

Review Research Article

A Conceptual Framework for Hospital Outdoor Landscape Designs from Theoretical to Practical Levels

(A Systematic Literature Review and Content Analysis)*

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Abstract | Despite numerous studies on how the hospital outdoor landscape affects user satisfaction and the publication of design guidelines, this field's research flow, strengths, and weaknesses have not been thoroughly reviewed. This makes it difficult for designers to access organized information on design's theoretical and practical aspects. The current research aims to comprehensively review and analyze the existing resources and present them in a conceptual framework. This process will enable us to identify the strengths and weaknesses of the current literature and identify specific areas that require further research in the field of hospital landscape design. After conducting a systematic review, 47 relevant sources were identified. These sources were then analyzed using the content analysis method and encoded in MAXQDA software to organize the obtained information. 618 codes were extracted and categorized into six main categories and 30 subcategories. These categories form the conceptual framework of hospital outdoor landscape design literature, covering topics such as 1) definitions of hospital outdoor landscape, 2) typology, 3) fundamental theories, 4) design approaches, 5) principles and design indicators, and 6) preferences and needs of users. Based on the research, the literature in this field has been developed appropriately from both theoretical and practical perspectives (i.e., programming and operational dimensions). The theoretical essence of hospital outdoor landscapes is evolving. It can now be defined as a space that serves functional and symbolic purposes while providing a sense of restoration. To describe the objective dimension of the landscape, typological studies have been conducted. The literature on designing hospital outdoor landscapes from a practical perspective initially focused on design approaches that aimed to implement their expected functions. These approaches may vary in principles, methods, and actions, but their main objective is to elucidate the interaction between the hospital landscape and its users. The principles, qualities, and recommendations are general and applicable to various users, making them suitable for public hospitals. The main weakness of hospital outdoor landscape literature is the lack of reliable evidence concerning the users' perception and interaction with the environment. To address this, it is crucial to conduct evaluation studies on various case samples in different settings to improve the quality of the literature.

Keywords | *Hospital campus, Hospital outdoor landscape, Systematic review, Content analysis, Conceptual framework.*

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Introduction | Numerous studies have indicated that a hospital outdoor landscape can positively impact patient satisfaction, staff productivity, and overall health and well-being (Marcus & Sachs, 2013, 76; Rodiek & Schwarz, 2013, 8). Leading healthcare facilities are taking measures to maximize the benefits of these spaces. However, in our country, hospital outdoor landscapes are becoming increasingly problematic. If not addressed, it may become one of the Ministry of Health’s most significant challenges in the future. The issues stem from the managers’ and designers’ attitude of providing only the bare minimum due to financial constraints (Whitehouse, Varni, Seid, Cooper-Marcus, Ensberg, Jacobs & Mehlenbeck, 2001, 302) perceiving the area as unimportant and unused (Ng & Laver, 2023, 97), or non-specialist interventions that result in higher material and spiritual costs (Golestani & Zahedan, 2017, 49). The lack of research and limited published articles on this design field in Iran have doubled the severity of the issue. On the other hand, due to the increasing growth of international research in recent years, it has become challenging for designers and managers to stay updated and knowledgeable about all aspects of this field. Therefore, there is an urgent need for research studies (Din, Russo & Liversedge, 2023, 2), particularly review studies, to systematically and scientifically analyze

previous research. This research aims to evaluate and present a summary of the literature on the designs of the hospital outdoor landscape, highlighting their strengths and weaknesses and identifying areas that require further investigation. Additionally, a conceptual framework of design (Chi, Gutberg & Berta, 2020, 31) has been created to provide easy access to the critical points discussed in the literature. This study utilizes a combination of systematic review and content analysis methods. This research is a response to Stichler’s (2018, 2) call for conceptual clarity in the design of healthcare centers, from theoretical to practical levels. The goal is to create a framework that brings together various concepts and issues and fosters a shared understanding (Walker & Avant, 2005, 63).

Research Background

Although hospital outdoor areas can positively impact users’ health and satisfaction, they are often neglected due to financial and spatial limitations, resulting in these areas being unused and abandoned compared to the main hospital building. This trend is also reflected in research, where limited studies have focused on the design of hospital outdoor landscapes. Between 2012 and 2020, only nine studies reviewed this topic, as summarized in Table 1, which outlines

Table 1: A summary of the findings of previous review articles. Source: Authors.

Author	Number	Goal	Findings
Shukor, Stigsdotter & Nilsson, (2012)	21 articles	Examining the existing evidence for design recommendations for health-supportive outdoor areas at healthcare facilities	A narrative summary of the design recommendations for health-supportive outdoor areas at healthcare facilities
Jiang (2014)	19 articles	Deciphering the Chinese literature to English-speaking scholars on the topics of Healing Gardens and therapeutic landscapes	Chinese research focuses on the application of traditional medicine theories in healing garden design, but the body of knowledge has not been well formed in the Chinese context.
Er & Shukor (2016)	15 articles	Reviewing design considerations for outdoor areas for the elderly at hospitals.	A list of the most essential design features of the hospital landscape Design for the elderly
Bell, Foley, Houghton, Maddrell & Williams (2018)	161 articles	Exploring how, where, and to what benefit the ‘therapeutic landscapes’ concept has been applied to date	Strengths and limitations of the concept of therapeutic landscape and its applications
Paraskevopoulou & Kamperi (2018)	13 articles	Examining post-occupancy research of hospital healing gardens.	Summary of EBD recommendations for hospital healing gardens
Weerasuriya, Henderson-Wilson & Townsend (2019a)	24 articles	Reviewing the evidence on user experiences during access to green spaces within a healthcare setting	User experiences were classified under three key themes.
Weerasuriya, Henderson-Wilson & Townsend (2019b)	24 articles	Describing the facilitators and barriers impacting passive access to green spaces within healthcare settings	The barriers to access were grouped into three themes (awareness, accessibility, and comfort). The facilitators were grouped into 13 themes.
Uwajeh, Iyendo & Polay (2019)	29 articles	Documenting the role of nature in healthcare environments and its impact on users’ well-being	A summary of design recommendations in the form of a table
Chi et al. (2020)	131 articles	Identifying how the natural environment in healthcare has been conceptualized	Conceptual Framework to Identify 5 Themes that Conceptualize the Natural Environment in Healthcare.

their objectives and findings. These studies reveal various issues such as the broad range of subjects discussed in the design literature, the consideration of multiple environmental factors simultaneously, a limited understanding of the meaning and essence of the natural environment in healthcare settings, an exclusive focus on patients' preferences and needs (excluding other users), and the inadequacy of theoretical foundations in hospital outdoor landscape design (Chi et al., 2020, 31). Also, the classification of user experiences, environmental barriers that hinder the use of hospital outdoor spaces (gardens), and design recommendations (e.g., Shukor, Stigsdotter & Nilsson, 2012, 32) are presented. While these studies offer valuable information, some ambiguities still need to be clarified in identifying essence, typology, theoretical foundations, and the overall presentation of a conceptual framework.

Theoretical Framework

Masnavi, Motedayen, Saboonchi & Hemmati (2021, 24) state that each epistemological field can be defined from two perspectives: a) theoretical, which focuses on the definitions, characteristics, and dimensions of that domain, and b) practical perspective, which focuses on the actions, operationalization, and functions of the definitions. In landscape architecture design knowledge, the theoretical perspective consists of concepts and perceptions from the landscape, while the practical perspective uses conceptual frameworks to solve design problems and propose approaches. Conceptual frameworks are based on a theoretical perspective, and approaches' emergence depends on theoretical and practical perspectives (*ibid.*, 30). Following a detailed explanation of the research methodology, the literature on hospital outdoor landscape design was studied through a systematic review and content analysis, focusing on both theoretical (theoretical dimension) and practical aspects (including programming and operational dimension). The programming dimension focuses on design approaches, principles, and design guidelines, and the operational dimension relates to the findings and evidence extracted from the post-occupancy evaluation of the case samples. Even though these dimensions were distinct, they impacted each other. The theoretical dimension, which defined the hospital's outdoor landscape, influenced the selection of approaches and principles. Additionally, the data obtained from environmental assessments influenced the redefinition of the hospital outdoor landscape's essence and the selection of approaches.

Research Method

This study utilized systematic review methods (Wright, Brand, Dunn & Spindler, 2007, 23) and content analysis (Elo & Kyngäs, 2008, 107) to better understand the topics discussed in the literature regarding the design of hospital outdoor landscapes. This process simplifies comprehending the literature's latent and manifest content by taking advantage of both methods. A systematic literature review adopts a clear research strategy to identify inclusion and exclusion criteria to assess the largest amount of relevant and available literature (Okoli & Schabram, 2010, 8). This method allows for the discovery, assessment, analysis, and data composition of explicit and implicit content, leading to accurate and structured findings (Petticrew & Roberts, 2008, 9). Meanwhile, using content analysis techniques, one can confidently draw reliable and accurate conclusions from both latent and textual data. This approach allows for the derivation of concepts from literature, which can then be effectively organized into categories (Elo & Kyngäs, 2008, 107; Oleinik et al., 2014, 2704). We developed a four-step methodological framework that combines eight steps of a systematic review with three steps of content analysis, namely: 1) the research objectives examination 2) literature search, 3) data extraction, organization, and coding, and 4) data analysis and reporting. This arrangement and structure help minimize bias and improve the validity and reliability of the study. The process of searching and identifying relevant studies: A systematic search was conducted to identify published articles (1995-2021) in Scopus, PubMed, Web of Science databases, and Google Scholar search engine using the PRISMA¹ instructions. Articles were identified by the combination of keywords "hospital garden or landscape," "hospital campus," and "restorative garden". Because the subject is developing and involves multiple disciplines, we gathered additional information from secondary sources like research center repositories, including CHD², HaCiCR³, and IADH⁴. To ensure the collection of all the resources, manual searching was done by referring to the sources of selected studies. Selection of included studies and their characteristics: 300 articles were collected, and duplicates were promptly removed. The titles and abstracts of these articles were then screened based on the inclusion and exclusion criteria. To be considered for inclusion in our study, articles needed to focus on the design or evaluation of hospital landscapes within the time frame of 1995 and 2021. The full text of the articles had to be available, and there were no restrictions on publication location. If there were multiple studies with overlapping findings from the same author, only the study with the

most information was included. Additionally, master's theses and review studies were excluded. In the third stage, two individuals independently reviewed the full text of the articles in two separate stages. To thoroughly assess the quality of the selected studies, an evaluation of each article's title, abstract, introduction, method, and findings was conducted using a checklist adapted from STROBE⁵ and PRISMA. Each article's title, abstract, introduction, method, and findings were subjectively scored. The resulting quality evaluations were color-coded for easy reference: green for good, yellow for medium, and black for poor in the respective tables. Ultimately, 47 studies met the inclusion criteria (Fig. 1). The data from these studies were organized in Excel software, including the first author's name, year of study, publication date, study type, sample size, participants, and data source. The content analysis studies have been geographically distributed as follows: 18 studies in Europe (38%), 14 studies in the United

States (30%), 11 studies in Asian countries (24%), and 2 articles each related to Africa and Australia. Only one study from Iran was included among the Asian studies. Fig. 2 indicates a significant increase in the frequency of articles published in the last decade, demonstrating an awareness and sensitivity among researchers toward the impact of hospital outdoor landscapes.

Results (Data Extraction, Organization and Coding)

After defining the research objectives, each text was analyzed using MAXQDA software. The paragraph was used as the unit of analysis. Based on the content analysis, 618 codes were extracted and categorized into six main categories and 30 subcategories (Table 2). To effectively present the results and establish an appropriate framework, we identified and compared categories based on theoretical, and practical perspectives of design knowledge across three dimensions: theoretical, programming, and

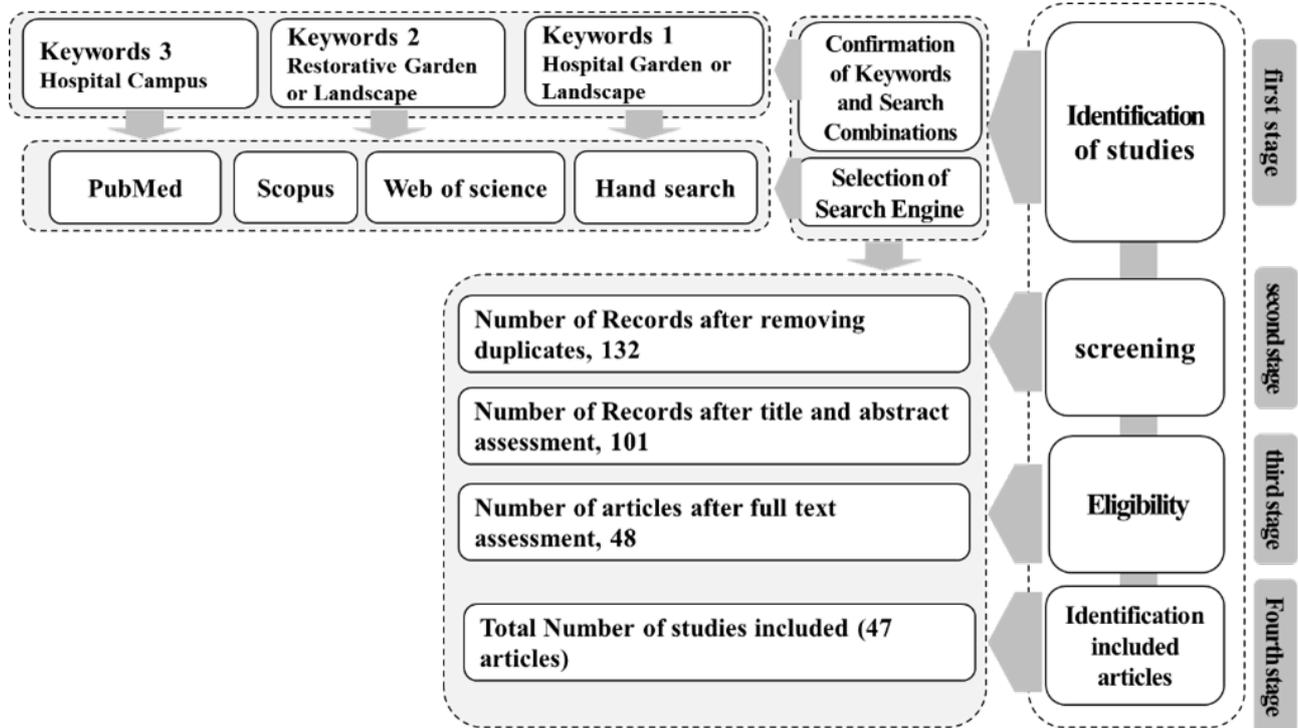


Fig. 1. Process of systematic analysis of the literature. Source: Authors.

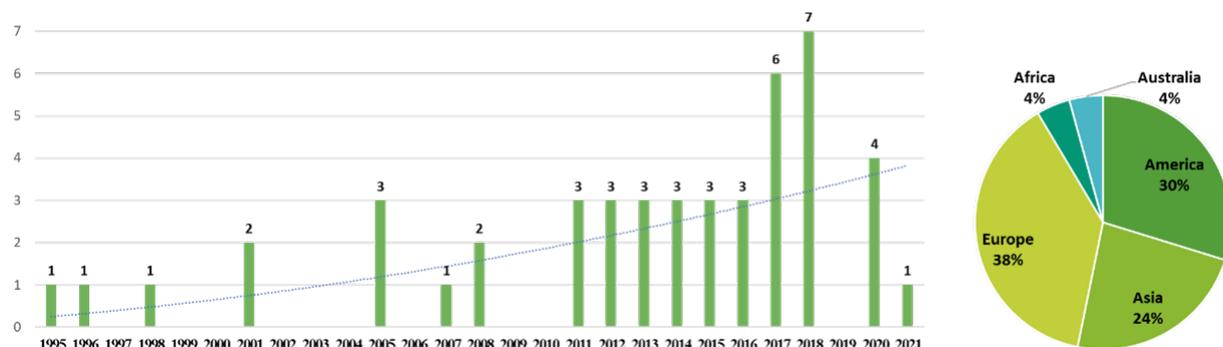


Fig. 2. The frequency of reviewed publications based on their year of publication from 1995 to 2021. Source: Authors.

Table 2. Extracted categories and subcategories from coding in MAXQDA software. Source: Authors.

Dimension	Category (frequency of codes)	Extracted Subcategories from content analysis (frequency of codes)
Theoretical dimension (203)	01-The essence of the hospital outdoor landscape (147)	01- Landscape as a restorative resource (46) 02- The role & position of the landscape regarding the city (as urban ecosystem services) (17) 03-Therapeutic landscape (23) 04-Restorative landscape (5) 05-Healing landscape (33) 06-Salutogenic environment (12) 07- Supportive landscape (11)
	02-Typology of hospital outdoor landscape (4)	08-Based on form & location of green spaces (Marcus) (2) 09- Based on interaction (between indoor and outdoor spaces) (1) 10- Spatially zoning (1)
	03-Proposed Theories in the hospital outdoor landscape literature (52)	11-Biophilia theory (3) 12-Prospect-refuge theory (2) 13- Stress reduction theory (14) 14-Attention-restoration theory (15) 15- Affordance Theory (14) 16- Therapeutic landscape concept (4)
Programming dimension (235)	04-Hospital outdoor landscape design approaches (43)	17-Evidence-based design (7) 18- Biophilia approach (2) 19- Salutogenic design (9) 20- Integration of Salutogenic and biophilic approaches (3) 21-Participatory design (13) 23- Theraserialization concept (2)
	05-Principles, & qualities of the hospital landscape (192)	24-Principles of hospital outdoor landscape design (design recommendations) (161) 25- The necessity of determining the target user and focusing on his needs (31)
Operational dimension (180)	06- Preferences and needs of the hospital outdoor landscape users (180)	26-Difference in user preferences regarding the quality of hospital landscape (30) 27- Strong desire of users to contact nature (16) 28- Users' awareness of the potential of the hospital outdoor landscape (25) 29-Reporting the good feeling after spending time in landscape (16) 30- Landscape elements; preferred by user groups (93)

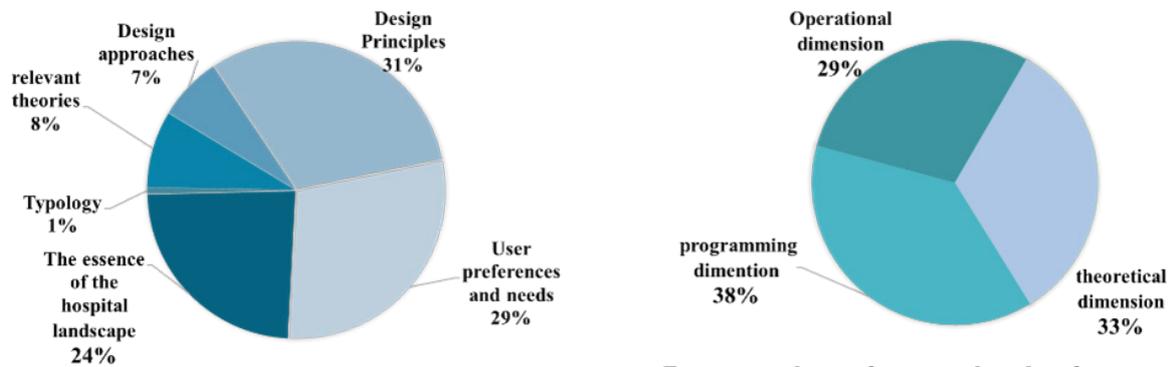
operational. Regarding Fig. 3, the percentages for theoretical, programming, and operational codes are 33%, 38%, and 29%, respectively. The codes are evenly distributed throughout all three dimensions, indicating a simultaneous and appropriate growth of all dimensions. The percentage of codes related to the operational dimension is relatively low (29%) compared to the other two dimensions. This suggests there is still limited understanding of the users, their preferences and needs, and how the environment impacts them. In the following sections, we will explain the categories related to each dimension.

• **Categories related to the theoretical dimension of designing the hospital outdoor landscape, including its essence, typology, and relevant theories**

In this dimension, there are three distinct categories: “The essence of the hospital outdoor landscape,” “The typology of the hospital campus landscape,” and “relevant theories in the literature of the hospital landscape.” The frequency of codes related to each category is 72.4%, 1.9%, and 25.6%, respectively (Fig. 4). The difference in the frequency of the codes indicates that research in this field is still developing, and researchers are putting effort into understanding the essence of hospital outdoor landscapes and creating a conceptual framework.

- **The lack of a precise and comprehensive definition of the hospital outdoor landscape**

Despite the assignment of numerous codes to the “essence of the hospital outdoor landscape” category, the content analysis results indicate that there is no comprehensive definition available to accurately describe its role, goals, and function regarding the city, hospital, and its users. However, its restorative, symbolic, and service functions have been partially explained (Table 3). Researchers have defined the essence of the hospital outdoor landscape by focusing on its restorative function. In various texts, terms such as “healing landscape,” “relaxing landscape,” “therapeutic landscape,” “Salutogenic environment,” and “supportive landscape” are used to describe this function (as shown in Table 4). It seems that the researchers’ approach to the primary function of the hospital campus landscape is providing space to promote the health and well-being of users, reduce mental fatigue, hasten recovery, help patients handle stressful situations, and engage their minds without becoming tired or stressed. The symbolic function of the hospital outdoor landscape can be explained by describing its relationship with the surrounding urban space. The hospital campus holds immense importance in the urban landscape, serving as a physical embodiment of the health culture’s identity. It stands as a symbol of the theories associated with healthy, green, and smart cities. Its continuous evolution can lead to a distinct sense of place



Frequency chart of extracted codes from content analysis in categories

Frequency chart of extracted codes from content analysis in 3 dimensions of hospital landscape design

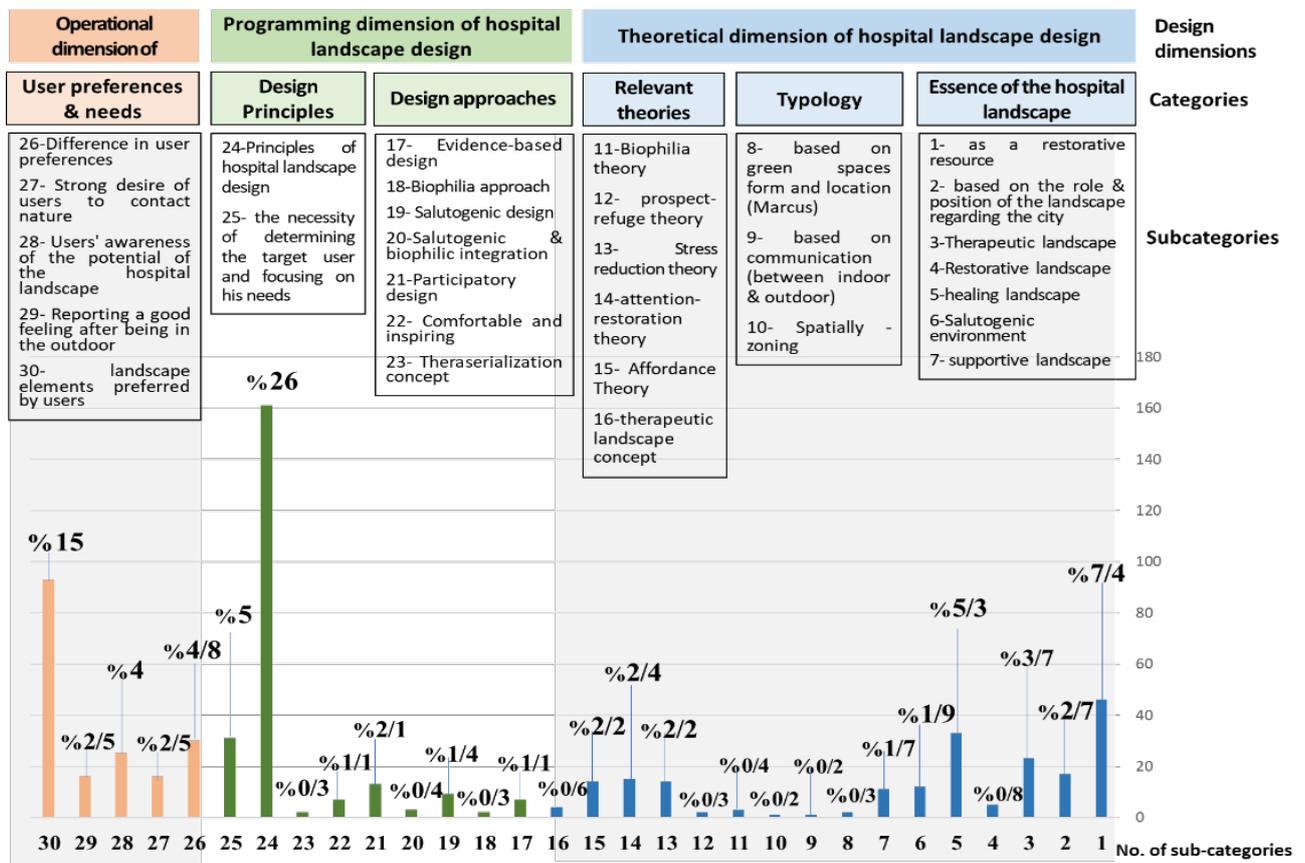


Fig. 3. Frequency of extracted codes from content analysis, organized by category & subcategory. Source: Authors.

within the urban environment. The hospital is involved in a conflicting dialectical relationship with the surrounding cityscape, and the landscape provides a connection between the hospital and the city (Đukanovic, Maric & Giofrè, 2017, 75; Akdeniz, Dalgic, Deniz, Kara & Ozkan, 2017, 70; El Baghdadi, Ziviani, Nieberler-Walker, Reeve & Desha, 2017, 11). According to Ma, Adeney & Long (2021, 2), the COVID- 19 pandemic has emphasized the importance of hospital campuses in preventing the spread of infection, providing primary treatment and quarantine services. As a result, there is a renewed need to comprehend the

functions and structure of these open spaces. The service function of the hospital outdoor landscape is closely related to the hospital building. The hospital campus landscape is considered an infrastructure that can improve the site's resilience through surface water management, air quality purification, reduction of environmental carbon dioxide, and wildlife habitat restoration (Jiang, Staloch & Kaljevic, 2018a, 98). Also, the green space of hospitals is recognized and evaluated as the space that separates buildings from each other, remaining space and space for future development (Jiang, Staloch & Kaljevic, 2018b, 25).

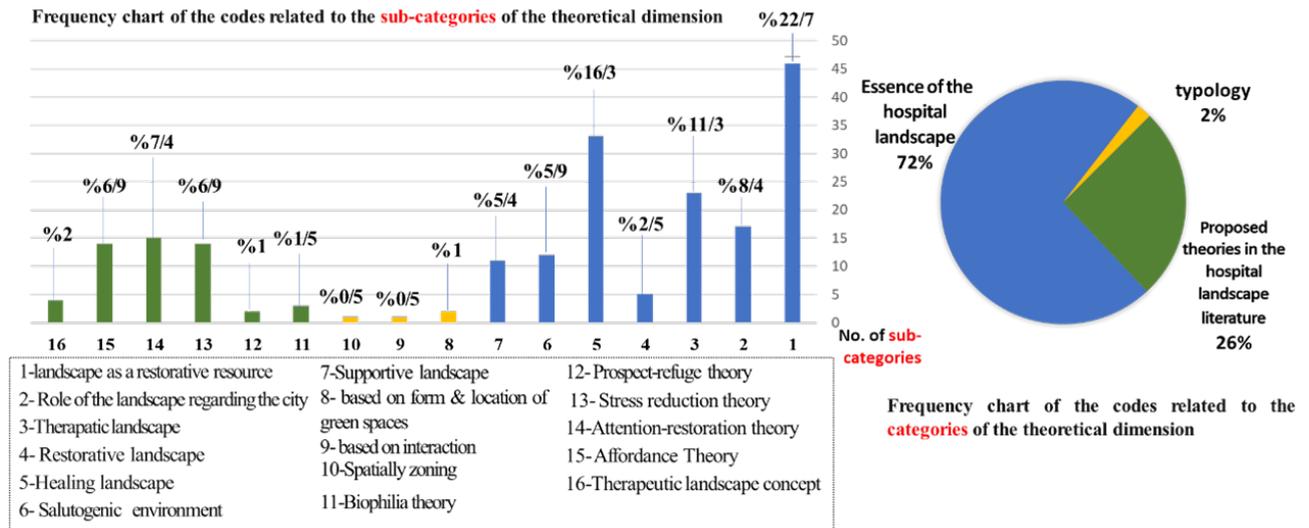


Fig. 4. Frequency chart of extracted codes related to the theoretical dimension. Source: Authors.

Table 3. Description of the essence of hospital outdoor landscape regarding user, hospital, & the city. Source: Authors.

Title	Type of relationship	Description
The essence of the hospital outdoor landscape	The relationship between Landscape and user (restorative function)	<ul style="list-style-type: none"> - Providing a chance for the user to recover, relax, and adapt to the stressful hospital environment. - Creating an opportunity for the user to connect with nature - Establishing a warm and inviting atmosphere. - Providing landmarks (Enhancing readability) - Providing space for socializing - Providing space for treatment - Providing secure outdoor space
	The relationship between the landscape and the city (symbolic function)	<ul style="list-style-type: none"> - Connecting the hospital to the city. - A symbol of theories related to a healthy, green, and smart city - As an urban landscape and important for the image of the city
	The relationship between the landscape and the hospital building (service function)	<ul style="list-style-type: none"> - As space between buildings - As remaining space (Available space) - Space for future development - As an infrastructure, improving the site's resilience effectively

Table 4. Summary of the various terminology utilized regarding the restorative function of hospital landscape. Source: Authors.

Terminology	School	Representatives	Definitions
Therapeutic landscape	Medical geography	Gesler (1992, 735); Gesler (2003, 8)	- Places with natural or historical features to maintain health and well-being are connected with the sense of place and lead to 4 dimensions of Therapeutic landscape: natural environment, built environment, symbolic and social environment.
Restorative environment	Environmental psychology	Kaplan & Kaplan (1989, 176)	- The environments that help people recover from mental fatigue.
Healing garden	Environmental psychology	Marcus & Barnes (1999, 9)	- The concept of a Healing Garden indicates that the physical environment can aid in speeding up the recovery process for patients and adaptation to the acute conditions of the treatment.
Salutogenic environment	Ecological psychology	Olmsted (1976); MacDonald (2012)	- Salutogenic environments incorporate greenery to engage the mind without inducing fatigue, which reduces symptoms of mental exhaustion and stress caused by pain. This is achieved through encouraging physical activity and facilitating social interaction.
Supportive Gardens	Environmental psychology	Ulrich (1999, 36)	- In this context, "supportive" refers to gardens with environmental features that help patients, visitors, and staff of medical centers cope with stress.

Descriptions of the hospital campus landscape as a place for

- A place to maintain health and well-being	- A place to improve mental fatigue	- A place to speed up the patient's recovery and adapt to the conditions	- A place to engage the mind without fatigue/symptom reduction	- A place to manage stress
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- The evolution of research of hospital landscape typology with low generalizability

To date, four distinct typologies have been presented (Fig. 5). Marcus and Barnes (1999, 11) in the book “Healing Gardens: Therapeutic Benefits and Design Recommendations,” have introduced the advantages and disadvantages of possible locations and forms of the hospital landscapes (under 16 titles, like entrance courtyard, roof garden, etc.). Yücel (2013, 382) has identified 13 possible forms of hospital landscapes that are relatively similar to the classification proposed by Marcus and Barnes (1999). Out of these, nine are common to both. Bengtsson (2015, 25) has identified four zones of contact with the outdoors in healthcare settings: zone 1, from inside a building (possibility of having contact with the outdoors from inside a building, through the windows); zone 2, the transition zone between indoors and outdoors (such as balcony, patio, etc.); zone 3, immediate surroundings (ideally garden); and zone 4, the wider neighborhood (every opportunity for the outdoor experience. Jiang and Werderber (2016, 15) have also introduced twelve landscape design patterns for the hospital campus to integrate green spaces into the campus and provide human-nature interaction. These design patterns are inspired by Christopher Alexander’s book (Pattern Language: Towns, Buildings, Construction) (Jiang et al., 2018b, 47). Through content analysis using an inductive approach, it can be claimed that the focus of typology studies has evolved. Initially, it was centered around categorizing the physical forms of outdoor spaces, but it has since shifted towards identifying landscape design patterns that enhance the user’s interaction with the environment. Despite their general aspect, existing typologies have limited generalization potential. They can be used as a draft to conduct typological research on the outdoor landscape of the hospital in other geographical areas.

- Psychological theories, the main core in the formation of the theoretical framework of hospital landscape studies
 Psychological-restorative theories like biophilia theory, prospect-refuge theory, Ulrich’s stress reduction theory, and Kaplan’s attention-restoration theory are commonly cited by researchers in this field to elucidate and augment the restoration function of hospital outdoor landscape. Design principles and recommendations, and assessment tools such

as H-GET⁶ and CMB⁷ are also developed based on restorative theories. Of course, cognitive theories (environmental psychology) have also been used in a limited way; for example, Gibson’s affordance theory is the conceptual framework of the SOS8 assessment tool.

• Categories related to the programming dimension of the hospital outdoor landscape design (approaches and principles of design)

This dimension is divided into “hospital landscape design approaches” and “principles, indicators, and features of hospital landscape design.” The frequency of codes related to each category is 18% and 82%, respectively, as shown in Fig. 6.

- Utilizing salutogenic Evidence as the principle of hospital outdoor landscape design approaches

Out of all the approaches suggested in the included articles, participatory design approach, salutogenic design, and evidence-based design have the highest number of codes. By conducting an inductive analysis and considering the timing of the publication of codes, it can be concluded that all the suggested approaches advocate evidence-based design and recommend utilizing salutogenic evidence and users’ feedback in the design process to accurately identify their requirements and preferences. This article’s findings support the research conducted by Chi et al. (2020, 30), who suggest that the definitions and concepts related to the natural environment and its ability to improve the hospital experience influence the design process in the literature in this field.

- Description of the users and quality of the hospital outdoor landscape (in objective and subjective dimensions)

Generally, the principles and qualities of the hospital landscape are conveyed through recommendations and instructions. These are in the form of single sentences or independent sections in articles. There are two types of recommendations: 1) To provide the objective and subjective quality of the landscape, and 2) To understand the users and their preferences. Table 5 contains some examples of these recommendations. Based on the table, the recommendations are general and focus on creating a restorative landscape. However, they do not specifically

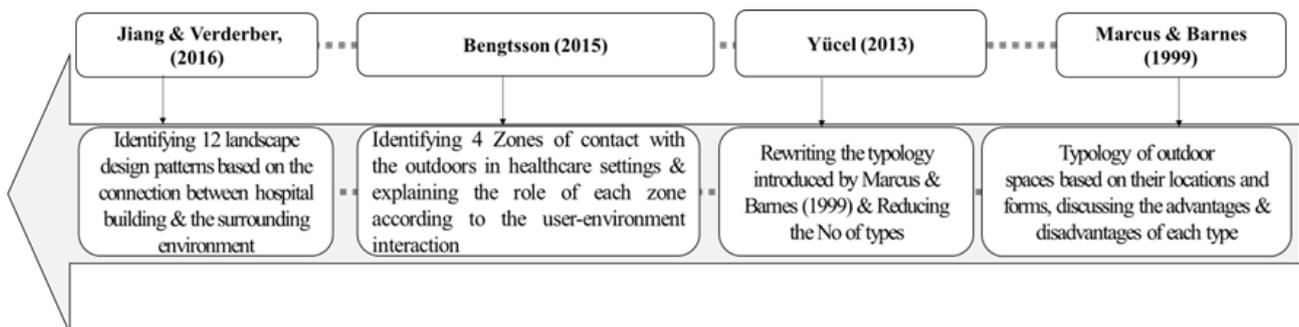


Fig. 5. Evolution of typologies studies of hospital outdoor landscape. Source: Authors.

Frequency chart of the codes related to the sub-categories of the programming dimension

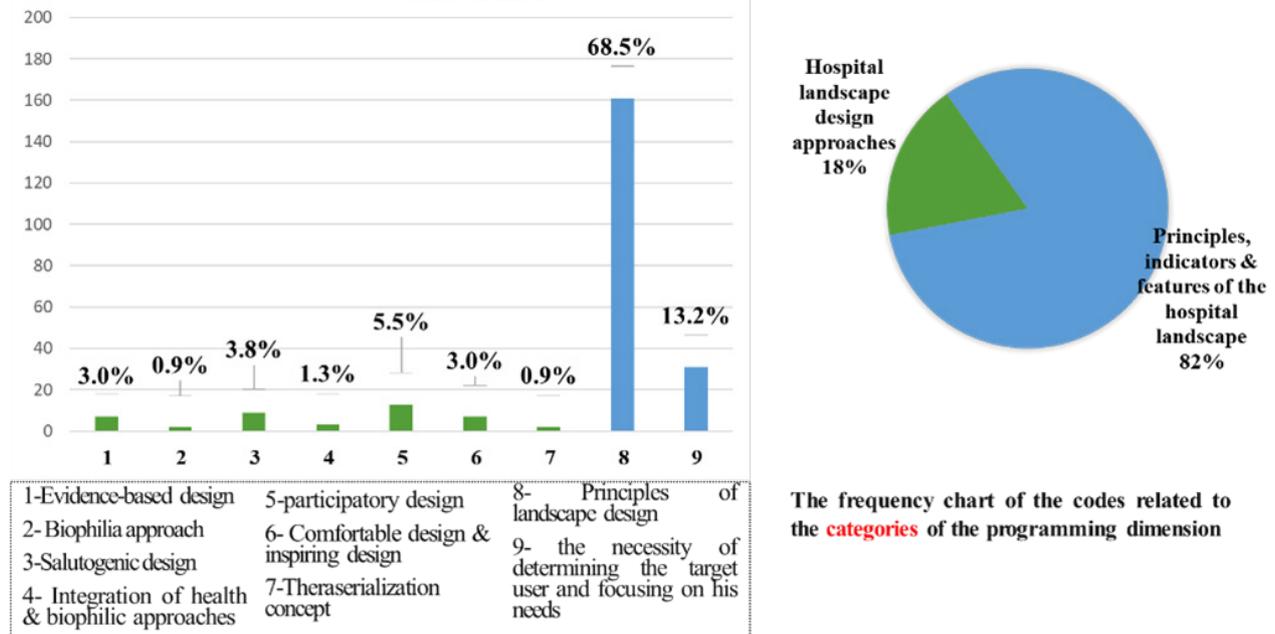


Fig. 6. Frequency of codes related to the programming dimension's categories & subcategories. Source: Authors.

Table 5. Recommendations regarding the physical aspect of the hospital landscape (objective & subjective qualities). Source: Authors.

Dimension	Recommendations	Sources
Subjective quality	Readability (easiness of navigation & memorability)	El Baghdadi et al. (2017); Georgi (2005) & Yücel, (2013)
	Naturalness (the opportunity to contact with nature)	Marcus & Barnes (1999)
	A feeling of personal control in the environment (feeling of silence and respecting his privacy)	El Baghdadi et al. (2017); Georgi (2005); Yücel (2013); Zhao & Mourshed (2012)
	Feeling safe in the environment (familiarity)	Cervinka et al. (2014); El Baghdadi et al. (2017); Georgi (2005); Marcus & Barnes (1995); Yücel (2013); Zhao & Mourshed (2012)
	Flexibility (anticipating a range of diverse spaces and activities to create a desire in users to visit)	El Baghdadi et al. (2017); Georgi (2005); Yücel (2013); Zhao & Mourshed (2012)
	Sensory enrichment (stimulation of all senses to create positive distractions)	Cervinka et al. (2014); El Baghdadi et al. (2017); Marcus & Barnes (1995, 1999); Yücel (2013); Zhao & Mourshed (2012)
	Easiness of physical access (circulation, connection between indoor and outdoor spaces)	El Baghdadi et al. (2017); Georgi (2005); Yücel (2013)
	providing visual access (e.g., the visibility of outside spaces from interior spaces)	El Baghdadi et al. (2017); Georgi (2005); Yücel (2013)
	providing Exercise equipment & leisure infrastructures (especially children's Playgrounds)	Marcus & Barnes (1999); Yücel (2013)
	Providing social and individual spaces on the campus (for active and passive behaviors)	Marcus & Barnes (1995)
Objective quality	Physiological comfort (thermal, visual, Olfactory, etc.)	Cervinka et al. (2014); Georgi (2005); Yücel (2013); Zhao & Mourshed (2012)
	Sustainability & adaptability (e.g., using plants according to the ecological data of the context)	Georgi (2005); Yücel (2013)
	Spatial flexibility (considering the future spatial needs)	Georgi (2005)
	Variety of animal species (aquatic elements and birds, etc.)	Georgi (2005); Marcus & Barnes (1995)
	Variety of plant species (choosing the appropriate plant species, flower beds, etc.)	El Baghdadi et al. (2017); Erbino, Toccolini, Vagge & Ferrario (2015); Georgi (2005); Marcus & Barnes (1995); Yücel (2013)
	Choosing and arranging furniture correctly (water features, seatings, benches, etc.)	Chang & Chien (2017)

target any particular user group, such as patients or their families. The hospital campus serves a variety of users, including patients, their families, staff, and the surrounding community. It is important to coordinate with their individual needs and requirements (Bengtsson et al., 2015, 70; Đukanovic et al., 2017, 74). When users feel that the landscape design and its functional setting do not meet their needs, it can result in low satisfaction reports and higher expectations (Ma, Adeney & Long, 2021, 1). One of landscape architects' crucial tasks is identifying users' needs and preferences due to the considerable investment in construction and the demand for continued use of the environment by managers. (Chang & Chien, 2017, 1; Mourshed & Zhao, 2012, 362). According to Cervinka, Röderer & Hämmerle (2014, 45), it is beneficial to know how users perceive and evaluate the landscape's restorative potential in the design process, and a standard method for analyzing and comparing users should be developed. Experts strongly recommend involving a wide range of users in the design process of medical centers (such as Curtis, Gesler, Fabian, Francis & Priebe, 2007, 591; Georgi, 2005, 1). It is crucial to consider the compatibility of the hospital environment with its users' personalities, preferences, and cultural and religious customs, especially for patient groups who have been admitted to the hospital against their will (Curtis et al., 2007, 593). According to Davis (2011, 42), defining the target user when designing a hospital landscape is essential. Without a clear user group definition, evaluating whether the environment is supportive becomes challenging (Bardenhagen & Rodiek, 2016, 3). Naderi and Shin (2008, 89) also state that there is no need to design for all stakeholder groups. Chang and Chien (2017, 2) believe a relationship exists between users and

their preferences for hospital landscape qualities. Another concern regarding hospital users is acquainting hospital users with the design and instructing them on how to use the space, or in other words, injecting the spirit of the space. In a study conducted by Davis (2011, 36) on a rehabilitation garden located on the roof of a hospital in Tennessee, it was discovered that staff were unaware of the initial design purpose. They removed or relocated plants based on their preferences, placing them in high-visibility areas rather than following the intended design plan. Overall, it is essential to determine the target user and involve them in the design process to understand their needs and preferences. However, there have been limited studies on how the hospital campus landscape impacts the patient experience (Tseung, Verweel, Harvey, Pauley & Walker, 2022, 256).

• **Categories related to the operational dimension of hospital outdoor landscape design (identifying the users, their needs and preferences)**

The operational dimension had only one category-preferences and needs of users about the hospital outdoor landscape. The category's content is extracted from the post-occupancy evaluation studies of case studies. According to Fig. 7, the sub-category "users' preferred landscape elements" has the highest code frequency. Considering the influence of user attitudes on the utilization of hospital environments (Chi et al., 2020, 10), Numerous researchers have conducted field research and employed tools like questionnaires to identify users' preferences, needs, and experiences and to gather feedback on hospital landscapes. 5 items (subcategories) have been reported by researchers commonly and frequently (with high generalizability). Table 6 provides examples of codes related to these subcategories:

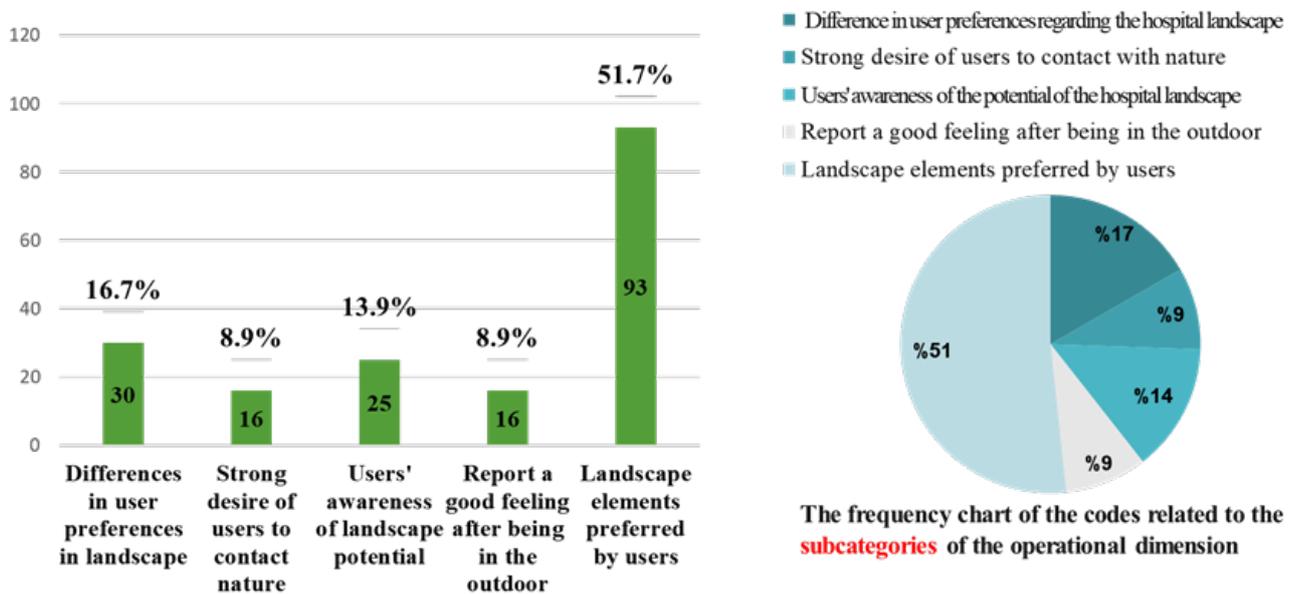


Fig. 7. Frequency of codes related to the subcategories of the operational dimension. Source: Authors.

Table 6. Examples of codes related to the variations in user preferences in the hospital outdoor landscape. Source: Authors.

Examples of codes related to the variations in user preferences in the hospital outdoor landscape	
Authors	Findings
Naderi & Shin (2008, 99)	Hospital managers tend to create a calming environment on campus.
Georgi, (2005, 5)	Employees are willing to spend their free time in the outdoor spaces of the hospital.
Naderi & Shin (2008, 101)	Nurses have a desire to have privacy and personal space while on the hospital campus.
Jiang et al. (2018b, 41)	Nurses desire to have a quiet, private space for themselves. Employees want to view the yard without necessarily needing physical access to it.
Erbino et al. (2015, 47)	Mental patients tend to engage in activities such as gardening, taking walks, and spending time outdoors to communicate with their relatives.
Georgi (2005, 4)	Medical students desire to spend their free time in an environment that exudes speed and rhythm.
Chang & Chien (2017, 1)	The residents in the neighboring areas want equipment for children's play and family activities to be provided on the hospital campus.
Van Der Riet, Jitsacorn & Thursby (2020, 9)	It is important to consider the type of patients, particularly children, and their desire to incorporate play into the treatment process as opposed to adult patients.
Whitehouse et al. (2001, 311)	There is a difference between the needs of hospitalized children and healthy children (siblings of hospitalized children).
Chang & Chien (2017, 1)	Employees and families of patients want landscape elements that encourage physical activity, such as play features.
Asano et al. (2008, 27)	Users at a hospital campus do not prioritize the need for sports equipment. (related to the cultural differences between Japan and other cultures).
Some examples of codes related to users being aware of the potential of the hospital landscape	
Authors	Findings
Asano, Marcus, Miyake, Sasaki, & Tsuda (2008, 25); Georgi & Anthopoulos, (2011, 642)	Users recognize that the hospital yard is crucial in promoting well-being and improving overall feelings.
Georgi, (2005, 5)	People desire an atmosphere that embodies the values and attributes of a restorative landscape.
Jiang et al. (2018b, 41)	Hospital employees are keen to experience nature and appreciate it in their workplace.
Davis (2011, 29)	Patients' awareness of the benefits of the hospital yard (as an alternative option to the interior space, a space to provide a view from inside the building, a space to breathe in fresh air and feel the sunlight, etc.).
Curtis et al. (2007, 599)	Patients are aware of the potential of campus design and the symbols used in it (mental patients are aware of the correlation between hospital wall fencing and the public's perception of mental health facilities).
Whitehouse et al. (2001, 312)	Users' awareness of the hospital courtyard as a space for restoration (however, it was not utilized).
Özdemir & Cengiz, (2018, 395)	Users can explain their reasons for being in the hospital garden: the possibility of being in a green and spacious, sunny, and shady space to reduce stress, socializing, and social relations.
Examples of codes related to the report of feeling good after spending time on the hospital campus	
Authors	Findings
Đukanovic et al. (2017, 82)	Over half of the users report feeling different and improved after spending time in the yard.
Sherman, Varni, Ulrich & Malcarne (2005, 167)	After comparing the mental states of users inside and outside the hospital building, it was discovered that those inside the courtyard reported a better mental state with lower pain and sadness than those inside the building.
Said, SaSarifil & Bakar (2012, 9)	Sick children tend to come back to the yard. 80% of the children had a positive feeling towards the yard.
Said, Salleh, Bakar & Mohamad (2005, 331)	94% of mothers and nurses believe sick children prefer being in the yard rather than in hospital wards. Moreover, spending time in the yard has a positive impact on the behavior of children. They tend to cooperate better during their treatment and become more obedient. Therefore, dealing with sick children becomes easier after they have spent some time in the yard.
Van Der Riet, Jitsacorn & Thursby (2020, 8)	Sick children were happy while spending time in the hospital's yard. (observing the joyful aspect of the yard in the paintings).
Chang & Chien (2017, 1)	Patients strongly desire to be in contact with nature as it makes them feel good.
Naderi & Shin (2008, 100)	88% of nurses consider it essential to be able to be outside the hospital building during their work hours.

Rest of Table 6.

Examples of codes related to users' preferred landscape elements & features	
Authors	Findings
Ahn (2014, 72); Asano et al. (2008, 26); Barnhart, Perkins & Fitzsimonds (1998, 153); Belcáková et al. (2018, 142); Chang & Chien (2017, 13); Davis (2011, 39); Erbino et al. (2015, 47); Georgi & Anthopoulos (2011, 643); Heath & Gifford (2001, 32); Idris, Sibley & Hadjri (2018, 5); Jiang et al. (2018a, 38); Marcus & Barnes (1995, 59); Özdemir & Cengiz, (2018, 396); Said et al. (2012, 9)	Greenery (Flowering & planting shade trees)
Belcáková et al. (2018, 142); Chang & Chien (2017, 9); Davis (2011, 39); Đukanovic et al. (2017, 82); Erbino et al. (2015, 47); Georgi & Anthopoulos (2011, 639); Heath & Gifford, (2001, 34); Idris et al. (2014)	Sitting area
Ahn (2014); Belcáková et al. (2018, 142); Davis (2011, 40); Georgi & Anthopoulos (2011, 639); Heath & Gifford (2001, 34); Özdemir & Cengiz (2018, 396); Shukor, Stigsdotter, Lottrup & Nilsson (2012, 87)	Providing thermal comfort (shade & covered space)
Ahn (2014, 72); Barnhart et al. (1998, 154); Belcáková et al. (2018, 142); Georgi & Anthopoulos (2011, 639); Heath & Gifford (2001, 30); Idris et al. (2018, 5); Marcus & Barnes (1995, 59); Özdemir & Cengiz (2018, 396); Said et al. (2005, 335); Sherman et al. (2005, 176); Shukor et al. (2012, 87); Whitehouse et al. (2001, 312)	Elements or features for positive distractions, such as water features

- Users' needs and preferences regarding the hospital outdoor landscape vary depending on the specific group they belong to. Demographic factors play a role in determining the level of these differences (Mourshed & Zhao, 2012, 369). For instance, patients' needs and preferences differ based on their age group (adults or children) or their type of illness (physical or mental).
- All user groups are aware of the restorative power that a hospital landscape can possess. They are conscious of their surroundings and can easily detect any hindrances or positive factors affecting their experience.
- All users experience a positive feeling after being in the hospital outdoors (common to all user groups).
- All users share a desire to connect with and spend time in the natural environment of a hospital outdoors (common to all user groups).
- The degree of users' satisfaction with landscape depends on the presence or absence of their preferred elements. These elements can include flowerbeds and shade trees, seating areas, gazebos, and other landscape features like fountains for a positive distraction.

Discussion

• The hospital outdoor landscape design literature from a theoretical perspective

The theoretical concepts for the hospital outdoor landscape design are presently in development. In the first place, the hospital landscape's restorative essence has taken scholars' attention. Numerous studies have explained the restorative power of hospital landscapes by referencing theories and experimental findings that demonstrate the impact of nature on the physical and mental well-being of hospital users. The use and symbolic function of this landscape have been neglected. Currently, there is no complete and comprehensive definition of this landscape available. Nevertheless, recent articles have utilized cognitive theories, such as Affordance Theory (Gibson), to define the essence of the landscape based on the user's experience, position, and relationship with the environment. The study of morphology is also developing. While early typology studies focused on the spatial location and form of green space within a campus, current research has shifted its focus toward analyzing the connection between the landscape and its stakeholders.

• **The hospital outdoor landscape design literature from a practical perspective**

The literature on hospital landscape design has transitioned to operationalize the findings in the design process following theoretical discussions. The study of hospital landscape design initially focused on design approaches, including evidence-based, salutogenic, and participatory design. These approaches aimed to operationalize the functions of the hospital landscape. Despite their different principles, methods, and actions, they all stem from the same concept, elucidating the interrelation between the user and the hospital outdoor landscape. Based on content analysis, findings of studies regarding practical perspective are divided into 1) design principles, features, and guidelines and 2) design evidence obtained from post-occupancy evaluation studies. A conceptual framework was compiled to condense the results of hospital landscape literature analysis from both theoretical and practical perspectives (Fig. 8).

Conclusion

This study reviewed 47 published research papers relevant to hospital landscape design to analyze the research flow, discuss the covered topics, and identify the strengths and weaknesses. Most of the included articles were published from 2011 onwards, indicating that researchers are becoming more aware and sensitive to the issue of hospital outdoor landscape design. It should be noted that only one study was conducted in Iran, indicating a need for more research in this region. Many

studies in this field have concentrated on demonstrating and elucidating how the landscape and its natural spaces affect users' well-being. However, insufficient emphasis has been given to the principles, qualities, and design methods. Consequently, gathering and selecting studies that coincide with the purpose of this research has consumed a considerable amount of time. Another main challenge is dealing with the wide range of topics covered by the included studies (e.g., typology studies and post-occupancy evaluation studies, etc.), as well as the diversity of research methods and data collection techniques. To address this complexity, we conducted a content analysis and coded the text of the articles, resulting in the identification of 618 codes within 6 categories and 30 subcategories. To enhance the clarity of the results, the categories were grouped into three dimensions: theoretical, programming, and operational. A balanced distribution of codes was observed across all three dimensions, indicating a simultaneous development of all three dimensions. In sum, research has been conducted on various aspects of design, such as its essence, typology, design approach, principles, and qualities. Additionally, the characteristics of users and their needs and preferences have also been explored, but these studies are limited, and further research is needed. In the theoretical dimension, the functions of hospital outdoor landscapes, their morphology, and theories of environmental physiology have been considered. While the description of a hospital landscape essence remains

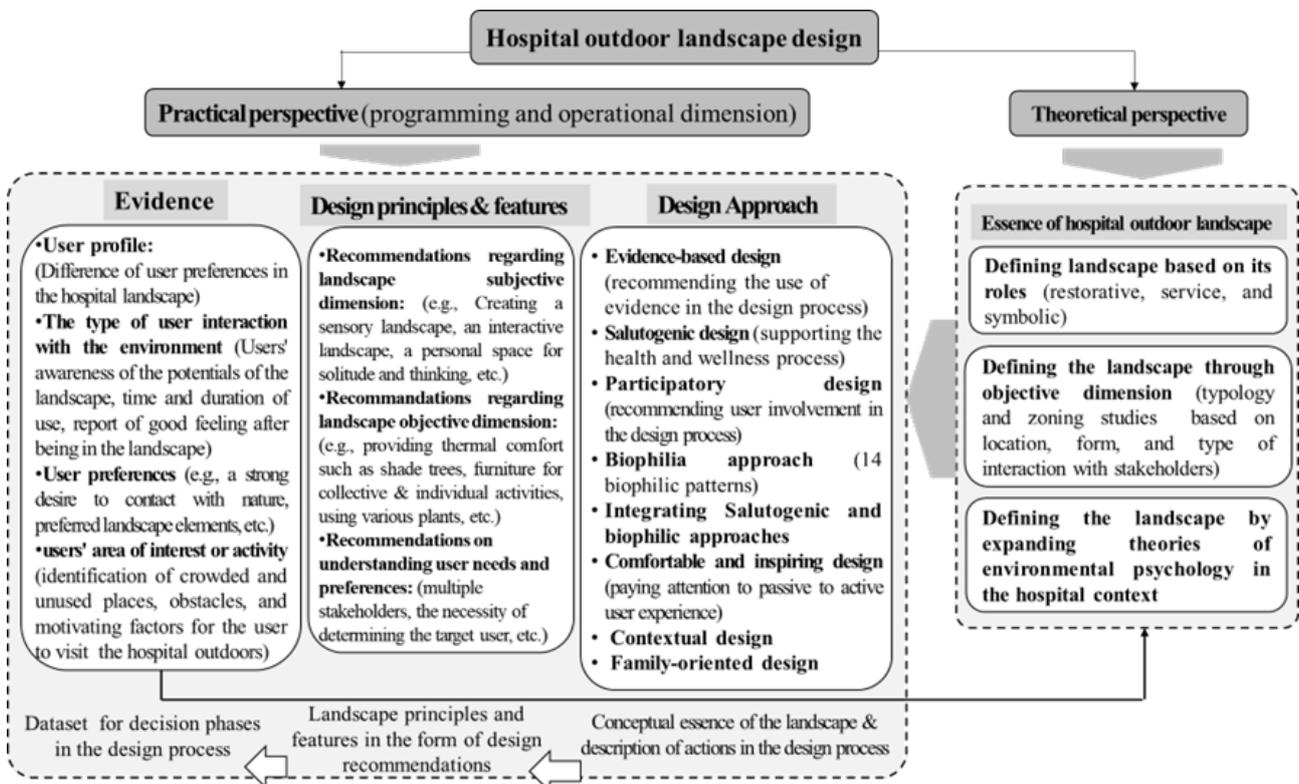


Fig. 8. Conceptual framework of the literature on designing hospital outdoor landscapes (through the systematic review and content analysis). Source: Authors.

elusive in the literature, its service, symbolic, and restorative functions have been explained. The restorative function has been further elaborated upon through reference to theories of environmental physiology (e.g., attention-restoration theory). Morphology-wise, typology studies have been carried out that initially concentrate on the form and location of green spaces, followed by spatial zoning, and finally, based on the type of interaction with the hospital building. A significant advantage of these studies from a theoretical perspective is the recognition of the hospital outdoor landscape as a restorative environment, reinforced by reference to the theories of environmental physiology. Additionally, recent typological studies emphasize the significance of the interaction between the hospital landscape and its stakeholders. However, the absence of a comprehensive definition of the hospital landscape and an explanation of its various functions is a significant drawback of these studies. Additionally, the generalizability of typological studies' findings is weak, further restricting their applicability.

The issues of reviewed articles regarding the programming dimension focus on introducing design approaches, principles, and landscape qualities in the form of design recommendations. Generally, the design problem-solving method of these approaches involves users in the design process to understand their

needs, preferences, and experiences and using evidence extracted from post-occupancy evaluation projects. Introduced approaches, such as the evidence-based approach, have been discussed in detail in the literature on hospital interior design and can be easily applied by landscape designers. The proposed principles and qualities for the subjective dimension of this landscape are also borrowed from restorative landscape design. However, the weakness of this field lies in the limited design recommendations for the objective dimension. These recommendations do not consider the differences in user groups' profiles and are only suitable for general hospitals.

Overall, the weakness of hospital outdoor landscape literature is the lack of a comprehensive and detailed description of its essence and limited evidence regarding user groups' profiles and their interaction with the landscape. Moreover, the studies mainly focus on the outdoor landscape of general hospitals, and there has been no analysis of the similarities and differences between the landscape designs of specialized and general hospitals. Therefore, it is imperative to conduct qualitative studies through surveys of experts and post-occupancy evaluations with the participation of ordinary users in various contexts (public, private, educational, general, specialized, single-block, or complex hospitals) to fortify the literature.

Endnote

* This paper is derived from Naeimeh Asadian Zargar's doctoral thesis, titled "Hospital Landscape Design Framework based on Usability Approach." The research is being conducted under the supervision of Kianoush Suzanchi and with the advisement of Mohammad Mehdi Sepehri within the Department of Architecture at Tarbiat Modares University in Tehran.

1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)
2. Center of Health Design

3. Health and Care Infrastructure Research and Innovation Centre.

4. International Academy for Design & Health. Available online: <https://www.designandhealth.org>

5. STROBE (Strengthening the Reporting of Observational Studies in Epidemiology)

6. Healthcare Garden Evaluation Toolkit

7. Therapeutic Garden Audit for Acute Care Hospitals

8. The Seniors' Outdoor Survey tool

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