Finding the Third Space through Gardening: Strengthening Relationship Mutuality and Lowering Stress in the Caregiver and Care Recipient who has a Disabling Injury or Illness through Gardening[1]

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Abstract

There is strong evidence that illustrates the health benefits of gardening. However, gardening to improve mutuality and caregiver strain and health has not been studied. Mutuality is defined as shared, reciprocal experience that strengthens dyadic relationships aiming to achieve optimal health, mitigate adverse effects, and improve psychological and over-all well-being. The purpose of this study was to evaluate the relationship between gardening and mutuality in care recipients (CR) with a sudden disabling condition, and mutuality, caregiver health and strain in caregivers (CG) for CR-CG dyads after discharge from inpatient rehabilitation. A mixed methods, quasi-experimental study of 90-day duration (n=63 dyads) received the intervention of 1) gardening evaluation 2) teaching adaptive skills, and 3) providing take-home adaptive gardening equipment and supplies, and 4) six visits from a Master Gardener after discharge to home. The pre-post quantitative results revealed 1) CR mutuality decreased, though was higher than a published benchmark, 2) CG mutuality was higher than the published comparison, 3) the CR reported higher mutuality than the caregivers, 4) caregiver strain was 14% lower (favorable) compared to the 2023 annualized facility 90-day follow up data (historical comparison) 5) CG health decreased, though study participants reported 16% better health than the historical comparison, 6) study participants reported 6% better physical health than the historical comparison, and 7) study participants reported 20% better mental health than the historical comparison. The qualitative themes revealed that 1) gardening activities created a sense of CR/CG mutuality, 2) assisted progress in recovery and provided motivation, 3) allowed growing/eating healthy food, and 4) adaptive tools contributed to success. Gardening provided a positive impact on persons with sudden disabling events and their caregivers.

Index words: caregiving, mutuality, disability, gardening.

Significance to the Horticulture Industry

The results of this study demonstrate the value of gardening in the caregiver/care recipient relationship. By embracing the therapeutic potential of gardening, the horticulture industry can align its products and services with the growing interest in wellness and caregiving. Given the high prevalence of family caregivers globally, this illustrates an opportunity to increase demand for products tailored to meet the needs of individuals with a disability, such as ergonomic tools, accessible garden beds, and container gardening, an area where there is opportunity for discovery of innovative solutions to promote access to gardening for this population. Horticulture therapy might be introduced in programs that serve the community of people living with a disability, optimized by industry partnerships to supply plants, materials, and equipment for such programs. Gardening for people with disabilities and their caregivers may be introduced into training programs for horticulture therapists. In addition to boosting sales, the horticulture industry can position the industry as a key contributor to improving physical and mental well-being in people with a disabling condition and their caregivers.

Introduction

The Centers for Disease Control and Prevention's Disability Health and Data System (CDC 2023) identified that 27% of adults in the United States have some type of disability in the areas of cognition, hearing, vision, mobility, self-care, and independent living, requiring them to have a caregiver, usually an unpaid family member, to assist them in completing daily tasks. Family caregiving has been shown to result in adverse physical and mental health effects for the caregiver, and addressing this issue has received national attention (NASEM 2016, Meyer et al. 2018). While caregiving by another was formerly perceived as a discrete role, more recent studies have shifted the concept of caregiving to a "relational event" as the dyads (care recipient and caregiver pairs) navigate a life-altering event together (Gibbons et al. 2019). The dyadic (caregiver/care recipient) relationship elicits mutuality wherein an environment conducive to open communication is established to strengthen rapport, empathy, and sense of fulfillment. Mutuality in this context is defined as 'a phenomenon of shared, reciprocal experience that strengthens dyadic relationships which aim to achieve

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optimal health, mitigate adverse effects, and improve psychological and over-all well-being (Streck et al. 2020).

Gardening in and of itself has been shown to have numerous critically positive effects, such as (1) improving patients' wellbeing (Ng et al. 2018, Scott et al. 2015), (2) improving survival of older people (Lêng and Wang 2016, Mass et al. 2009), (3) lessening stress and decreasing mental health issues (Cipriani et al. 2017, Fjaestad et al. 2023, Han, Park and Ahn 2018), (4) improving outcomes in patients with breast cancer (Bail et al. 2018), and stroke (Ho, Lin & Kuo 2016), and to (5) create feelings of hope and strength (Szabo et.al. 2023). Park and Shoemaker (2009) discussed how to adapt gardening to enable continuity of this activity as one ages. When researching the effect of gardening during the COVID-19 pandemic, Kingsley et al. (2023) noted that gardening was able to reduce mental distress, enhance mental resilience and improve life satisfaction. They found gardeners were able to maintain social connectedness through the pandemic by exchanging seeds/seedlings, connecting through social media, and starting gardens in their front yards in hopes of connecting with neighbors. In a comprehensive systematic review of 40 articles with metanalysis, Pantiru and colleagues (2024) found an overall positive impact of gardening activities on mental status, quality of life, and health status, with both gardening and horticulture therapy showing a significant and positive effect on well-being [effect size (ES) 0.55, 95% confidence interval (CI) 0.23, 0.87, $p < 0.001$]. Gardening specifically as an activity to enhance caregiver/care recipient mutuality has not been explored in the literature.

This study aimed to answer the question, in a rehabilitation hospital treating patients after a disabling injury or illness, can participation of the patient and their caregiver in a gardening program which will extend into the home, decrease stress and improve the self-reported health of the caregiver and increase mutuality in the caregiver/care recipient dyadic relationship? The hypothesis (null) was that there will be no relationship between the gardening project and decreased stress and improved health of the caregiver, and increased mutuality in the caregiver and care recipients approximately 90 days after discharge and that the activity of gardening would not provide a "third space of lifted burden" of the patient's illness.

Theoretical framework. The theoretical work of social scientist Ray Oldenburg provided a conceptual framework for the study of using gardening to provide a "third space." Oldenburg (1999) discussed the first space of living to be home and the second space of living to be work. He then conceptualized a third space as somewhere people "desiring to live a more authentic and connected way of life can gather, put aside the concerns of work and home, and find a third space to be together simply for the pleasures of good company." This "third space can give meaning to an activity that the caregiver and care recipient can share, in which the psychological burden of the caregiver/care recipient situation can be lifted, and the focus shifted to gardening, green plants, window boxes, flowers and plants, and to promote consumption of fresh, healthy produce." Bell and colleagues (2018) discuss how green landscapes can act as 'third places', places that are "affective sanctuaries, that provide otherwise elusive opportunities for emotional refuge and non-demanding social interaction." This framework was seen as a method to create a positive mutual space for patients and their caregivers through gardening.

Materials and Methods

Design. This quasi-experimental mixed method (quantitative and qualitative) study utilized convenience sampling. Potential participants were identified through referral from any team member in the rehabilitation hospital based on the patient or caregiver expressing an interest in the study. Participants were patients admitted to an inpatient rehabilitation facility (IRF) along with their family caregivers (creating the dyad) from an integrated healthcare delivery system in Northern California during the study period from 2020 to 2024. The study was approved by the local Institutional Review Board.

Study participants. The population for the study were patients admitted to an IRF following a debilitating injury or illness (e.g., brain injury, spinal cord injury, stroke) and their informal (unpaid; often family) caregivers. An informal caregiver was identified as the person who would assist the patient with basic and instrumental activities of daily living (e.g. managing money, shopping, preparing meals, household chores) upon discharge.

To participate in the study, both patient and caregiver had to be 18 years of age or older. The patient study inclusion criteria were: (1) patient admitted to the IRF; (2) has a designated family caregiver; (3) has the capacity to consent; and (4) has a planned discharge to home. Additionally, the patient cannot have a severe cognitive impairment as measured by the Brief Interview for Mental Status (BIMS<8). The BIMS is a performance-based cognitive assessment of working memory/recall, temporal orientation, and attention (Shier et al. 2022). The BIMS is scored from 0 to 15 points, with higher scores indicating better cognitive function. The caregiver study inclusion criteria were (1) speak English, Spanish or Tagalog, and (2) identified as the designated family caregiver for the respective patient. Because the participants would potentially be working with soil, those with immunosuppression were not recruited. Also, every person who consented had to be protected from tetanus with proof of an active immunization.

To obtain the appropriate sample size, we looked at Polit and Beck (2017, p 424, 432) in their analysis for sample size for t-tests at .05 to achieve 80% power. For a desired power of 90% to detect at least a medium effect size (Cohen's $f2 \geq 0.15$) at an alpha value of 0.05, the minimum required sample size was each of 63 patients and caregivers. Effect size offers a measure of practical significance in terms of the magnitude of the effect is independent of sample size (Selya et al. 2012).

Patient and caregiver dyads who met the inclusion criteria were recruited, provided informed consent, and enrolled into the study. Participants were provided approximately $100 in adaptive gardening tools and supplies (e.g. soil, microgreens kit, sun hat) midway through the study.

Adaptive gardening tools are specialized tools designed to make gardening more accessible for individuals with physical limitations, disabilities, or reduced strength and mobility. They are often modified or ergonomically designed (e.g. lightweight, ergonomic or cushioned handles for easier grip, extended handles for better reach, lever-assists to reduce the required force to operate), to reduce strain, increase comfort, and enable people of all abilities to garden. A $25 gift card was given to participants following completion of the final survey and interview.

A mixed method design using guidelines from Creswell and Clark (2017) was used to both evaluate the intervention from a quantitative perspective and look deeply into the impact that gardening might have upon patients and their caregivers after discharge from a rehabilitation hospital through hearing the participants voices and lived experience (qualitative perspective).

Instruments. Several instruments were used to measure the caregiver's well-being. The Patient Reported Outcomes Measurement Information System Global Health Survey (GHS) (Hays et al. 2009) consists of 10 items that assess overall physical health, mental health, social health, pain, fatigue, and overall perceived quality of life. The GHS has good reliability (Cronbach's alpha [α]=.81) in a study of family caregivers of elders (Weierbach and Cao 2016). Cronbach's α provides a measure of the internal consistency (the extent to which all the items in a test measure the same concept or construct of a test or scale) and is expressed as a number between zero and one, with a higher number indicating greater internal consistency reliability (Tavakol and Dennick 2011).

The modified Caregiver Strain Index (mCSI) (Sullivan 2002) (Thornton and Travis 2003) is a 13-item survey designed to measure strain related to the provision of care by long-term caregivers. The survey assesses strain in several domains, including financial, physical, psychological/emotional, social, and personal. The CSI has excellent reliability in the population of informal caregivers ($\alpha = .90$) (Thornton & Travis 2003).

The Mutuality Scale (MS) (Archbold et al. 1990) is a 15-item instrument that measures mutuality from both the caregiver and patient perspective. Examples of items are: "How close do you feel to the person you care for?" or "How much do you confide in the person you care for?" Each item is scored on a 5-point Likert-type scale from 0 (not at all) to 4 (a great deal). The total scale score, a mean of all item scores, ranges from 0 to 4: higher scores indicate greater mutuality. The MS has excellent reliability in the population of patients and informal caregivers ($\alpha > .90$) (Pucciarelli et al. 2016).

All patients and caregivers self-reported their survey responses using paper/pencil. The caregivers completed the mutuality scale, GHS and mCSI prior to IRF discharge (T1) and 90-days post-discharge (T2). The patient completed the mutuality scale at T1 and T2. Patient characteristics were collected from the medical record and included diagnosis, age, sex, and race. Caregiver characteristics included relationship to the patient. The Gardening Assessment Tool (Scott, Masser and Pachana 2015) was also administered to assess gardening experience and guide necessary home instructions, but these data were not analyzed.

Intervention. The intervention is outlined in Table 1 and began after obtaining informed consent from both the patient and caregiver. The occupational therapists (OT) worked with patients to identify gardening habits and discuss their Home Space Assessment (HSA). The OTs then made recommendations for adaptive gardening tools (refer to Table 2) to assist the patient in their unique gardening habits and environment, and to meet the patient's gardening goals. Once the tools were selected, the OT then instructed patients on how to use the adaptive tool(s) and reviewed energy conservation techniques, safety precautions and mobility tips, as indicated. The Master Gardener consultant then created an individualized *Garden Plan* which included recommended plants and vegetables based on the patients and caregiver's preference and geographic location, ranging from various herbs and vegetables to flowers and microgreen kits. Each dyad received individual recommendations and supplies to support their *Garden Plan*. The supplies were purchased using the $100 allocated for each dyad.

Once discharged, the garden consultant attempted to follow up with each dyad a total of six times within 90 days to answer questions and provide the dyad additional support. During a period of the study, many dyads were affected by Northern California wildfires. During this time, it was recommended to stay indoors, and our garden consultant recommended indoor gardening activities for the dyads and encouraged them to take time to sit and look out a window and enjoy nature. With these tools, techniques and supplies (e.g. soil, plants, microgreens kit), dyads were able to garden immediately post discharge and use gardening as a means of functional therapy.

Interviews. Each dyad initially consented to an interview upon project completion (90 days after discharge). The program coordinator obtained names and phone numbers and arranged the time for the interview. The person conducting the interviews was a PhD-prepared nurse with training and experience in qualitative methodology with assistance from a registered clinical nurse. Thirty dyads agreed to participate in the interview component of the study. The researcher telephoned the home and, in most cases, both patient and caregiver joined the call together. Notes were recorded throughout the call.

Funding. This research was funded by the Horticultural Research Institute ("HRI"), 2130 Stella Court, Columbus, OH 43215 | 614.884.1155 HRIresearch.org. The HRI was established in 1962 to support and promote horticultural research that benefits the nursery and landscape industry. The mission of HRI is to direct, fund, promote and communicate horticultural research, which increases the quality and value of ornamental plants, improves the productivity and profitability of the nursery and landscape industry, and protects and enhances the environment. The hospital also provided personnel, computer use, printing, and materials to conduct the research.

Table 1. Study Procedure: evaluation, enrollment, intervention and follow-up.

1. Patient admitted to the inpatient rehabilitation hospital with a disabling condition.
2. The Occupational Therapist (OT) completed an initial evaluation which included leisure interests, identifying those with an interest in gardening (either past, present or future).
3. The Recreational Therapist Program Coordinator (PC) screened the initial evaluation looking for those interested in gardening, and/or received an email from a therapist notifying PC of patient's interest in the garden study.
4. PC assessed for inclusion criteria & reviewed patient's chart for tetanus vaccination. If patient did not have recent tetanus vaccination, notified patient and physician. Physician then discussed with patient the benefit of a tetanus shot, and if the patient was agreeable, the physician ordered administration of the vaccine. Caregivers were also assessed to verify they had a current tetanus vaccine.
5. PC approached patients and caregivers who met inclusion criteria to discuss program participation.
6. PC obtained informed consent from patient and caregiver dyad and created their unique Study ID. PC then filed all personal health information into a separate locked filing cabinet.
7. PC obtained baseline assessments (Patient: MS; Caregiver: MS, CHS, mCSI) and Home Space Assessment (HSA).
8. PC recorded above data into a Microsoft Excel spreadsheet and physical copies of the paper assessments (Patient: MS; Caregiver: MS, CHS, mCSI) were filed in a locked cabinet. No identifying personal health information was attached to the instrument or data spreadsheet.
9. PC coordinated with primary OT regarding patient's enrollment, uploaded HSA into patients' chart and routed it to the OT.
10. OT met with dyad and discussed adaptive tools, energy conservation, safety and mobility.
11. OT completed a note in patient's chart with recommendations, then routed/shared finished note to PC.
12. PC made an appointment with dyad and Garden Consultant.
13. PC informed Garden Consultant what the OT's recommendations were regarding adaptive tools and remaining budget.
14. Garden Consultant met with dyad to collaborate on *Garden Plan*.
15. Garden Consultant completed Garden Plan, sent it to PC.
16. PC brought Plan of Care and *Garden Plan* to dyad for review and final confirmation of tools and supplies to be procured.
17. PC purchased necessary equipment and materials (within the $100 per dyad allocation) and provided them to the patient/caregiver prior to discharge.
18. PC met with dyad prior to discharge to review any questions and remind them to expect letters in the mail regarding the 90 day follow up.
19. Once discharged, GC followed up six times via telephone (due to wide geographic area served by regional inpatient rehabilitation facility) with dyad regarding Garden Plan during the 90 days.
20. At end of 90 days, paper surveys (Patient: MS; Caregiver: MS, CHS, mCSI) were mailed to participants in a self-addressed and stamped envelope. Phone call reminders were conducted as needed once per week for three weeks to remind participants to complete and return the surveys.
21. Once the PC received the post-surveys, PC called dyads to invite participants to telephone interviews for qualitative component.
22. Once dyad completed telephone interview, PC mailed out a $25 gift card to the caregiver for use at a local garden supply facility.

Research was guided by the World Medical Association adoption of the Declaration of Helsinki (2008) and the Convention on Human Rights and Biomedicine. This study received Institution Review Board oversight, under Research Expedited number 1553490-7. Patients and caregivers signed consent for all areas of participation. Patient Research Bill of Rights were provided and Health Insurance Portability and Accountability Act (HIPAA) forms were signed and distributed. Participation at each step was voluntary. All instruments were coded, and data was collected anonymously. As noted earlier, immunosuppression and tetanus status screenings were done as prevention of harm.

Data analysis. Patient characteristics were reported using means and standard deviations for continuous/ordinal variables and percentage and frequency for categorical variables. Sensitivity analyses were conducted on each demographic variable to compare the demographic characteristics of those who did and did not complete assessments during the study duration. We utilized the dependent (paired) samples t-test, comparing the baseline (pre) and 90-days (post) measures. We also compared our caregiver and care recipient primary outcome (mutuality) on published Mutuality Scale scores to see how far from the reported average score our sample self-reports to provide a benchmark on the effectiveness of the gardening program. Cases with missing data between two time points (i.e., due to attrition), were deleted listwise in the analyses. SPSS version 25.0 (IBM Corp. 2017) was used for all analyses.

Table 2. Adaptive gardening tools selected to meet each patient's needs.

- Adaptive trowel
- Adaptive weeder
- Adaptive fork
- Adaptive cultivator
- Adaptive long reach trowel
- Adaptive long reach weeder
- Adaptive long reach fork
- Adaptive long reach cultivator
- Adaptive long reach hoe
- Adaptive pruners
- 36-inch 8 pattern watering wand
- Seated stationary gardening bench
- Telescoping rake
- D grip mount
- Supportive arm cuff

For the qualitative component, we interviewed all dyads who agreed to be interviewed at the end of the study, using the Miles and Huberman method of Narrative Inquiry (1984). Qualitative data is collected as words rather than numbers, and the data is reported as themes, with short quotes to illustrate the themes. Each interview was transcribed and entered into ATLAS ti© version 9 (2020), which was used for analyzing words and creating themes for coding. The open-ended questions were analyzed using the Narrative Inquiry method by Miles and Huberman (1994). To ensure rigor of the qualitative analysis, the two interviewers coded the transcripts independently and then came to consensus between themselves and the other two members of the research team on the findings to minimize bias. Line-by-line content was read and coded, grouped into themes, and is demonstrated by selection of example quotations. Interviewers maintained rigor through inter-rater reliability (a measure of how consistently multiple raters assess the same phenomenon [McHugh 2012]), fidelity to the data collection method and analysis strategies,

Table 3. **Study participant characteristics.**

Patient (n=42)	**N (%)**
Diagnosis	
Stroke	31 (62%)
Brain Injury	5 (12%)
Spinal Cord Injury	3 (1%)
Major Trauma	3 (1%)
Average Age	62
Sex	
Male	18 (44%)
Female	23 (56%)
Race	
Hispanic	5 (12%)
Asian	9 (21%)
Black	7 (17%)
White	21 (50%)
Caregiver Relationship	
Spouse/Partner	28 (68%)
Child	8 (20%)
Sibling	1 (1%)
Friend	1 (1%)
Unknown	3 (7%)

bracketing own thoughts, making a grid of codes to combine to themes, and frequently meeting to discuss the theme.

Results and Discussion

A total of 63 patient and family caregiver dyads consented to participate in this study, though only 42 completed all surveys (while 30 participants completed the interview/qualitative component). Participant characteristics are presented in Table 3. The majority of patients experienced a stroke (n=31; 62%), with five (12%) sustaining a brain injury, three (7%) a spinal cord injury, and three (7%) with major trauma. Most patients were female (n=23; 56%), and White (n=21; 50%) with the partner/spouse as caregiver (n=28; 68%). Missing values were less than 5% and missing at random. At 90 days (T2), 21 (33%) of dyads were lost to follow-up (did not complete the surveys nor the phone calls). This attrition was due to the participants not completing the designated follow-up surveys, despite reminders, likely due to the burden of disability on the family system. Sensitivity analysis revealed that there were no differences in demographic variables between completers versus non-completers of the surveys.

Study outcomes are presented in Table 4. A cohort (n=389) of caregiver data from the 2023 annualized inpatient rehabilitation facility 90-day follow up data was used as a historical control for the 90-day study outcomes, when available. Caregiver strain (financial, physical, psychological/emotional, social, and personal strain) in the study sample was 14% lower (favorable) compared to the facility historical control of patients not in the garden study. Global health was evaluated both overall and by each of physical (general physical health, physical functioning, fatigue, pain intensity) and mental health (general mental health, quality of life, emotional distress, social role satisfaction) subdomains. There was a statistically significant (p=.03) decrease in caregiver global health. This is consistent with the literature that illustrates the adverse health effects of caregiving (NASEM 2016, Meyer et al. 2018). However, study participants reported 16% better global health than the historical control (37.05 points versus 31.30 respectively). Consistent with the above, the study sample reported 6% better physical health than the historical control group (14.8 points versus 13.87 respectively). Caregiver mental health decreased, and this was significant (p<.05). However, study participants reported 20% better mental health than the historical comparison (15.02 versus 12.15).

Table 5. **Correlation between patient and caregiver mutuality.**

	Patient: Caregiver mutuality	**Patient: Caregiver mutuality**
	Pre-intervention	**Post-intervention**
R	0.13	0.18

Caregiver mutuality decreased minimally from a mean of 3.77 to 3.70 at 90 days post-discharge. The patients reported higher mutuality than the caregivers. There was a weak correlation between patient and caregiver mutuality both pre- and post-garden intervention.(Table 5). This is consistent with the literature which reflects each of caregiver and care recipient with different experiences of the relationship given the patient disability and burden of caregiving.

Interview. Thirty dyads agreed to participate in the voluntary telephone interview. Interviews were shorter than normal qualitative interviews, possibly because some patients had difficulty talking and/or fatigue because of the disability and caregiving. One patient had complete aphasia, so the caregiver did the speaking. The initial question was "Can you tell me about your experience with the gardening project?" To ensure that the dyads had participated

Table 4. **Study outcomes: strain, health, and mutuality pre- versus post-intervention.**

		Pre-Intervention	**90-day Post-Intervention**			**Historical Comparison (n=389)**
	N Dyads	**M (SD^z)**	**M (SD^z)**	**p**	**Effect size**	**M (SD)**
Caregiver Strain	41	9.56 (5.92)	8.22 (5.23)	0.15	0.23	9.59 (6.75)
Caregiver Global Health	39	38.97 (4.70)	37.05 (5.98)	0.03	0.37	31.30 (1.98)
Caregiver Physical Health	39	15.25 (2.28)	14.8 (2.34)	0.30	0.16	13.87 (1.41)
Caregiver Mental Health	39	16.12 (2.23)	15.02 (2.76)	.004	0.50	12.15 (1.24)
Mutuality: Patient	39	3.82 (0.75)	3.74 (0.83)	0.18	0.26	
Mutuality: Caregiver	35	3.77 (0.82)	3.70 (0.86)	0.32	0.77	

^{z}SD=standard deviation.

together in the gardening project, the dyads were asked "On a scale of 1-10, how much gardening did you do together?". The most frequent result was 10/10 (mode), with 7/10 being the mean and 7/10 being the median. The scores ranged from 2-10. Through line-by-line analysis and grouping of codes into themes, qualitative themes identified were "Mutuality," "Family," "Recovery and Progress," "Healthy Food" and "Materials," "Recommendations".

Mutuality. Patients and caregivers did find that the gardening activities created a sense of mutuality between them. They were able to complete the gardening activity together, and it contributed positivity to a difficult time in their lives. One participant (#13) stated, "(The project) felt like a little bit of stardust, a gift, it lightened us, . . . life can go on, you can do something together. It doesn't have to be difficult." A caregiver (#22) reported, "When we first came home, we were both in profound shock. He felt really helpless; I had to take care of him. This was a project we could do together."

Family. The patients, when they arrived home, were often overwhelmed. The project helped them interact positively with their families and the work together cheered them up. One (#14) stated, "When I would not want to walk, everyone encouraged me, even the kids, and we got to where the whole family would go outside to water. We looked forward to it every evening." Another (#20) stated: "My niece helps me. . .when you do the plants, when the flower blooms, you feel good instead of crying and suffering."

Recovery and progress. The main result expressed by the dyads was the relationship between the gardening and their progress in recovery. These views were stated in almost every interview. One participant (#14) stated "It was therapeutic to go out and be able to water– throughout all the stages in my recovery. . . It got me to go outside doing something. As the plants grew, I grew stronger. In the beginning I could not do anything but watch (others) work. My balance was bad. My rehab really helped. I am 4 months post op now and doing very well." A participant (#22) showed their strength and motivation, "The garden project helped me, I rototilled and sat down, rototilled and sat down, pruned roses from the wheelchair; when I was standing, I pruned my fruit trees. I do what I can, I take a break, I recover and do it again. I evaluated my situation, accepted, adapted, and moved forward." Another (#7) stated, "When I was able to go back to doing stuff, I felt really good about it, but it was not easy being paralyzed. I thought I would be able to do a lot more than I could do. I had to adjust to what I could do. It made me realize my limitations. But it helped me get back into something normal." In general, the gardening project was seen as motivating. A participant (#16) stated, "It motivated me. Forced me to get something done. Made a difference. It gave me benchmarks to work towards. I was able to do more and more. . . it motivated me. I used one arm to try to get the other arm on the broom to sweep up the leaves. It kept me involved."

Healthy food. Growing and eating healthy food was an unanticipated finding. Many of the patients and caregivers talked about the joy of eating what they grew. Comments included, "We ate the vegetables we grew in an omelet" (p18). "We picked and ate tarragon, kale, oregano, fresh herbs, made pasta, grew basil" (#17). Again, healthy food contributed to the relationship, "Mutuality was encouraged as we worked together on planning meals and recipes to eat with the produce we grew" (#2).

Materials and recommendations. At the end of the interviews, we asked the dyads to share whether they had used any of the gardening tools and supplies we sent home with them and what recommendations they had about the project. We found that the adaptive gardening tools we had provided for those with weakness or paralysis were very helpful and "made all the difference" (#21). A participant (#19) stated, "I used the adaptive equipment. It got me to go outside doing something." "Adaptive rake and spade really helped me, rolling bench, too." "Adaptive digging tools and shears were perfect" (#2). "Adaptive wand and rake and snippers and hat were excellent" (#30). "I am still in a wheelchair but (with the tools) I am able to water and plant and pick vegetables" (#9).

Recommendations made will be helpful to a replication of this study. This facility has gardens in the rehabilitation unit. Some participants advised increased use of the garden area during recovery while in the hospital. One (#15) stated, "Have gardening be part of schedule in the hospital. Another (#23) stated "it should be part of agenda; it is so important."

Limitations. This research, which was funded to be carried out in 2020, was disrupted by the COVID-19 pandemic and by local wildfires. Because hospitals had to limit any visitation during COVID, the recruitment of caregivers and patient dyads could not take place until 2022. Because we lost 33% of the dyads for the follow-up of the second set of questionnaires at T2, we did not meet power in our findings. It is possible that had we have done so, quantitative results in mutuality, caregiver strain and caregiver quality of life may have differed. Another limitation was that there were various OTs involved with the intervention. This may have impacted the results. Additionally, findings may not be generalizable to those outside of our service population. The participants in the sample were all insured persons who were being discharged to home with a family caregiver. Both the patient and caregiver had to be available, consenting and cognitively intact. Rigor in methodology, using the GRAMMS (O'Cathain, Murphy and Nichol, 2008), COREQ (Tong, Sainsbury and Craig 2007) and Creswell and Plano (2017) guidelines helped to establish believability of findings.

The lower caregiver strain of the study sample compared to the historical control (Table 4) illustrates the positive effect the gardening program had on family caregivers. Although there was a decrease in the self-evaluation of global health, the study participants reported better health than those in the historical control group. A systematic review of studies on mutuality between caregivers and care recipients illustrated that mutuality progressively decreases along the caregiving trajectory (Park & Schumacher 2014). Additionally, a longitudinal study of 158 stroke dyads by Godwin and colleagues (2013) evaluated stroke dyads at discharge from inpatient rehabilitation, at 6 months and at one year, and provided data to compare with this study sample. They identified that the greatest decrease in mutuality for both patient and caregiver is in the first 6 months after inpatient discharge from the rehabilitation facility. Different from the Godwin study, the decline in mutuality for caregivers in this study was minimal (3.77 at baseline; 3.70 at 90 days), illustrating a potential protective effect of the gardening intervention. Archbold et al (1992) identified four dimensions of mutuality: love and affection, shared pleasurable activities, shared values, and reciprocity. This study supports the benefits of engaging in a shared pleasurable activity, such as gardening, to mitigate the adverse health effects of family caregiving and promote health of the family unit.

Recommendations for clinical practice and research. Assessment of family caregivers using a validated tool, such as the Preparedness Assessment for the Transition Home (PATH)© (Camicia et al. 2021, Camicia, Lutz and Theodore 2023), that includes items such as the amount of conflict in the relationship, can be used to identify the need for targeted mutuality-building interventions, such as gardening, in the caregiver plan of care (Camicia, Laslo and Lutz 2021).

Several conclusions can be drawn from this study. In a Mixed Methods study (Creswell and Clark 2017), the researcher uses interview words to support or refute the findings of the quantitative survey. In our interviews, we focused on the concept of mutuality between patient and caregiver. Both patients and caregivers expressed appreciation for the gardening project. They clearly felt gardening together supported their mutuality and enhanced patient recovery. Although mutuality scores did not significantly improve in the quantitative component of the study, the description of mutuality achieved in the interviews was robust. Participants described that there was a relationship between the gardening project and increased mutuality in care recipients and caregivers after discharge. We did not find the gardening project to decrease caregiver stress, although when mental health scores were compared between the gardening group and the facility historical control group, those gardening had 20% higher mental health scores. The dyadic gardening intervention appears to have had a protective effect on caregiver strain, caregiver health, and mutuality. Gardening as described in the interviews did provide Oldenburg's "third space of lifted burden" on the patient's illness.

Literature Cited

Archbold, P.G., B.J. Stewart, M.R. Greenlick, and T. Harvath. 1992. *In*: Key aspects of elder care: Managing falls, incontinence, and cognitive impairment . Sandra G. Funk (author). Springer Publishing. Chapel Hill, NC. 360 p.

ATLAS.ti Scientific Software Development GmbH. 2023. ATLAS.ti (Version 8) [Qualitative data analysis software]. https://atlasti.com. Accessed May 6, 2019.

Bail, J.R., A.D. Frugé, M.G. Cases, J.F. De Los Santos, J.L Locher, K.P. Smith, . . . W. Demark-Wahnefried. 2018. A home-based mentored vegetable gardening intervention demonstrates feasibility and improvements in physical activity and performance among breast cancer survivors. Cancer (0008543X), 124(16):3435.

Bell, S.L., R. Foley, F. Houghton, A. Maddrell, and A.M. Williams. 2018. From therapeutic landscapes to healthy spaces, places and practices: A scoping review. Soc Sci Med. 196:123-130. https://doi.org/10.1016/j.socscimed.2017.11.035.

Camicia, M.E., M.A. Laslo, and B.J. Lutz. 2021. Implementing a caregiver assessment and tailored plan: an emerging case management competency. Prof Case Manag, 26(4):205-213. https://doi.org/10.1097/NCM.0000000000000513.

Camicia, M., B.J. Lutz, D. Stram, L.Y. Tucker, C. Ray, and B.R. Theodore. 2021. Improving caregiver health through systematic assessment and a tailored plan of care. West J Nurs Res. 44(3):307-318. doi:10.1177/01939459211045432.

Camicia, M., B.J. Lutz, and B.R. Theodore. 2023. The preparedness assessment for the transition home after stroke predicts key domains of caregiver health. Topics in Stroke Rehabilitation 30(4):384-392. https://doi.org/10.1080/10749357.2022.2038835.

Centers of Disease Control and Prevention. 2023. Disability and health data system. https://www.cdc.gov/ncbddd/disabilityandhealth/dhds/overview.html. Accessed May 6, 2019.

Cipriani, J., A. Benz, A. Holgren, A. Kinter, McGarry, and Rufino. 2017. A systematic review of the effects of horticultural therapy on persons with mental health conditions. Occupational Therapy in Mental Health, 33:1, 47-69. https://doi.org/10.1080/0164212X.2016.1231602n.

Creswell, J. and V.L.P. Clark. 2017. Designing and conducting mixed methods research. Sage Publications. Thousand Oaks, CA. 520 p.

Family Caregiver Alliance. 2016. https://www.caregiver.org/caregiver-statistics-demographics. Accessed May 6, 2019.

Fjaestad, S., J. Mackelprang, T. Sugiyama, M. Chandrabose, N. Owen, G. Turrell, and J. Kingsley. 2023. Associations of time spent gardening with wellbeing and life satisfaction in mid-to-late adulthood. Journal of Environmental Psychology 87:101993. https://doi.org/10.1016/j.jenvp.2023.101993.

Gibbons, S., A. Ross, and L. Wehrlen, et al. 2019. Enhancing the cancer caregiving experience: Building resilience through the role adjustment and mutuality. European Journal of Oncology Nursing: 43(2):E71-E79. https://doi.org/10.1016/j.ejon.2019.09.004.

Han, A.R., S.A. Park, and B.E. Ahn. 2018. Reduced stress and improved physical functional ability in elderly with mental health problems following a horticultural therapy program. Complement Ther. Med. 2018 Jun, 38:19-23. https://doi.org/10.1016/j.ctim.2018.03.011. Epub 2018 Mar 28.

Hays, R.D., J.B. Bjorner, D.A. Revicki, K.L. Spritzer, and D. Cella. 2009. Development of physical and mental health summary scores from the patient-reported outcomes measurement information system (PROMIS) global items. Qual. Life Res. 2009 Sep, 18(7):873-80. doi: 10.1007/s11136-009-9496-9. Epub 2009 Jun 19. PMID: 19543809; PMCID: PMC2724630.

Ho, S.H., C.H. Lin, and F.L. Kuo. 2016. The effects of gardening on quality of life in people with stroke. Work 54(3):557–567. https://doi.org/10.3233/WOR-162338.

IBM Corp. 2017. IBM SPSS statistics for Windows, Version 25.0. IBM Corp. Accessed May 6, 2019.

Institute of Medicine, Board on Population Health and Public Health Practice, Committee on Living Well with Chronic Disease: Public Health Action to Reduce Disability and Improve Functioning and Quality of Life. 2011. Living well with chronic illness: A call for public health action. https://nap.nationalacademies.org/catalog/13272/living-well-with-chronic-illness-a-call-for-public-health. Accessed May 6, 2019.

Kingsley, J., K. Donati, J. Litt, N. Shimpo, et al. 2023. Pandemic gardening: A narrative review, vignettes and implications for future research. Urban Forestry and Urban Greening 87: 128062 (September 2023).

Lêng, C.H. and J.D. Wang. 2016. Daily home gardening improved survival for older people with mobility limitations: an 11-year follow-up study in Taiwan. Clin. Interv. Aging. 2016 Jul 15, 11:947-59. doi: 10.2147/CIA.S107197.

McHugh, M.L. 2012. Interrater reliability: the kappa statistic. Biochem. Med. (Zagreb) 22(3):276-282.

Meyer, K., N. Kaiser, D. Benton, S. Fitzpatrick, Z. Gassoumis, K. Wilber, and the California Task Force on Family Caregiving. 2018. Picking up the pace of change for California's family caregivers: A report from the California task force on family caregiving. Los Angeles, CA: USC Leonard Davis School of Gerontology. https://cacfc.org/wp-content/uploads/2018/07/USC_CA_TFFC_Report_Digital-FINAL.pdf. Accessed May 6, 2019.

Miles, M.B. and A.M. Huberman. 1994. Qualitative data analysis: An expanded sourcebook, 2nd Edition. Newbury Park, CA: Sage Publications. 317 p.

McCusker, J., S.D. Lambert, M.J. Yaffe, M.G. Cole, M. Hidalgo, E Amir, … E. Belzile. 2019. Pilot study of a transitional intervention for family caregivers of older adults. Canadian Journal on Aging 38(2):210–221. https://doi.org/10.1017/S071498081800051X.

National Academies of Sciences, Engineering and Medicine (NASEM) in the Families Caring for An Aging America. 2019. http://www.nationalacademies.org/hmd/Reports/2016/families-caring-for-an-aging-america.aspx. Accessed May 9, 2019.

Ng, K.S.T. A. Sia, M.K.W. Ng, C.H. Tan, H.Y. Chan C.T.Y. Tan, I. Rawtaer, L. Feng, R. Mahendran, K.S. Ng, A. Larbi, M.K. Ng, G.L. Gan, E.H. Kua, and R.C. Ho. 2018. Effects of horticultural therapy on elderly' health: randomized controlled trial. Int. J. Environ. Res. Public Health 15(8):1705. https://doi.org/10.3390/ijerph15081705.

O'Cathain, A., E. Murphy, and J. Nicholl. 2008. The quality of mixed methods studies in health services research. Journal of Health Services Research & Policy: 13(2):92-98. https://doi.org/10.1258/jhsrp.2007.007074.

Oldenburg, R. 1999. The great good place: Cafes, coffee shops, bookstores, bars, hair salons, and other hangouts at the heart of a community, 3rd Edition. Cambridge, MA: Da Capo Press. 384 p.

Panțiru, I., A. Ronaldson, N. Sima, et al. 2024. The impact of gardening on well-being, mental health, and quality of life: an umbrella review and meta-analysis. Syst. Rev. 13:45. https://doi.org/10.1186/s13643-024-02457-9.

Park, E.O. and K.L. Schumacher. 2014. The state of the science of family caregiver-care receiver mutuality: a systematic review. Nursing Inquiry 21(2):140–152. https://doi-org.kaiserpermanente.idm.oclc.org/10.1111/nin.12032.

Park, S.A. and C. Shoemaker. 2009. Observing body position of older adults while gardening for health benefits and risks. Activities, Adaptation and Aging, 33:1, 31-38, https://doi.org/10.1080/01924780902718582.

Polit, D. and C. Beck. 2017. Nursing research, generating and assessing evidence for nursing practice, 10th edition. Lippincott, Williams and Wilkins. Philadelphia, PA. p. 424, 432.

Pucciarelli, G., H.G. Buck, C. Barbaranelli, S. Savini, S. Simeone, R. Juarez-Vela, R. Alvaro, and E. Vellone. 2016. Psychometric characteristics of the mutuality scale in stroke patients and caregivers. The Gerontologist, 56(5):e89–e98. https://doi-org.kaiserpermanente.idm.oclc.org/10.1093/geront/gnw083 .

PROMIS, Patient-Reported Outcomes Measurement Information System, and the PROMIS logo are marks owned by the U. S. Department of Health and Human Services. 2023. http://www.healthmeasures.net/explore-measurement-systems/promis. Accessed December 23, 2024.

Scott, T.L., B.M. Masser, and N.A. Pachana. 2015. Exploring the health and wellbeing benefits of gardening for older adults. Ageing and Society 35:2176–2200. Cambridge University Press. Cambridge, England.

Selya, A.S., J.S. Rose, L.C. Dierker, D. Hedeker, and R.J. Mermelstein. 2012. A Practical Guide to Calculating Cohen's f(2), a Measure of Local Effect Size, from PROC MIXED. Frontiers in Psychology 3:111. https://doi.org/10.3389/fpsyg.2012.00111.

Shier, V., M.O. Edelen, T.L. McMullen, S.C. Ahluwalia, E.K. Chen, S.E. Dalton, S. Paddock, A. Rodriguez, C.D. Sherbourne, S. Mandl, T. Mota, and D. Saliba. 2022. Standardized assessment of cognitive function of post-acute care patients. Journal of the American Geriatrics Society 70(4):1001–1011.https://doi.org/10.1111/jgs.17652.

Streck, B., D. Wardell, G. Wood. 2020. Family caregiver-receiver mutuality: A concept analysis. Advances in Nursing Science, 43: E71-E79. https://doi.org/10.1097/ANS.0000000000000302.

M.T. Sullivan. 2002. Caregiver strain index. J. Gerontol Nurs. 28(8):4-5.

Szabo, M., A. Dumitras, D. Mircea, et al. 2023. Touch, feel, heal. The use of hospital green spaces and landscape as sensory-therapeutic gardens: a case study in a university clinic. Frontiers in Psychology 14. https://doi.org/10.3389/fpsyg.2023.1201030.

Tavakol, M. and R. Dennick. 2011. Making sense of Cronbach's alpha. International Journal of Medical Education 2:53–55. https://doi.org/10.5116/ijme.4dfb.8dfd.

Thornton, M. and S.S. Travis. 2003. Analysis of the reliability of the modified caregiver strain index. J. Gerontol. B. Psychol. Sci. Soc. Sci. Mar, 58(2):S127-32. https://doi.org/10.1093/geronb/58.2.s127. PMID: 12646602.

Tong, A., P. Sainsbury, and J. Craig. 2007. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int. J. Qual. Health Care 19(6):349-357.

Weierbach, F.M. and Y. Cao. 2016. A model of health for family caregivers of Elders. Healthcare (Basel). Dec 22, 5(1):1. https://doi.org/10.3390/healthcare5010001. PMID: 28025490; PMCID: PMC5371907.