

An aerial photograph of a garden. In the upper left, there is a central octagonal structure with a light-colored interior and a darker border, surrounded by a dirt path. Several circular topiary bushes are scattered around. To the right, a large, dense, green tree dominates the middle section. Below it, a winding dirt path leads through more greenery. The overall scene is a lush, well-maintained garden with various plant life and a central architectural element.

Design of hospital healing gardens linked to pre- or post-occupancy research findings

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Angeliki Triandafillou Paraskevopoulou, Emmanouela Kamperi

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Design of hospital healing gardens linked to pre- or post-occupancy research findings



Angeliki Triandafillou Paraskevopoulou*, Emmanouela Kamperi

Laboratory of Floriculture & Landscape Architecture, Department of Crop Science, School of Agricultural Production, Infrastructure and Environment, Agricultural University of Athens, Iera Odos 75, 11855 Athens, Greece

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Abstract

This work examined the evidence-based design (EBD) and post-occupancy research of hospital healing gardens. The lack of statutory design guidelines raises concerns on how such gardens are created and whether they meet the intended design purpose. This issue is particularly important for hospitals because a neutral or even a negative effect on users can be generated. A systematic analysis of the literature in two databases (Scopus and Web of Science) was undertaken. Results showed that pre- and post-occupancy research findings on hospital healing garden design are sparse and design recommendations vary among users. Despite the lack of research on the design of healing gardens, the review showed that while post-occupancy research findings evaluate the effectiveness of design recommendations, pre-occupancy research findings, combined with site analysis, constitute a traditional approach followed in landscape architecture practice and determine the site and user features that must be addressed for each hospital. Pre- and post-research findings must be considered in the design process to create a “successful” healing garden. A summary of EBD recommendations for different users is presented, and the need to enrich the existing amount of EBD recommendations is highlighted.

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*Corresponding author.

E-mail addresses: aparas@aua.gr (A.T. Paraskevopoulou), emmakamperi@hotmail.com (E. Kamperi).

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1. Introduction

Over the years, timeless interest has led to a considerable amount of study on the influence of landscape and nature's effects on human health and well-being (Nightingale, 1860; Appleton, 1975; Ulrich, 1979, 1984; Tzoulas et al., 2014; Ulrich et al., 2008; Kaplan and Kaplan, 1989; Kaplan, 1995; Cooper Marcus and Barnes, 1999a; Ward Thompson et al., 2010; Ward Thompson, 2011; Chawla, 2015). These studies gradually informed the design of contemporary healing gardens, which began to appear in the mid-1990s (Cooper Marcus and Sachs, 2014). The design of the first contemporary healing gardens had no precedent to "consult" and was based on the designers' perspective, which failed at times. Although several authors based on research studies in an attempt to provide design principles for healing gardens and thus fill the gap between research and design practice (Tyson, 1998; Gerlach-Spriggs et al., 1998; Cooper Marcus and Barnes, 1999b), no statutory guidelines have been produced worldwide. Policymakers realized this need and requested evidence-based designs (EBDs) for hospitals and healthcare facilities (Shukor et al., 2012).

Healing gardens are the evolving concept of designing spaces that are intended to heal with predominant greenery; the term consists of two words: "healing" and "garden." According to the Oxford Dictionary, the verb "heal" means "cause (a wound, injury, or person) to become sound or healthy again" and the noun "garden," "a piece of ground adjoining a house, in which grass, flowers, and shrubs may be grown." Researchers' perspectives on the application of the term "healing gardens" vary, thereby leading to a large number of definitions. Ulrich (1999) defined healing gardens as "a variety of garden features that have in common a consistent tendency to foster restoration from stress and have other positive influences on patients, visitors, and staff or caregivers. To qualify as a 'garden' the feature should contain prominent amounts of real nature such as green vegetation, flowers, and water."

Cooper Marcus and Barnes (1999a) referred to healing gardens as "a space to look out at, and a space for passive or quasi-passive activities such as observing, listening, strolling, sitting, exploring, and so on." Eckertling (1996) defined such gardens as "a garden in a healing setting designed to make people feel better." Considering the influence of landscape and nature's restorative effects on humans, the lack of a precise definition for "healing garden," and the definition by the World Health Organization of health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity," healing gardens today, although predominantly associated with hospitals and healthcare facilities, are not necessarily strictly confined to such environments and are found in other public or semi-public spaces, such as parks and campuses (Alt, 1999; Lau and Yang, 2009; Ivarsson and Grahn, 2012; Grahn et al., 2017). Certain healing gardens in hospitals and healthcare facilities, but more so in public or semi-public spaces, do not meet the basic design principles of healing gardens. With the lack of statutory guidelines, any practitioner and private initiative can, in theory, design and construct an open space and call it a healing garden. This situation is alarming, considering that a supposed

healing garden can generate a neutral or even negative effect instead of fulfilling its intended purpose. Seeing in Enniskillen, Northern Ireland that an important goal for the development of a new hospital is the creation of a site designed as an integral part of the healing process is promising but nonetheless raises concerns (Sullivan et al., 2014). The design and construction of hospital and healthcare buildings worldwide usually conform to statutory guidelines that have been proven effective by research; working toward this direction for the design and construction of healing gardens, which can play a pivotal role in supporting the well-being and health of the people working, staying, or visiting these buildings, is necessary.

Well-designed healing gardens in hospitals and healthcare facilities reduce stress, improve clinical outcomes, provide opportunities for escape from stressful clinical settings, heighten patient/consumer satisfaction with healthcare providers, increase care quality, and consequently improve economic outcomes by reducing the costs of care (Ulrich, 2002). Medicine conceives well-being from a physiological and psychological perspective and in the context of health but has only rarely dealt with the relationship between well-being and landscape or open spaces at the least (Council of Europe, 2006). In recent years, interest in the psychological or emotional needs of patients has been growing along with the traditional concerns, including infection risk exposure and functional efficiency, in the design of hospitals (Ulrich, 2001). Landscape architecture is a multidisciplinary field, individually examining each open space on the basis of site analyses and integrating evidence-based information in the design process of open spaces. Thus, landscape architecture can contribute to the design of healing gardens. Hospitals and healthcare facilities are generally either long or short term (acute care facilities) and address cases that are either routine medical and surgical or specialized, such as trauma, rehabilitation, pediatrics, geriatrics, psychiatry, and so on. Hospitals and healthcare facilities typically cater to the needs of three groups of people: patients, staff, and visitors. The relationship among the type of hospital or healthcare facility, the abovementioned groups of people and their needs, and healing gardens are different. These aspects must be considered in the design of a healing garden.

This research aims to examine the EBD and post-occupancy evaluation of existing healing gardens of hospitals, summarize EBD recommendations for healing gardens for different users, inform landscape architects, healthcare providers, and potential policymakers, and identify any potential need for further research.

2. Methods

This research focused on literature evaluating the design of existing healing gardens for healthcare facilities, primarily hospitals (Figure 1). The online search databases used were Web of Science and Scopus. The database search took place in the title, abstract, or keyword fields of works published in the past 30 years. The keywords used for the search included exact terms (enclosed in quotation marks " ") and combinations of terms (with use of "or"). The terms used were "healing garden," "healing landscape,"

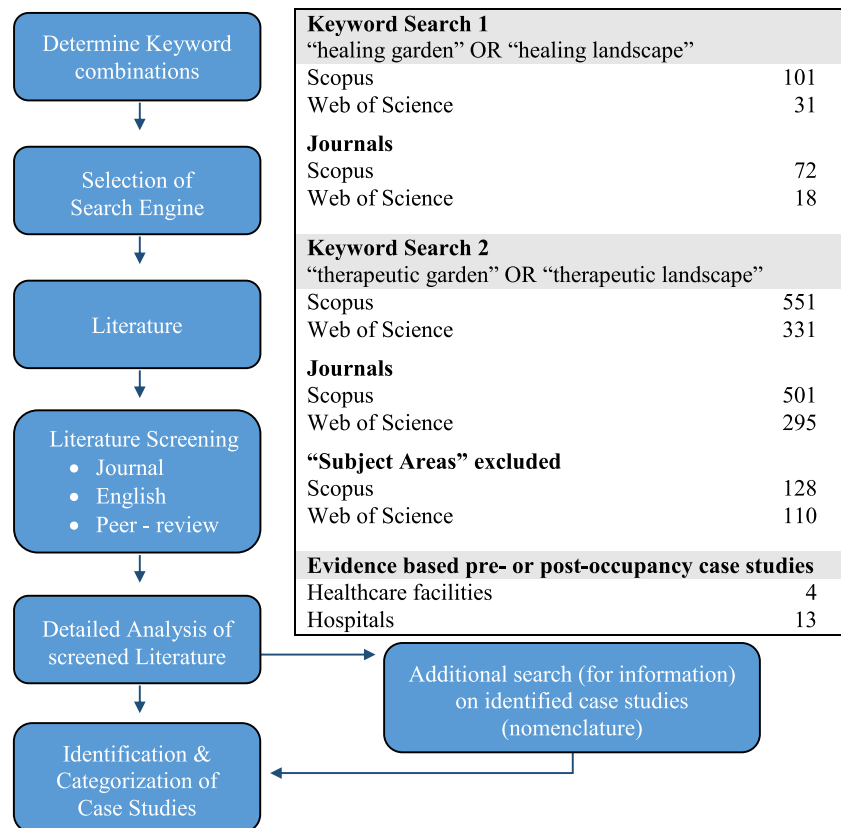


Figure 1 Flowchart of the followed systematic analysis of the literature.

“therapeutic garden,” and “therapeutic landscape.” The keyword search was divided into two main groups; the first group yielded 101 in Scopus and 31 in Web of Science, and the second group yielded 551 in Scopus and 331 in Web of Science publications (Figure 1). Both searches were refined to peer-reviewed literature published in journals and written in English. The term “therapeutic landscape” is also used in medical literature to describe distinctive therapeutic or healing methods of particular diseases. Therefore, in the second group, articles in the subject areas of medicine; biochemistry, genetics, and molecular biology; pharmacology genetics and molecular biology; and immunology and microbiology were excluded in the search of the Scopus database. Works in the categories of oncology; biochemical research methods; biophysics; medicine research experiments; chemistry analytics; chemistry medicine, chemistry multidisciplinary; genetics heredity; immunology; infectious diseases; biochemistry molecular biology; transplantation; veterinary sciences; clinical neurology; pharmacology pharmacy; hematology; gastroenterology hepatology; urology nephrology; endocrinology metabolism; radiology nuclear medicine medical imaging; and cell biology were excluded from the search of the Web of Science database. In total, 128 and 110 publications were obtained from Scopus and Web of Science, respectively. The titles and abstracts of these publications were screened carefully for case studies of healing gardens in hospitals and healthcare facilities that were based on pre- and/or post-occupancy research; 54 publications were considered relevant.

After full text screening, 17 publications were selected. Most cases studied included hospitals ($n = 13$), followed by

residential healthcare facilities ($n = 4$). The healing garden case studies identified in each selected publication for study ($n = 17$) were categorized initially on the basis of hospital or healthcare facility type. The types of medical care the studied hospitals offered were cancer, general (multidisciplinary medical expertise), mental disorders, obstetrics, and pediatrics, and the types of residential healthcare facilities covered mental disorders and geriatrics. With the considerable variety and amount of information contained in all 17 publications and the constraint posed by the length of the review paper, the review focused on healing gardens in hospitals. The case studies ($N = 13$) were further studied in detail to determine the research method used (pre- and post-occupancy), design aim, design description, identified main activities, identified barriers, and need for further research.

The publications represented six countries; most studies were from the United States of America (U.S.A.) ($n = 9$), and one work each were from Australia, China, France, and Italy. The healing garden case studies identified in each selected publication for study ($N = 13$) were categorized on the basis of medical care type, location, developed year, size, and level (Table 1). According to the available information, the origins of the healing garden designs varied among a large architecture firm, design team, landscape architect, steering committee, and volunteers, and the sizes of the healing gardens were small ($100\text{--}600\text{ m}^2$), middle ($\approx 4500\text{ m}^2$), and large ($\geq 10,000\text{ m}^2$); the gardens were mainly constructed on the ground or at various levels integrated within buildings (Table 1). Most of the healing gardens were designed for

Table 1 Categorization and basic descriptive information of healing gardens in hospitals published in peer review journals and based on pre- or post- occupancy research.

Medical care type	Healthcare facility	Location	Designer	Healing garden	Year	open space size (m ²)	Level	Users: patients (P) visitors (V) staff (S)	References
Pediatric	Children's Hospital and Health Center	San Diego, U.S.A.	Healing Environment Steering Committee	located on the campus: Leichtag Family Healing Garden	1997	372	ground	P, V, S	Whitehouse et al. (2001)
	Children's hospital	Southern California, U.S.A.	Design team: - Tony Figueras, Staff Architect - Michael Kato, Landscape Architect - Kim Emerson, Artist - T.J. Dixon, Artist/Sculptor - Thomas R. Remensperger, PE, President, Sundt Construction	Carley's Magical Gardens (a group of 3 gardens located on the campus created in memory and celebration of a little girl who had been a cancer patient): Garden of dreams (GD) Friendship garden (FG) Buggy garden (BG)	1999			P, V, S	Sherman et al. (2005); Children's Health Queensland Hospital and Health Service, 2015
						583			
						430	ground		
	Three Children's hospital	Texas, U.S.A.		Five open spaces, open during daytime, with disabled access, visible and accessible from popular hospital areas: outdoor space A outdoor space B outdoor space C outdoor space D outdoor space E		102	ground	P, V, S	Pasha (2013)
	Lady Cilento Children's Hospital (LCCH)	Brisbane, Australia	Conrad Gargett Riddell and Lyons Architecture	4/11 healing gardens integrated into the hospital layout: Secret garden (SG) Adventure garden (AG) Staff garden (StG) Babies garden (BG)	2014				Reeve et al. (2017)
						200	5	P, V, S	
						500	6	P, S	
						350	7	S	
						285	9	P, S	

Table 1 (continued)

Medical care type	Healthcare facility	Location	Designer	Healing garden	Year	open space size (m ²)	Level	Users: patients (P) visitors (V) staff (S)	References
Cancer	Roswell Park Cancer Institute	Buffalo, New York, U.S.A.		Kaminski Park & Gardens	2000	10,117		P, V, S	Busa (2013)
	Moores Cancer Center, Thornton Hospital	San Diego, Southern California, U.S.A.	Kathryn Sptiz and Associates, Landscape Architects, Los Angeles, California	three healing gardens, part of university campus: Ben D. and Sheri L. Kelts Bamboo Court (KBC) Howard Cohen Healing Garden (HCG) Toby Cohen Healing Gardens (TCG)	2005 (building)			P, V, S	Valente and Marcus (2015)
Mental Disorders	Villa di Salute clinic for mental disorders	Trofarello, Italy		Villa Bianca garden		4510	278 m altitude	P, V, S	Erbino et al. (2015)
General	Danderyd Hospital Rehabilitation Clinic	Sweden	Gustav Alm, landscape architect based on teamwork with staff	Horticultural Therapy Garden	1986	600 (20 × 30)			Söderback et al. (2004)
	St. Joseph Regional Health Care Center	Bryan, Texas, U.S.A.		courtyard surrounded by three-storey buildings	detailed for construction	436		S	Naderi and Shin (2008)

Table 1 (continued)

Medical care type	Healthcare facility	Location	Designer	Healing garden	Year	open space size (m ²)	Level	Users: patients (P) visitors (V) staff (S)	References
	University Hospital of Nancy	Nancy, France	Working group formed by physicians, nurses, a psychologist, landscape gardeners, engineers, technicians and communication service specialists	Art, Memory and Life garden	2010	4000		P, V, S	Rivasseau Jonveaux et al. (2013)
	Lourdes Hospital	Binghamton-New York, U.S.A.	Julann Ashman, Certified Radiation Oncology Nurse; Master Gardener from local Cornell Cooperative Extension garden; supported by the hospital's Foundation Board of Directors and the community	Lourdes Healing Garden	2014			P, V, S	Ashman (2016)
	Fifth Xiangya Hospital	Changsha, China	Payette leading architectural design firm						Rawlings (2017)
Obstetrics	Family Birth Center, St. Mary's Janesville Hospital	Janesville, Wisconsin, U.S.A.	Built by the Hospital Foundation					P, V, S	McNall (2015)

Table 2 Summarized information of pre- or post- occupancy research on the design of hospital healing gardens for different users (patient types, hospital staff or the broader community) published in peer review journals.

Healthcare facility	Studied healing garden	User	Pre-occupancy research	Post-occupancy research	Research aim	Research method used	Proposed further research	References
Children's Hospital and Health Center San Diego, U.S.A.	Leichtag Family Healing Garden	children		empirical evidence	- evaluate patient, visitor, staff perceptions and utilization of garden - determine barriers to use - investigate perception differences on garden features between children and adults	- behavioral observations (>200 people) - surveys and interviews: - 28 adult patients - 53 family members and staff - 16 children/ adolescent out- or in- patients - 6 siblings of patients	- the ideal amount of hard landscape vs soft landscape - requirements of chronically ill and disabled children	Whitehouse et al., 2001
Children's Hospital Southern California, U.S.A.	"Carley's Magical Gardens" (a group of 3 gardens located adjacent to the Cancer Center):Garden of dreams (GD) Friendship garden (FG) Buggy garden (BG)	children		empirical evidence	- examine across gardens, differential usage patterns (patient, visitor or staff) - the relationship between garden and patient room window use - person levels of anxiety, sadness, anger, worry, fatigue, and pain inside hospital compared to within garden	- behavioral observations	- healing garden's effect on health outcomes - factors that may affect window use (provision of privacy)	Sherman et al., 2005
Three Children's hospitals Texas, U.S.A.	5 open spaces, open during daytime, with disabled access, visible and accessible from popular hospital areas outdoor spaces: A, B, C, D, E	children		empirical evidence	- identify barriers to use of outdoor spaces in Texas pediatric health-care facilities (effect of inadequate shade, uncomfortable or limited seating on duration and frequency of visits)	- surveys: - 76 family members - 70 staff members	- reasons that gardens remain undiscovered in hospitals - on visitors with patients unable or not allowed to visit outdoor spaces - impact on garden visitation of: - amenities for children - more planting	Pasha, 2013

Table 2 (continued)

Healthcare facility	Studied healing garden	User	Pre-occupancy research	Post-occupancy research	Research aim	Research method used	Proposed further research	References
Lady Cilento Children's Hospital (LCCH) Brisbane, Australia	11 healing gardens integrated into the hospital layout; Secret garden (SG) Adventure garden (AG) Staff garden (StG) Babies garden (BG)	children	children, young people, and their families consulted during early planning (results not presented)	empirical evidence	- examine: - perceptions and value by patients, patient families, and staff - types of activities undertaken in these spaces - how the benefits of time spent in the garden compared with the intended design outcome	- comments in visitors' books (bench diaries) in 4/11 gardens over a period of four weeks	- therapeutic benefits from time spent in the gardens (the relationship between physiological markers of stress and time spent in the gardens) - therapy conducted in the garden (impact of garden visits with rates of healing) - quantify and monetize benefits for all garden users	Reeve et al., 2017
Roswell Park Cancer Institute Buffalo, New York, U.S.A.	Kaminski Park & Gardens	cancer		qualitative		- personal experience	- understand people who use healing gardens	Busa, 2013
Moore's Cancer Center, Thornton Hospital San Diego, Southern California, U.S.A.	three healing gardens: Ben D. and Sheri L. Kelts Bamboo Court (KBC), Howard Cohen Healing Garden (HCG) and Toby Cohen Healing Gardens (TCG)	cancer		empirical evidence	- identify user needs	- informal observations - survey	- quantitative analysis of surveys that provide numerical data and indicator parameters in reference to different users and groups of users for each case	Valente and Marcus, 2015
Lourdes Hospital Binghamton, New York, U.S.A.	Lourdes Healing Garden	cancer	the research literature on the benefits of gardening and nature on human well-being					Ashman, 2016

Table 2 (continued)

Healthcare facility	Studied healing garden	User	Pre-occupancy research	Post-occupancy research	Research aim	Research method used	Proposed further research	References
Danderyd Hospital Rehabilitation Clinic Sweden	Horticultural Therapy Garden	physical disabilities following (neurological and/or musculoskeletal impairment)	Gustav Alm landscape architect based on teamwork with staff	will follow			- evaluate the effectiveness of intervention approaches	Söderback et al., 2004
University Hospital of Nancy Nancy, France	Art, Memory and Life garden	Alzheimer and associated diseases (ADAD)	literature review by pilot group (physicians, nurses, a psychologist), empirical evidence	empirical evidence	- pre-occupancy: - describe the design process that led to the development of the garden - pre- and post- occupancy: - collect experiences and information before and after the garden was created	- pre-occupancy: - symposium, - survey of family caregivers of persons with AD living at home - survey on gardens in nursing homes for dependent elderly (21 responses/63 institutions) - surveys (55 participants; P,V, S) - post- occupancy: - surveys (68 participants; P,V, S)	- evaluate the effectiveness of spatial structure and landmarks of the garden in relation to the ability to orient oneself within the garden - study the respective roles of artistic and cultural dimensions of the gardens and the relationship to plants and nature in general - study the importance of regional sociocultural memory references of Lorraine - examine the presence of an optimal exposure (i.e. duration, frequency, etc.) - explore the possibility to examine each design principle independently	Rivasseau Jonveaux et al., 2013

Table 2 (continued)

Healthcare facility	Studied healing garden	User	Pre-occupancy research	Post-occupancy research	Research aim	Research method used	Proposed further research	References
Villa di Salute clinic for mental disorders Trofarello, Italy	garden Villa Bianca garden	mental disorders (schizophrenia and personality disorders)	qualitative and quantitative empirical evidence	will follow (to verify its effectiveness)	- explore patient's perceptions on clinic garden to identify: - positive features and desired characteristics - limits and potentials of garden - activities - determine needs of patients, relatives, and staff	- site analysis, - focus group discussions: - psychiatrists - psychologists - rehabilitation technicians - landscape architect - patient surveys (100 questionnaires)	- assess whether objectives have been met - evaluate the effectiveness of design from a therapeutic aspect	Erbino et al., 2015
Family Birth Center, St. Mary's Janesville Hospital Janesville, Wisconsin, U.S.A.		- pregnancy loss: - stillbirth - miscarriage - infant death		qualitative descriptive (1 family: parents and both sets of grandparents)		- comments by a family in loss of an infant (stillbirth)		McNall, 2015
St. Joseph Regional Health Care Center Bryan, Texas, U.S.A.	courtyard surrounded by three-storey buildings	hospital (nurse)	staff empirical evidence	will follow (to verify its effectiveness)	- identify landscape design principles and features that encourage restorative spatial experiences of renewal for nursing staff	- ecological site design variables: (views, wind, sun, temperature, and humidity across seasons) - on-site informal observations - surveys (61 nurses)	- evaluate the outcome of design, including retention rates and staff satisfaction - adopt structured behavior observation protocol to compare before and after the redesigned garden	Naderi and Shin, 2008
Fifth Xiangya Hospital Changsha, China		broader community	consider the design impact beyond site boundaries; on the broader community					Rawlings, 2017

use by patients, visitors (family members), and staff. Two types of research were identified: pre- and post-occupancy research. The data collected were quantitative and/or qualitative, and the research methods applied included observation, survey, visitors' comment books, interview, and focus group discussion (Table 2). Several authors commented on the sampling limitations of their research and proposed further research (Table 2). An overview of the case studies, which includes basic descriptions, design aims, described/identified garden features, activities and barriers, and design recommendations for each studied healing garden, is provided according to available information. In addition, the pre- and/or post-occupancy findings for each type of hospital healing garden are presented, and EBD recommendations for each type of patient/user are determined.

3. Overview of case studies

The overview showed that in most case studies, hospital healing garden design was tailored to particular types of patients because hospitals provide medical care for various individuals. To consider the variety of patient types, this category was further divided into four subcategories (children, cancer, mental disorders, and pregnancy or infant loss). A few case studies also examined the design of healing gardens in relation to hospital staff and are presented below separately. Finally, only one healing garden design case study addressed the general community, and it is presented separately.

3.1. Patient type

3.1.1. Children (Pediatric hospitals)

Four publications were identified for healing gardens in pediatric hospitals. All such publications involved the post-occupancy research of healing gardens. Although varied, the research goals of the publications overlapped in examining how healing gardens were perceived and valued by patients, patient families, and staff, exploring how perceptions differ between children and adults, and identifying barriers to the use of such gardens. Although pre-occupancy research was not particularly mentioned in the publications examined, in the case of the four healing gardens of the Lady Cilento Children's Hospital in Brisbane, Australia, which was designed by a large architecture firm (Reeve et al., 2017), children, young people, and their families of two former Brisbane children's hospitals were consulted in the early planning phase. At the Children's Hospital and Health Center in San Diego, U.S.A., the design of the Leichter Family Healing Garden (LFHG) was based on the garden's steering committee's definition of "healing environment" (Whitehouse et al., 2001). The three healing gardens of Carley's Magical Gardens at the Children's Hospital and Health Center in southern California, U.S.A., were designed by a team in memory of a young girl who had cancer (Sherman et al., 2005; Children's Health Queensland Hospital and Health Service, 2015). The first published post-occupancy empirical investigation of a children's hospital was published in 2001 by Whitehouse et al. The main features of the above healing gardens included bright

colors, sound of running water, plants, artworks, and sense of enclosure. Features that offered person-environment and person-person interactions (such as dipping fingers in water or floating objects down the river) were the most popular. On the contrary, five healing gardens located in three unidentified children's hospitals in Texas, U.S.A., did not contain design details, lacked play features, and had few trees and flowers (Pasha, 2013). In all four healing gardens, similar activities were identified (relaxing, eating, walking, and children's playing), but only the three former gardens possessed the qualitative characteristics of healing gardens, such as engagement of senses, multi-sensory stimulation, sensory seeking, contact with nature, and fresh air. These qualitative garden traits were likely associated with the variety of the abovementioned design features. Barriers to use of the healing gardens were identified in the LFHG and Texas healing gardens. In LFHG, a lack of knowledge of the garden's presence and confusion about its use and purpose were observed in light of the limited staff and the substantial time needed to introduce the garden to patients and their families while prioritizing direct patient care. An additional barrier was difficulty in acquiring wheelchairs to help patients with mobility problems access the garden from remote areas in the hospital (Whitehouse et al., 2001). Lack of knowledge of the garden at the hospital was also found in the Texas healing gardens, but the main barriers to their use were related to design. Users were dissatisfied mainly with the limited availability and poor quality of seats, poor shade, and unpleasant weather (Pasha, 2013). Furthermore, Sherman et al. (2005) found an inverse relationship between the use of windows overlooking a healing garden and the number of people in the garden, indicating a need to provide a natural view while preserving privacy. From these post-occupancy research findings, design recommendations for healing gardens aimed at children were determined as follows (Table 3).

- Include trees and greenery.
- Incorporate design features that are highly familiar to children (bright, colorful, and novel child-scale artwork).
- Integrate water features with the sound of running water.
- Place features that allow person-environment and person-person interactions.
- Provide comfortable, movable, and diverse seating options.
- Include interactive activities for children, who are either patients without physical constraints or siblings of patients.
- Introduce programs that encourage the use of the gardens by children and visitors.
- Educate staff to incorporate the use of the healing garden into patient care.
- Allocate wheelchairs to support visitation by children with mobility problems.
- Reduce the distance between patient rooms and garden where feasible.
- Assign volunteers to bring patients and visitors to the garden.

The need for further research was proposed in all four publications. These suggestions included quantifying and monetizing the benefits for all garden users, studying the effects of the healing gardens on health outcomes,

Table 3 Main evidence-based design recommendations of healing gardens identified for each category of users (patient type, hospital staff, and community).

User type		Evidence-based design recommendations	References
patient	children	- include trees and greenery - include design features highly familiar to children (bright, colorful and novel child-scale artwork) - include water features with the sound of running water - include features that allow person-environment and person-to-person interactions - provide comfortable movable and diverse seating options - include more interactive activities for children that are either patients without physical constraints or siblings - introduce programs to encourage the use of the gardens by children and visitors - educate staff to incorporate the use of the healing garden into patient care - raise awareness of healing garden presence; provide signage to the healing garden, views to the garden from within the hospital building and integrate the healing garden with popular used indoor hospitals spaces - dedicate wheelchairs to support visitation by children with mobility problems - reduce where feasible the distance between patient rooms and garden - assign volunteers to bring patients and visitors to the garden	Whitehouse et al. (2001) ; Sherman et al. (2005) ; Pasha (2013)
	cancer	- provide variety and plenty of planting - avoid strong fragrances - provide comfortable seating - provide plenty of shade and avoid glare - provide private and semi-private spaces - provide soothing sounds and avoid noise - provide paths with a smooth surface - provide patients with weak immune system rooms looking into the garden	Busa (2013) ; Valente and Marcus (2015)
	mental disorders	General design recommendations - provide contact with nature - provide experiences through the senses - provide comfortable seating - provide for safety (shelter from the sun) - provide a family atmosphere - provide autonomy - independent movement - provide activities - provide an unimpeded view of the garden from the patient rooms that do not use the garden	Söderback et al. (2004) ; Rivasseau Jonveaux et al. (2013) ; Erbino et al. (2015)

Table 3 (continued)

User type	Evidence-based design recommendations	References
Alzheimer and associated diseases	- integrate artwork (designed to stimulate, touch and explore and integrate materials that contain certain elements inherent to the local culture and art) as landmarks to help orientation and navigation in the garden (note: further research is needed to evaluate the effectiveness of the spatial structure and the landmarks of the garden on the ability to orient oneself in the garden) - integrate local materials to solicit memory and communication	Rivasseau Jonveaux et al. (2013)
Disabilities caused by neurological and/or musculoskeletal impairments	- provide a non-demanding, calm and silent, natural environment - adapt garden tools to patient's use - provide gardening as a leisure activity preserved or encouraged as a new leisure interest with the intention of being continued after discharge - use gardening in mediating occupational therapy - use as an education center for horticultural-therapeutic gardening for patients and rehabilitation teams	Söderback et al. (2004)
hospital staff	- create a sense of privacy; useable under various weather conditions - block views from surrounding building windows using planting, plant along paths and around seating - provide comfortable places, oriented to nature in different microclimates - provide some movable seating preferably for stretching (chaise lounges, long benches, grass mound) - provide refuge (privacy and observation) - design an aesthetic garden that contrasts with the experience inside the hospital - emphasize thresholds and edges of the garden to heighten the sense of place - design spaces with the best microclimate for year-round use - frame quality views	Naderi and Shin (2008)
broader community	- Consider healing garden design in relation to the broader community, particularly in cases of large hospital developments	Rawlings (2017)

relationship between time spent in the garden and health outcomes, effect of visits and rate of healing, defining the ideal amount of hard versus soft landscapes, effect of amenities for children and additional planting on garden visitation, requirements of chronically ill and disabled children and patients not allowed to visit outdoor spaces, and factors that influence window use ([Table 2](#)).

3.1.2. Cancer

Three publications examined healing gardens designed for patients with cancer. Pre-occupancy research of the healing gardens at two hospitals involved consulting the research literature on healing gardens and the benefits of gardening and nature for human well-being ([Table 2](#)). The three healing gardens at the Moores Cancer Center, Thornton Hospital in

San Diego, U.S.A., were designed by a landscape architecture firm, and the Lourdes Healing Garden at the Lourdes Hospital in Binghamton, New York, U.S.A., was made by a nurse who was prompted by a master gardener. Details of the methodologies followed were limited. Post-occupancy empirical research was undertaken only at the healing gardens of Moores Cancer Center, Thornton Hospital to identify user needs. The main desirable features cited by the patients with cancer in the latter gardens were plentiful greenery (The use of various plants with different leaf shapes, colors, textures, and other characteristics fascinates and distracts patients with cancer.), soothing sounds, places that allow solitude, comfortable seating, and shade; the absence of undesirable features, such as noise, manmade materials (steel, concrete, plastic), sharp lines, formality, and excessive fragrance and public openness, was noted as well (Valente and Marcus, 2015). Informal but informative post-occupancy qualitative information was presented by Busa (2013), who provided perspectives from a landscape architect's viewpoint of using the Kaminski Park & Gardens while he was hospitalized at the Roswell Park Cancer Institute in Buffalo, New York, U.S.A., as a patient with leukemia. Busa (2013) identified barriers to the use of healing gardens by patients with cancer. Such barriers included the lack of shade, which was also identified by Valente and Marcus (2015), given that patients with cancer are sensitive to direct light because of their medical treatment. Valente and Marcus (2015) also mentioned the need to avoid glare, such as that caused by the use of steel or aluminum surfaces. An additional barrier was the presence of strong fragrances in gardens, which can induce nausea as a result of chemotherapy (Valente and Marcus, 2015). Other barriers may even cost the life of a cancer patient, such as typical landscape maintenance practices (lawn mowing, strimming, and use of leaf blowers), pollen (which can create particle dust), and crowds (particularly children and elderly) that may unexpectedly transmit infections owing to the weak immune system of patients with cancer (Busa, 2013). Non-smooth path surfaces were also a barrier to use by patients with IV poles because the poles' small wheels are jerked even by slight bumps (Busa, 2013).

In summary, the above post-occupancy research findings determined the following design recommendations for healing gardens aimed at patients with cancer (Table 3).

- Provide a large quantity and variety of planting.
- Avoid strong fragrances.
- Place comfortable seating.
- Integrate plenty of shade and avoid glare.
- Incorporate private and semi-private spaces.
- Provide soothing sounds and avoid noise.
- Construct paths with smooth surfaces.
- Assign patients with weak immune systems to rooms overlooking the garden.

Busa (2013) and Valente and Marcus (2015) proposed the need for further research for different users and subgroups (disablement, age, geographical region, and educational

level) on quantitative empirical evidence to understand people using healing gardens well (Table 2).

3.1.3. Mental disorders

Two publications focused on healing gardens in hospitals designed for people with mental disorders. A publication of a hospital healing garden addressing physically disabled people by neurological and/or musculoskeletal impairment was also included in this healing garden category (Söderback et al., 2004). The authors (Rivasseau Jonveaux et al., 2013; Erbino et al., 2015) of the two former healing garden papers described as a case study the design process followed in creating the healing gardens presented. The design process followed in both publications were similar in that they both included pre-occupancy research, site analysis, and work group consultation. The pre-occupancy research generally aimed to determine the needs of patients, relatives, and staff and identify positive features, desirable characteristics, and activities. The Art, Memory and Life garden at the University Hospital of Nancy, in Nancy, France, was designed for patients suffering from Alzheimer's and associated diseases (Rivasseau Jonveaux et al., 2013). The Villa Bianca garden at the Villa di Salute clinic for mental disorders in Trofarello, Italy, was designed for patients suffering from schizophrenia and personality disorders (Erbino et al., 2015). Both gardens were designed to provide contact with nature, experiences through the senses, autonomy-independent movement (clear and visible paths and signages, visible access to buildings, and landmarks), safety and comfort (suitable furniture, shelter, vegetation that cannot harm patients, and easily accessible paths), activities, and family-friendly atmospheres. Contrary to the abovementioned healing gardens, the Horticultural Therapy Garden at the Danderyd Hospital Rehabilitation Clinic in Sweden (Söderback et al., 2004) was designed through teamwork between a landscape architect and hospital staff for patients with disabilities caused by neurological and/or musculoskeletal impairments to create a meeting point for relief and relaxation and for training in horticultural therapy; the garden and associated activities constitute a supplementary daily activity among individuals; support mental healing, recreation, and social interaction; and mediate patients' rehabilitation (training for sensory stimulation, cognitive re-organization, sensory-motor functions, pre-vocational skills assessment, and teaching ergonomic body positions). To meet its purpose, the garden was designed to be accessible by wheelchair users and people using walking aids, differences in levels were avoided or clearly marked with guiderails, a tool shed was designed to meet user needs (tools marked with symbols at accessible heights and hooks designed for easy handling), robust trellises were built to aid in standing, a greenhouse was created for year-round activities, planting beds were constructed at different heights to allow for various working positions (standing, bending, and sitting), a pond and a waterfall were built to enhance the impression of nature,

garden furniture were placed to allow relaxation and socialization, and a boulevards track was provided to encourage activity.

Post-occupancy research allows evaluating the effectiveness of design objectives. The post-occupancy research undertaken at the Art, Memory and Life garden showed that patients, visitors, and staff were generally satisfied with the garden design. [Rivasseau Jonveaux et al. \(2013\)](#), were the first to show that selectively located works of art (sculptures designed to stimulate, touch, and explore) are helpful for orientation and navigation in gardens and arouse positive feelings throughout the year, symbolizing longevity in contrast to the continuous renewed interest over the changes of nature's cycle. Additionally, the integration within the artwork of materials containing elements inherent to Lorraine arts and crafts (local materials) or inspired by cultural invariants, solicits memory and communication. [Rivasseau Jonveaux et al. \(2013\)](#) were the first to show how the concept of healing gardens must be adapted to activities; patients with Alzheimer's preferred activity gardens to quiet gardens. The therapeutic team of Art, Memory and Life developed multiple activities for the patients and themselves; the use of sensory elements, such as various scents, colors, textures, and sounds stimulates the senses and arouses interest. The choice of materials that avoid glare phenomena, such as non-reflective surfacing or walkways, was emphasized because eye diseases associated with aging can deter patients from visiting the garden ([Rivasseau Jonveaux et al., 2013](#)).

Generalizations in this category must be treated with caution. According to the above analysis, the designs of healing gardens for patients with mental disorders present similarities but also differ on the basis of the needs of each mental disorder. [Rivasseau Jonveaux et al. \(2013\)](#) and [Erbino et al. \(2015\)](#) suggested undertaking a systematic analysis of an existing green space or garden according to an objective, agreed, and adopted criteria, identifying the weakness of the existing space, determining the potential for developing it into a healing garden, and conducting a survey to identify user needs and then integrating them into the design. The design recommendations for healing gardens aimed at patients with mental disorders were categorized as follows ([Table 3](#)).

General design recommendations:

- Allow for contact with nature.
- Provide sensory experiences.
- Place comfortable seating.
- Ensure safety (shelter from the sun).
- Provide a family-like atmosphere.
- Allow for autonomy-independent movement.
- Arrange activities.
- Provide an unobstructed view of the garden from rooms occupied by patients who do not use the garden.
- Design recommendations for patients with Alzheimer's and associated diseases:
- Integrate artwork (designed to stimulate, touch, and explore and integrate materials that contain certain

elements inherent to local culture and art) as landmarks to help orientation and navigation in the garden (Further research is needed to evaluate the effectiveness of the spatial structures and landmarks of gardens on the ability to orient oneself in gardens).

- Incorporate local materials to solicit memory and communication.
- Design recommendations for patients with disabilities caused by neurological and/or musculoskeletal impairments:
- Establish a non-demanding, calm, and silent natural environment.
- Offer garden tools for patient use.
- Provide gardening as a leisure activity that patients are encouraged to preserve as a new leisure interest that will be continued after discharge.
- Use gardening in mediating occupational therapy.
- Utilize the garden as a center for education in horticultural-therapeutic gardening for patients and rehabilitation teams.

Further research proposed by the aforementioned authors of the papers on mental disorders included exploring the possibility for optimal exposure (duration and frequency of garden visits by patients), exploring the possibility to examine design principles individually, evaluating the effectiveness of spatial structure and landmarks within gardens in relation to the ability to orient oneself, studying the importance of integrating regional sociocultural memory references within gardens, and exploring the role of artistic and cultural features and the general relationship of patients with plants and nature within healing gardens ([Table 2](#)).

3.1.4. Pregnancy or infant loss (Obstetrics hospitals)

Obstetrics hospitals generally provide care for women during pregnancy and childbirth and for newborn infants. One publication described the use of a healing garden at the Family Birth Center, St. Mary's Janesville Hospital in Janesville, Wisconsin, U.S.A., which was designed to support patients, visitors, and staff in coping with stillbirths, early pregnancy losses, and infant deaths ([McNall, 2015](#)). No pre-occupancy information was presented; instead, this publication provided post-occupancy qualitative information gathered from grieving family members about the qualities of gardens that support infant loss. The design of the garden included a pathway, seating, a labyrinth, flowering plants, fragrant flowers and water features. Positive comments were given on the bloomed flowers and their scents, soothing water sounds, and sunshine. However, the information was insufficient for producing any design recommendation for women and family members who are coping with pregnancy losses or infant deaths.

3.2. Hospital staff

Hospital environments are demanding working environments for staff. Healing gardens designed for employees can provide restorative spatial experiences of renewal. Most of

the hospitals in the 13 publications studied had healing gardens that were used by patients, visitors, and hospital staff; only three hospitals had healing gardens for exclusive use by staff (Naderi and Shin, 2008; Erbino et al., 2015; Reeve et al., 2017). Reeve et al. (2017) described the main features of the staff garden at the Lady Cilento Children's Hospital but did not study the experiences of different user groups individually. The staff garden at the Lady Cilento Children's Hospital comprised an open space for lunch and staff functions, a lawn, and paved areas; the planting included a variety of plants in beds and a green wall. Meanwhile, the focus group of the pre-occupancy research undertaken at the Villa di Salute clinic for mental disorders commented that during breaks, patients often spent time with the staff, thereby making having a break for relaxation, lunch, or a cigarette difficult; therefore, they proposed the creation of a separate area accessible only to staff. The staff zone of the Villa Bianca garden was designed to have restricted access to employees from a separate entrance of the hospital building and consisted of a relaxation area with a panoramic view of the hills, benches, a covered smoking and dining area, two trees, two flower beds with herbs, wooden planters with small trees, and evergreen ornamental shrubs that concealed a concrete boundary wall.

Nurses work long shifts under considerable stress (Naderi and Shin, 2008). Similar to Rivasseau Jonveaux et al. (2013) and Erbino et al. (2015), Naderi and Shin (2008) undertook pre-occupancy research and site analysis to design a healing garden for nurses in a courtyard surrounded by three-story buildings at St. Joseph Regional Health Care Center in Bryan, Texas, U.S.A. Most of the nurses stated that going outdoors was important, and they showed a strong preference for privacy and nature contact (Naderi and Shin, 2008, 2015). Naderi and Shin (2008) noted that the culture of the nurses was "to get away from it all;" for the nurses' healing garden to be effective, "the garden-as-escape needed to present a spatial experience that contrasted with the interior environment of the hospital: hard surface had to be contrasted with soft ones, noise with quiet, lack of privacy with privacy, lack of nature with abundant greenery, social demands with solitude, artificial lighting and noise with natural light and the sounds of nature, dull flat surfaces with richly coloured and highly textured surfaces." Sometimes, the only outdoor experience for the nurses was traversing between hospital locations; these paths must be maintained because repeated short breaks are more effective than long but less frequent breaks (Naderi and Shin, 2008). The staff garden at St. Joseph Regional Health Care Center consisted of small private places for a few people defined by planters and portable furnishings that function as visual screens for additional privacy. Among the three hospitals mentioned, post-occupancy research was undertaken only at the Lady Cilento Children's Hospital, but as in the case of the pre-occupancy research, it did not individually examine different user groups.

Considering the aforementioned analysis, the design recommendations for healing gardens for hospital staff are as follows (Table 3).

- Create a sense of privacy; useable under various weather conditions.
- Block views from surrounding building windows using planting, plants along paths, and around seating.
- Build comfortable places oriented to nature in different microclimates.
- Install movable seating preferably for stretching (chaise lounges, long benches, and grass mounds).
- Provide refuge (privacy and observation).
- Design an aesthetic garden that contradicts the experience inside the hospital.
- Emphasize garden thresholds and edges to enhance the sense of place.
- Design spaces with the best microclimate for year-round use.
- Frame quality views.

3.3. Community

One publication described the development of a healing garden at Fifth Xiangya Hospital in Changsha, China, by Payette, a Boston-based architectural design firm (Rawlings, 2017). No pre- or post-occupancy research was presented. However, this publication was the only one that considered delivering value beyond that for traditional users and the facility; the community was highlighted as well. With regard to the users, emphasis was given to reduce stress at the hospital entry point by creating an initial focal point of an outdoor waiting room fronting a major healing garden with views to the mountain and adjacent park, as opposed to the traditional "front door arrival." Direct access to the healing garden from staff-intensive areas was created, and an outdoor gathering/eating space adjacent to the staff cafeteria was provided. The exterior space was used to accommodate diverse services and eliminate indoor, structured, and conditioned spaces. The interior of the garden consisted of a variety of seating areas for a few people, a crowd, and personal pull-off spots for personal meditation, pocket spaces located within and along meandering paths, and an extensive water feature with gentle falls and sound to positively affect the small waiting nooks. A key principle in landscape design is to consider the design of a site beyond site boundaries. In the case of Fifth Xiangya Hospital, the traditional healing garden landscape was extended into a public park (Rawlings, 2017). The design of this healing garden considered the effect of the size of the development on the cultural landscape of the existing community and set three key objectives: strengthening pedestrian experience by enhanced park access, providing hospital-based educational opportunities to the public, and incorporating access to public transportation at the park perimeter. With regard to educational opportunities, Söderback et al. (2004) also proposed the use of the healing gardens at Danderyd Hospital Rehabilitation Clinic in Sweden as an educational center in horticultural-therapeutic gardening and for training in horticultural therapy.

Although Rawlings (2017) did not present any pre- or post-occupancy research of the major healing garden at Fifth Xiangya Hospital, the following design recommendation should be considered, particularly in the case of large hospital developments.

- Consider what lies beyond site boundaries by considering the effect of the design on the general community.

4. Discussion

4.1. Pre- versus post-occupancy research

EBD “is a process for the conscientious, explicit, and judicious use of current best evidence from research and practice in making critical decisions, together with an informed client, about the design of each individual and unique project” (Stichler and Hamilton, 2008). Pre- and post-occupancy research are important factors of EBD. Pre-occupancy research findings incorporate information generated by clients and users and provide valuable input in EBD projects (Johan Van der Zwart and Van der Voordt, 2015). Meanwhile, scientific evidence obtained from post-occupancy research is used in the design decision process of EBD projects (Johan Van der Zwart and Van der Voordt, 2015). Pre-occupancy research is a pre-measure, while post-occupancy research is a post-measure of each individual and unique project in this study of healing gardens. Therefore, the perceptions and needs of people who will occupy future healing gardens are measured in pre-occupancy research, and the response of people to healing gardens is measured in post-occupancy research; thus, these research forms are a valuable instrument of measuring design quality (Bechtel, 1989). Users can experience a space such as a healing garden only in reality, so measuring its performance before it is developed is not easy compared with when the healing garden is occupied. This condition may be the reason that our study showed that most of the literature has concentrated on post-occupancy research. Moreover, pre-occupancy research findings are commonly used in landscape architecture practice (Reid, 1993); therefore, pre-occupancy research findings as a standard practice may be undervalued for publicizing, resulting in a small number of published papers compared with post-occupancy papers. In our study, pre- and post-occupancy research on the design of healing gardens are sparse. Only seven publications presented qualitative and/or quantitative empirical evidence. Specifically, one publication showed results from pre- and post-occupancy research (Rivasseau Jonveaux et al., 2013). Two publications showed only the results of pre-occupancy research (Naderi and Shin, 2008; Erbino et al., 2015), and four showed only the results of post-occupancy research (Whitehouse et al., 2001; Sherman et al., 2005; Pasha, 2013; Reeve et al., 2017). Additionally, one publication presented post-occupancy research without showing the quantitative analysis of the surveys (Valente and Marcus, 2015). The remaining publications had no systematic research results but were nevertheless considered because they provided a holistic view of the design of hospital healing gardens.

4.2. Design process

The European Landscape Convention, the first international treaty focused exclusively on the European landscape and all related issues (Council of Europe, 2006), defined landscape as “an area perceived by people, whose character is the result of the action and interaction of natural and/or

human factors” (Council of Europe, 2000). This definition applies to all types of landscapes, including healing gardens. Only five of the healing garden case studies were designed by a working group, a design team, and an architecture or landscape architecture firm with a landscape architect. A traditional approach to landscape architectural design is to examine the client's request, the parameters of the site, and the needs of the potential users (Reid, 1993). Three publications presented the design processes followed to create healing gardens (Naderi and Shin, 2008; Rivasseau Jonveaux et al., 2013; Erbino et al., 2015) and were found to be similar. In all three publications, a survey analysis and pre-occupancy research were undertaken following a traditional landscape architectural design approach. Site and user analyses constitute important parameters of the design process because every site and associated users differ among various spaces (Blake, 1999).

Hospital design and layout and their associated healing gardens and types of patients differ across hospitals. Site analysis involves the assessment of the physical and cultural factors of sites, including the collection of information on the sites' climate/microclimate, geology and soils, hydrology, topography, vegetation, land use, land ownership, archaeological and local history, access and circulation, pollution, viewpoints, and planning and building legislation (Blake, 1999; Zimmerman, 2000). Meanwhile, user analysis involves the assessment of users' needs by observation, interviews, or surveys. The information collected is site- and user-unique and must be evaluated to determine the main site assets, problems, required functions, and condition of existing features (Blake, 1999). In landscape architecture practice, the use of evidence-based research in the planning, design, and management of landscapes is increasing (Brown and Corry, 2011). As shown in the current study, evidence-based literature on the design of healing gardens for hospitals is scarce, and the design recommendations for healing gardens vary for different patients; the main research-based design recommendations for each patient type and hospital staff are presented in Table 3. Informed by the site's overall opportunities and constraints and the user's needs, the design of a healing garden for particular users is most likely to address effectively the design objectives. Although a survey analysis and pre-occupancy research are undertaken as mentioned by Naderi and Shin (2008), Rivasseau Jonveaux et al. (2013), and Erbino et al. (2015), a post-occupancy research is suggested to evaluate the effectiveness of garden designs. Undertaking post-occupancy research on healing gardens designed for different users is necessary (types of patients, visitors, and staff) to determine design recommendations (guidelines) for healing gardens that will contribute to effectively meeting design aims. The presence of EBD guidelines for healing gardens specified for users is not suggested to replace pre-occupancy research but must be considered during the design process of a traditional landscape architectural design approach (site and user analysis) to be integrated and tailored to each site and user group.

4.3. Design implications

This work identified two important barriers that influence the visitation or purpose of a well-designed healing garden. Even

when the healing gardens were located in areas viewed by patients and visitors, people were uncertain of their purpose. Insufficient staff and time needed by the staff to introduce the gardens, the lack of educated staff to incorporate the use of the gardens into patient and visitor care, the lack of programs or activities that encourage the use of the gardens by patients and visitors, the lack of signages in the hospitals, and access to wheelchairs for patients in rooms located away from the gardens were found to limit visitation (Whitehouse et al., 2001; Sherman et al., 2005; Pasha, 2013). To optimize the benefits of healing garden use, the healing gardens are proposed to be integrated within the working schedule of the hospital, similar to one of the hospital's laboratories with its staff and daily schedule; the only difference is that the garden is outdoors. Window use and visitation were found to be negatively associated; window use reduced visitation, and vice versa (Sherman et al., 2005; Naderi and Shin, 2008). Privacy must be secured for both parties (people in the healing garden and people indoors), particularly patients that are not allowed outdoors and confined to their rooms. Both barriers might initially seem unrelated to the design of a healing garden, but they are from a landscape perspective; the buildings surrounding the healing gardens constitute an integral part of the landscape, and the requirements for running programs or activities in the garden may influence design (Söderback et al., 2004; Righetto et al., 2016). The context of the programs and activities taking place in the healing gardens is a field of research in itself (Huxmann, 2016; Grahn et al., 2017), and information regarding this topic should be considered in the design process if available to integrate any requirement in the healing garden design.

5. Conclusions

The main aim of this study was to examine pre- and post-occupancy research findings of existing healing gardens in hospitals and provide a summary of EBD recommendations for healing gardens for different users. The review showed that hospital healing garden design must be tailored to the needs of each patient type. Nevertheless, among the various patient types identified herein, common EBD recommendations for hospital healing gardens were as follows.

- Provide plenty of plantings with a variety of plants. Increased care should be given in the selection of plants for patients receiving medical treatment, such as patients with cancer, who need to avoid strongly fragrant plants.
- Design spaces with optimum microclimate for year-round use. Build shelter from the sun and glare, particularly for patients receiving medical treatment, such as patients with cancer and with eye diseases associated with aging. Use appropriate surfacing materials that do not reflect sunlight.
- Install comfortable seating with diverse levels of privacy (private, semi-private, and public). Offer fixed and movable seating.
- Provide autonomy and independent movement. Dedicate wheelchairs to patients with mobility problems. Construct

paths with smooth surfaces. Reduce the distance between patient rooms and healing gardens where feasible.

- Offer views from the patient rooms into the healing garden while preserving privacy, particularly for patients with a weak immune system and thus cannot visit the garden.
 - Integrate design features tailored to the needs of each patient type, such as bright, colorful child-scale artwork for children. Artworks must act as landmarks to assist orientation and navigation in the garden for patients with Alzheimer's and associated diseases. Offer soothing sounds (running water) for patients with cancer.
- The review also indicated that hospital staff must have their own private healing garden. The first two EBD recommendations made for the different patient types were similar to those for hospital staff. Additional recommendations were as follows.
- Provide comfortable and several movable seating. Offer seating for stretching (chaise lounges, long benches, and grass mound). Construct seating in different microclimates.
 - Create a sense of privacy. Plant around seating and block views from surrounding buildings and paths using planting. Provide refuge (privacy while allowing observation).
 - Design an aesthetically pleasing garden that contradicts the experience inside the hospital.
 - Frame quality views and emphasize garden thresholds and edges to enhance the sense of place.

Finally, according to the review of large hospital developments, the healing garden design must be considered in relation to the general community.

The above EBD recommendations for healing gardens can inform landscape architects, healthcare providers, and potential policymakers and contribute to developing healing gardens that meet design aims and objectives. However, the literature review also showed a limited amount of EBD recommendations and post-occupancy evaluation for healing gardens of hospitals. This limitation is further enhanced by considering the needs of various user groups, which differ. Pre- and post-occupancy research must be continued to enrich the existing amount of EBD recommendations. Post-occupancy research evaluates the effectiveness of design recommendations, while pre-occupancy research findings, combined with site analysis, constitute a traditional approach followed in landscape architecture practice and determine for each individual hospital the site and user features that must be addressed. Rigorous further research with additional participants and details, such as addressing the needs of individual user groups rather than pooling different user groups or examining individual design elements rather than the whole garden, is necessary. EBD recommendations are valuable tools to consider during the design process. Every hospital should be treated individually because the needs of different patients/users of healing gardens vary. In addition to considering the EBD recommendations, a design process that undertakes a site and user

analysis is likely to effectively address the design aims and objectives of healing gardens.

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