Law, adopted in the late 1980s with the goal of enabling older adults to age in place [51]. Services include recreational and social activities, transportation, nutritious meals, and health services including physical and occupational therapy, nursing care, and dietary supervision. ADCCs are formal services that attempt to reduce the sense of loneliness among older adults by providing them with a variety of opportunities for social interaction [52].

All the study participants were already active members in the day activities of his/her ADCC/ CCRC. To be eligible for this study, participants had to be diagnosed with dementia (as written in the ADCC/CCRC's records). Participation in the study was offered to all members and residents of the ADCCs and CCRC or to their family members if the member/ resident was unable to provide consent. Interested participants were then contacted to review the letter of information and to obtain consent. In the cases where the coordinator identified a person who met the criteria but was unable to provide his/ her own consent, the coordinator contacted the person's legal guardian to obtain permission for including the PWD as a study participant. Following this purposive sampling, a total of 51 PWD were recruited to participate in the research. The demographics of these participants and their institutional association appear in Table 1. The participants received HT and were included in the other activities offered in the ADCCs and CCRC (there was only one other activity occurring simultaneous to the HT activity) once per week for 10 consecutive weeks, two groups were observed during the same time slot by two observation teams. Data concerning wellbeing and engagement along with activity details were collected during the activities for the entire 10 weeks.

### Measures

#### *Behavior and mood scores*

Behavior and mood scores were measured by the observational tool 'dementia care mapping,' a tool wherein researchers assess apparent wellbeing and engagement of PWD [47]. As described previously, this is achieved by recording a behavior category code (DCM category codes translated to Hebrew letters) and a mood score between +5 and -5 for the person's level of wellbeing and engagement every five minutes [53, 54]. A higher score in this variable signifies greater wellbeing.

#### *Communication and functioning action categories*

Communication and functioning action categories were measured separately by the two actions that appeared during the activities. As previously detailed, the mood and behavior of the PWD was coded by a number every five minutes, and a letter representing the functioning action of the PWD during the same five minutes was also coded. The occurrence of these actions was separately counted in order to determine whether there was a difference between the frequency and number of "positive" actions (communication and functioning) between HT and the other activities. A higher number of every action correlated with a higher measure. The research team made the observations and completed the assessments.

#### *Background variables*

Gender, age, marital status and health status were gathered based on family member report. Age and number of children were defined as continuous variables. Sex was coded as a dichotomous variable, 0=male, 1=female. Marital status was coded as a dichotomous variable, partnered=1, unpartnered (single, widowed or divorced)=0.

#### *Data analyses*

In the first stage, univariate analyses were performed to describe the sociodemographic characteristics of participants and to examine the distribution of the study variables. The mood and behavior codes and communication/ functioning actions were converted into variables by summarizing the codes and number of every specific action for each participant in every activity (HT and every other activity separately). This process allowed us to perform paired t-test between the mood and behavior scores and communication/ functioning actions in the next stages. In the second stage, paired t-test analyses were performed to examine differences between the behavior category and score of the HT activity compared to the other activities. The third stage included paired t-tests to examine differences between measures of communication and functioning action categories in HT activity and the other activities.



**Table 6** Descriptive statistics of the study variables (N=51)

Covariates		N (valid %)	Mean (S.D)	Range
Gender	Female	31 (60.7)		
	Male	18 (35.3)		
	Missing	2 (4.0)		
Age		34	80.44 (5.68)	69 - 94
	Missing	17		
Marital status	No partner	18 (35.3)		
	Has a partner	21 (41.2)		
	Missing	12 (23.5)		
Health status	Good	8 (15.7)		
	Medium	21 (41.2)		
	Not good	3 (5.9)		
	Missing	19 (37.2)		
<b>Research variable</b>				
HT behavior and mood score		49	115.18 (80.78)	-26-293
HT communication and action categories		42	11.52 (9.39)	1-41
HT functioning action categories		47	26.70 (20.45)	1-89

This research was a ‘real-time’ testing; that is, paired t- tests were conducted and a comparison was made between the mood and behavior score of each participant in HT vs. that participant’s scores in an activity other than HT, as well a comparison of a participant’s communication and functioning in HT vs. another activity.

**Results**

The majority of the study population were women. Most study participants for whom marital status was known (n=39) were married or partnered. The age range was 69-94 (M=80.44, SD=5.68). A majority of the sample reported (by family member and medical staff) medium to good health status (based on 32 responses, not the entire sample).

The range sample score on the **HT behavior and mood score** was (-26)- 293 (M=115.18; SD=80.78); the range for **HT communication** measures was 1-41(M=11.52; SD=9.39); the range for **HT functioning** measures was 1-89 (M=26.70; SD=20.45). (See Table 6).

The SDs of the behavior and mood scores and communication and functioning measures are high, perhaps due

to the wide range of the scores of this particular measure in relation to the relatively low number of respondents in each ADCC and CCRC. This creates a relatively large dispersion around the average of the scores.

Paired t- test analyses examined differences between the behavior and mood scores of the HT activity compared to the other activities. Results revealed that the differences between the HT scores and other activities scores were significant in three out of four research locales (in the three ADCCs), where the HT behavior and mood scores were higher compared to the other activities (only significant results are presented in text, unless highlighted otherwise, all the results are presented in the tables). In SA (22 participants, but not all of them participated in all of the activities), the HT behavior and mood scores (M=98.43, SD=67.97) were significantly higher compared to conversation [(M=72.88, SD=26.33), t(7)=5.10, p=.001], yoga [(M=53.38, SD=34.47), t(8)=3.58, p=.007], physical exercise [(M=42.50, SD=38.23), t(11)=2.82, p=.008] and table games [(M=48.56, SD=18.81), t(8)=2.08, p=.036].

In AH (10 participants, all of them participated in all the activities), the HT behavior and mood scores (M=90.60, SD=33.21) were significantly higher compared to conversation [(M=38.10, SD=21.49), t(9)=6.53, p<.001] and singing [(M=30.40, SD=18.55), t(9)=8.16, p<.001].

In RE (7 participants, not all of them participated in all the activities), the HT behavior and mood scores (M=235.57, SD=47.38) were significantly higher compared to physical exercise [(M=168.29, SD=29.56), t(6)=7.05, p<.001], dog handling [(M=72.29, SD=24.26), t(6)=15.41, p<.001] and journalism [(M=12.0, SD=6.57), t(5)=13.75, p<.001].

In BH (10 participants, not all of them participated in all the activities), the HT behavior and mood scores (M=92.91, SD=88.63) were not significantly higher compared to physical exercise [(M=67.70, SD=58.71), t(9)=1.37, p>.005].

Paired t- test analyses examined differences between number of “positive actions”: communication and functioning action categories, between HT activity and the other activities (detailed measures are detailed in Tables 7, 8, 9 and 10). Results revealed that the differences between the number of “positive actions” during HT were significantly higher compared to the other

**Table 7** Communication and functioning actions in site SA (N=22)

Site	behavior and mood scores						
			HT	conversation	yoga	physical exercise	table games
SA	communication	M	11.13	6.38	--	3.25	7.57
		SD	9.9	7.41	--	1.01	5.88
	functioning	M	16.13	--	20.67	--	9.88
		SD	5.38	--	16.23	--	8.31

**Table 8** Communication and functioning actions in site RE (N=8)

Site			behavior and mood scores			
			HT	physical exercise	Dog handling	journalism
RE	communication	M	13.88	3.25	--	--
		SD	7.99	1.01	--	--
	functioning	M	62.57	60.0	18.86	6.0
		SD	18.68	8.74	6.39	0.000

**Table 9** Communication and functioning actions in site BH (N=11)

Site			behavior and mood scores	
			HT	physical exercise
BH	communication	M	12.64	5.33
		SD	11.80	4.21
	functioning	M	11.64	5.33
		SD	10.40	3.78

**Table 10** Communication and functioning actions in site AH (N=10)

Site			behavior and mood scores		
			HT	conversation	singing
AH	communication	M	13.70	3.62	3.60
		SD	9.02	1.69	2.30
	functioning	M	38.20	2.80	2.0
		SD	13.37	0.45	1.0

activities. Communication actions during HT were significantly higher compared to the other activities in SA, AH and BH.

At SA, the number of “communication actions” during HT (M=11.13, SD=9.9) was significantly higher compared to conversation [(M=6.38, SD=7.41), t(7)=2.24, p=.030], physical exercise [(M=3.25, SD=1.01), t(7)=4.37, p=.003] and table games [(M=7.57, SD=5.88), t(6)=3.29, p=.017].

At RE the number of “communication actions” during HT (M=13.88, SD=7.99) was significantly higher compared to physical exercise [(M=3.25, SD=1.01), t(7)=4.37, p=.002].

At BH the number of “communication actions” during HT (M=12.64, SD=11.80) was significantly higher compared to physical exercise [(M=5.33, SD=4.21), t(8)=2.26, p=.05].

At AH the number of “communication actions” during HT (M=13.70, SD=9.02) was not significantly higher compared to conversation (M=3.62, SD=1.69), and singing (M=3.60, SD=2.30).

**Functioning actions** during HT were higher compared to the other activities at SA, AH and RE (see tables above).

At SA, the number of “functioning actions” during HT (M=16.13, SD=5.38) was significantly higher compared to table games [(M=9.88, SD=8.31), t(7)=1.97, p=.045].

At RE the number of “functioning actions” during HT (M=62.57, SD=18.68) was significantly higher compared to dog handling [(M=18.86, SD=6.39), t(6)=7.12, p<.001].

At BH the number of “functioning actions” during HT (M=11.64, SD=10.40) was not significantly higher compared to physical exercise (M=5.33, SD=3.78).

At AH the number of “functioning actions” during HT (M=38.20, SD=13.37) was significantly higher compared to conversation [(M=2.80, SD=0.45), t(7)=3.78, p=.003] and singing [(M=2.0, SD=1.0), t(4)=5.99, p=.004].

### Discussion

The purpose of this study was to examine whether HT emotional and communication measures (noted in the research as mood and behavior level) are higher compared to other activities (discourse, yoga and sport, table games, singing, dog handling, journalism) offered in ADCCs and CCRC dedicated to PWD, and whether there is a difference between the impact of the HT on the number of “positive actions” (communication and functioning action categories) compared to the other activities.

The findings revealed that PWD involved in HT had higher mood and behavior levels compared to the other activities that took place in the ADCCs but not in the CCRC. The reason for this may be that compared to most of the Western world, in Israel older adults tend to age in place as much as possible and the percentage of those living in CCRCs is relatively small and only when the situation requires it. Thus, it is possible that the PWD in a CCRC are in a more advanced state of dementia and the differences between the activities are less evident with regard to mood and behavior.

The second result was that PWD engaged in more “positive actions” during HT compared to the other activities. However, it is important to note that some of the activities held in the CCRC and ADCCs are not geared toward communication and functioning, as can be seen in some activities where these aspects did not come up at all (in yoga, dog handling and journalism there was no communication at all and in conversation there was no functioning at all). For PWD it is crucial to consider and emphasize activities that can increase communication and functioning.

The first aim and the result are consistent with prior studies reporting the benefit of HT on behavior and

mood of PWD [44]. This implies that not all the activities taking place in ADCCs whose intentions are to improve behavior and mood among PWD, are equal in terms of efficacy. HT seems to be more beneficial than other activities offered in many ADCCs (e.g., singing, physical exercise, conversation, journalism and current affairs) concerning behavior and mood levels. There are several possible explanations for the efficacy of HT. Many studies [53–55] have documented that nature has a positive effect on people in terms of reducing depression and anxiety, raising pleasant memories, stimulating a sense of relaxation, and promoting cooperation, communication and functioning. However, older adults in general and PWD in particular, have few, if any, options to go out into nature. HT is a way to bring nature to those people [35].

Another possible explanation might be that the HT activities respond to the need of human beings to be engaged; most individuals manage to satisfy this need independently but PWD have difficulty doing so. For PWD, engagement with stimuli (e.g. music or gardening) and structured activities (e.g. singing group or HT) has been found to improve affect and decrease behavior problems [56]. With regard to group activities, several studies have found social interaction to be the most potent stimulus for PWD in alleviating agitation and improving engagement [57]. These findings suggest that group activities may provide added benefits because they combine social stimuli with another form of stimulus (e.g. reading or music or HT). The combination of social and other stimuli can address the need for social contact and alleviate boredom simultaneously [58].

The second research aim, to explore whether there is a difference between the impact of HT on the number of “positive actions” (communication and functioning action categories) compared to the other activities, was supported by the findings. There were indeed more “positive actions” during the HT compared to the other activities. This result is consistent with other studies that examined levels of agitation and BPSD during and after HT and vs. other activities [31, 59, 60]. Another study using the same method as the current study, found that the main activity during HT was “leisure” [44].

The possible explanation for that is that HT can entice PWD to spend more time in a positive activity (functioning). Hartig et al. [53] reported that PWD benefit from multiple forms of contact with nature in the form of decreased stress and increased physical and social engagement (communication). Furthermore, nature is an excellent resting environment that focuses attention and produces a restorative effect [54]. Another explanation for the advantage of therapeutic gardening is the emphasis on given to the sensory aspects, fine motor skills, conversation and reminiscing, these aspects encourage communication and functioning during the

activity. According to Park et al., HT provides forms of activity that improve the physical and cognitive functions of PWD and enable interpersonal communication and social interaction [61].

Several ramifications are derived from the current study’s findings. The study suggests that activities for PWD can be more than just “filling the day” or “passing the time”. HT can benefit behavior and mood, and during HT there are more functioning and communication activities. HT can be structured as a person-centered approach (activities corresponding to different levels of physical, functional and mental abilities) where tailored activities are described to improve well-being in people with dementia. In addition, several studies reporting findings that person-centered interventions reduced BPSD and improved quality of life [62]. For that reason, choosing activities for PWD requires a multidisciplinary and comprehensive approach that relates to the special benefits of each activity, the therapeutic goals of the activity and the facility’s abilities. Therefore, greater collaboration and communication within and between experts of different disciplines (therapists from different disciplines, gerontologists, psychologists, sociologists) is necessary to choose the best therapy from which PWD can benefit. HT is only one therapy; it can be practiced in ADCCs and CCRCs, and there may be other therapeutic activities that are also beneficial. This study opens new venues for further research on the advantages of the different therapeutic activities for PWD and calls for further investigation concerning these therapeutic activities and other nonpharmacological means that can benefit PWD.

## Conclusion

The present study stresses that HT may have therapeutic benefits for PWD which are not seen in other activities. Since one of the main purposes of the activities in ADCCs and CCRCs is to try and improve behavior, mood, communication and functioning abilities of PWD there is great importance in understanding which activity best serves PWD.

The first conclusion is that HT is an important activity for its benefits to PWD. The second conclusion concerns the impact of the HT on a number of “positive actions” (communication and functioning action categories), meaning that during HT, PWD in ADCCs exhibit more communication and functioning actions compared to the other activities. Since these aspects (mood, behavior, communication and functioning) are extremely important for the everyday activity of PWD, the main conclusion is the importance of using HT in ADCCs (the results were not significant concerning CCRCs and should be interpreted carefully), to introduce more proven therapeutic activities (such as music therapy [63]) and to



conduct more studies on the possible efficacy of animal therapy, art therapy, drama therapy and others.

Another important understanding of the research is that therapeutic activities (like horticulture, music and therapeutic art) are conducted by professionals whose training is evidence-based; that is, based on successful interventions that had higher impact on PWD than other activities led by nonprofessionals or simple everyday activities that merely “fill the day” in ADCCs and CCRCs. Thus, our main conclusion is that more proven therapeutic activities need to be available for PWD.

### Implications

From the perspective of policy and practice, the current study elucidates the impact of HT as compared to the other activities in terms of mood, behavior, communication and functioning. Since the role and intention of the ADCCs and CCRCs that support the person-centered approach are to positively impact PWD, policy and practice stakeholders should be more aware of this type of therapeutic activity and consider integrating it in ADCCs, CCRCs and other institutions, as long as it fits the individual's interests and needs. When dealing with advanced dementia, one of the main challenges is behavior and communication; the current research found that HT can positively impact these measures. Thus, stakeholders should keep that in mind and incorporate these activities more often.

### Limitations

We should point out the limitations of the current study. One is the cross-sectional study design, which does not allow the prediction of a causal relationship between the variables. A future study should use longitudinal data to examine the impact of HT on PWD for longer time. Two additional limitations might be the small sample which make it difficult to generalize the results, (although as has been seen, studies on PWD tend to have a very small scope [31, 44, 59], and the fact that the data were gathered by observation and not by interview or questionnaire, and may therefore be less precise (although the same method also served the study's examination of all the activities). A fourth limitation concerns the study population. Since the therapists speak only Hebrew, the sample included only Hebrew-speaking participants. Future research should find a way to include a more diverse sample. A fifth limitation concerns the large standard deviations in the results section, which implies a wide range of mood and behavior scores.

Despite these limitations, the present study provides initial insights into the benefits of HT for PWD, a topic not widely studied to date.

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N.A.

### Author contributions

A.V.S wrote the main manuscript text, M.C, A.N and T.H.P read the text, commented and helped to revise the text. O.G.D. helped with ethics and connections through the research.

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### Data availability

The datasets generated and/or analysed during the current study are not publicly available due to third party restrictions, but are available from the corresponding author on reasonable request.

### Declarations

#### Ethical approval

The research approved by the ethics committee of Tel-Hai Academic College (IRB application number: 7/2021-1).

#### Consent to participate

The authors confirm that informed consent was obtained from all subjects and/or their legal guardian(s). The consent statements are written in Hebrew.

#### Consent for publication

Not Applicable.

#### Competing interests

The authors declare no competing interests.

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