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Original Study

Effects of Horticulture on Frail and Prefrail Nursing Home Residents: A Randomized Controlled Trial

Claudia K.Y. Lai PhD^{a,*}, Rick Y.C. Kwan PhD^a, Shirley K.L. Lo MN^a,
Connie Y.Y. Fung MSc^b, Jordan K.H. Lau BSW^c, Mimi M.Y. Tse PhD^a

^aSchool of Nursing, The Hong Kong Polytechnic University, Hong Kong, SAR, China

^bThe Hong Kong Association of Therapeutic Horticulture, Hong Kong, SAR, China

^cPok Oi Hospital, Hong Kong, SAR, China

A B S T R A C T

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Objective: Frail nursing home residents face multiple health challenges as a result of their frail status. The aim of this study was to examine the effects of HT on the psychosocial well-being of frail and prefrail nursing home residents.

Design: Randomized controlled trial.

Setting: Nursing homes.

Participants: One hundred eleven participants were randomly allocated into the intervention [horticultural therapy (HT)] and control (social activities) conditions.

Intervention: HT group participants attended a weekly 60-minute session for 8 consecutive weeks. Control group activities were social in nature, without any horticulture components.

Measurements: The outcome measures include happiness, depressive symptoms, self-efficacy, well-being, social network, and social engagement. The time points of measurement were at baseline (T₀), immediately postintervention (T₁), and 12 weeks postintervention (T₂). A modified intention-to-treat approach was adopted. A multivariate general estimating equation was used to analyze the data.

Results: Forty-six and 50 participants received at least 1 session of the intervention and control condition protocol, respectively. A significant interaction effect between group and time was observed only on the happiness scale ($\beta = 1.457, P = .036$), but not on other outcome variables. In a follow-up cluster analysis of those who received HT, a greater effect on subjective happiness (mean difference = 6.23, $P < .001$) was observed for participants who were happier at baseline.

Conclusion: HT was found to be effective in promoting subjective happiness for frail and prefrail nursing home residents. Its favorable effect suggests that HT should be used to promote the psychosocial well-being of those who are frail.

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Frailty is a clinical state of vulnerability, leading to a compromised state in homeostasis.¹ A person who is in a frail state is also at an increased risk of adverse outcomes such as disability, diseases, and death.² Frailty leads to restrictions on participating in the activities of daily living or in pastimes, which further impair the physical and psychosocial health of older people.³ Frailty is a significant factor in

late life depression^{4,5} and loneliness.⁶ Those admitted to nursing homes are in an increasingly frail state. Unfortunately, many nursing home environments are monotonous and lack adequate stimulation, further negatively impacting the frail older residents.

Most of the interventions in the literature focus on employing diet and exercise to combat the decline in physical fitness of older people.^{7,8} Seldom are attempts made in these trials to determine whether these interventions improve the psychosocial health of older people. Studies that rigorously examine the effects of interventions that promote the psychosocial well-being of frail older people are lacking, yet sorely needed given the reduced capacity of this segment of the population to participate in activities of various kinds.

The biophilia hypothesis suggests that human beings have an innate emotional affiliation to other living organisms, that our relationships

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* Address correspondence to Claudia K.Y. Lai, PhD, School of Nursing, The Hong Kong Polytechnic University, Yuk Choi Road, Hung Hom, Kowloon, Hong Kong, SAR, China.

E-mail address: claudia.lai@polyu.edu.hk (C.K.Y. Lai).

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with nature are fundamental to our good health.^{9,10} Horticultural therapy (HT) is an intervention that utilizes interactions with living things—namely, plants—to achieve specific therapeutic goals to maximize psychosocial well-being.¹¹ There is some preliminary evidence showing that HT can be used effectively to promote psychosocial health, such as by reducing stress and enhancing the self-efficacy of different vulnerable groups, as in those with mental illnesses.¹² HT was also found to promote activity engagement in people with dementia.¹³

There are also reports that HT can be feasibly delivered in nursing homes to promote residents' quality of life,¹⁴ enhance their satisfaction with life, expand their social networks,¹⁵ promote their well-being,¹⁶ and reduce their feelings of depression.¹⁷ HT has also been found to promote happiness, interpersonal intimacy, and engagement in the activities of daily living (ADL) in a nursing home environment.¹⁸ Thus, the findings from these studies indicate that HT can have favorable effects on the psychosocial health of vulnerable nursing home residents.

One special feature of HT is its flexibility and adaptability for people with different needs.¹⁹ The degree and mode of participation in HT can be adapted to suit the diverse functional levels of the participants. Thus, the skill level and dexterity required to participate in HT activities can be adjusted to suit the capabilities of people, even those who are physically frail. Therefore, HT can potentially be used to promote the health of frail older people in nursing homes. Yet, there is a dearth of studies specifically evaluating its effect on such a population. Previous experimental studies evaluating the effect of HT have been found to contain major flaws, such as a lack of reporting on the methods used in randomization, inadequate concealment and blinding, and a failure to use intention-to-treat analysis.²⁰ The aim of this study is to use a rigorous design to investigate the effect of HT on the psychosocial well-being of frail older people in residential care homes.

Methods

This study employed a randomized controlled trial design. The participants were randomly assigned into either the experimental (HT) or control (social activities) groups. The outcome variables were measured at 3 time points: at baseline (T₀), immediately post-intervention (T₁), and in the 12th week postintervention (T₂).

Setting, Subjects, and Sampling

The study was conducted in collaboration with a nongovernmental organization (NGO) in Hong Kong. In Hong Kong, residential care homes serve older people with a moderate level of impairment (functional or cognitive) who require assistive care. All of the residents in the 4 residential care homes (hereafter referred to as nursing homes) under the management of the NGO were screened by the staff for their eligibility to join the study.

The inclusion criteria were: those who were aged 70 and above, able to communicate orally in Cantonese, in a frail or prefrail state according to the criteria of Fried et al,²¹ normal or only mildly impaired cognition (normal cognition as defined by a Chinese Abbreviated Mental Test score of ≥ 6 of 10,²² and mildly impaired cognition defined as questionable or mild dementia according to the Clinical Dementia Rating scale),²³ and no terminal illness and not in a rapidly deteriorating state of health. Those with cardiac problems requiring hospital care or major surgery in the last 3 months; impairment of both upper limbs; allergic to pollen, plants, seeds, soil, and fertilizers; concurrently receiving other complementary therapies, for example, cognitive behavioral therapy; and had received HT within the last 6 months, were excluded.

Randomization, Concealment, and Blinding

An independent member of the project team who was not involved in any other part of the project was responsible for random allocation. Each recruited subject was assigned a code. Permuted-block randomization was employed to assign the subjects by code into either the experimental or control condition after baseline data collection. The team member responsible for randomization was blinded against the subjects' profile. Data collectors were blinded against the participants' group label throughout the study period.

Intervention and Control Conditions

Experimental Group: HT

The HT protocol is a weekly 60-minute program carried out over 8 weeks. It was developed by a registered horticultural therapist with expertise in HT for vulnerable groups (eg, the intellectually challenged) and older people in the community and in nursing homes. The intervention protocol was tailor-made to fit the needs of the frail older individuals (eg, an assistant to help cut the stems of a plant for those with decreased muscle strength and dexterity). Each session consisted of various horticultural activities such as fertilizing, re-potting plants, watering, trimming, propagation, species introduction, and seeding. The participants were first shown the procedures, then facilitated by an assistant to work on their own plant after choosing from a lot (Figure 1). Hardy plants were used depending on the availability of plants in the market in the season. Even though there might have been minor changes in the protocol, the principle was to use plants to show a sense of continuity and cyclical development in plant life. The participants were encouraged to bring their plants back to their room to be taken care of and be appreciated. If their room did not have sufficient sunlight, the staff would be asked to remind the participants to water their plants, or help them to get to their plants for watering and appreciation, such as pushing their wheelchairs to the sun room. At least half of the time the therapy sessions were held in an outdoor environment. There were 6 to 8 participants in each group. At least 85% of all sessions needed to be completed to be regarded as compliant. Remedial sessions were offered if a session was missed (eg, sudden illness). The program was led by one registered horticultural therapist assisted by an intern.

Control Group: Social Activity Protocol

The control condition was designed to control for the social interaction effect of an intervention. All aspects of the Social Activity Group were equivalent to the HT Group except for the use of living plants. Activities that did not include the use of plants or plant-related materials were conducted. These included talking about the news, card games, and so on.

Measurements

The data collected at T₀ included sociodemographic and clinical variables such as age, gender, marital status, education level, number of medications, number of diagnosed chronic illnesses, length of stay in the home, any vision and hearing impairments, and participation in HT activities within the past 12 months. Comorbidity levels were measured using the Charlson Comorbidity Index (CCI),²⁴ nutritional status was assessed using the Mini-Nutritional Assessment,²⁵ and functional status was measured using the Modified Barthel Index²⁶ and Lawton's Instrumental Activities of Daily Living scale.²⁷

Screening Measure: Fried Frailty Index

The Fried Frailty Index²¹ consists of 5 items (weight loss, exhaustion, physical activity, walking time, and grip strength) on a dichotomous (1 or 0) scale to screen for frailty. Those with a total score of

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