UDC 725.54
DOI https://doi.org/10.32782/2415-8151.2024.34.26

ENVIRONMENTAL DESIGN OF THE REHABILITATION CENTER

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Abstract. Environmental Design of the Rehabilitation Center, addresses to the urgent need for specialized spaces to support individuals affected by military conflicts, disasters, and violence. With rehabilitation facilities in Ukraine still in their developmental stage, this work focuses on enhancing the design and functionality of such centers.

***The aim** is to create a comprehensive environment that supports the full recovery of patients, emphasizing ergonomic standards, universal design, and inclusivity. The study outlines challenges faced in rehabilitation center design and offers modern solutions that improve the effectiveness of rehabilitation processes.*

***Results.** The paper includes a detailed analysis of global rehabilitation center designs, explores relevant design principles, and identifies key requirements for the creation of such facilities. The primary case study for this research is the "LIFE TREE" sports and rehabilitation center, for which an interior design concept has been developed. The concept includes architectural plans, visualizations, and material specifications.*

***The research methodology** combines a thorough review of global practices, ergonomic studies, and design theories.*

***The scientific novelty** of the study is the approach to the integration of psychological factors of patient behavior with functional design solutions.*

***The practical significance** of this work is evident in its potential to improve rehabilitation environments, benefiting both patients and staff.*

***The results** of this research emphasize the urgent need for modern, well-equipped rehabilitation centers in Ukraine, particularly for military personnel. The analysis of site-specific data for the proposed "LIFE TREE" rehabilitation center in Avangard village, Odesa region, revealed several key factors. The topography and climate are suitable for the center's outdoor rehabilitation activities, and the demographic analysis indicated a strong local demand for such services. The proposed design adheres to international standards of rehabilitation, focusing on sustainability, energy efficiency, and inclusivity.*

Keywords: rehabilitation center, interior design, functional zones, military recovery.

INTRODUCTION

Over the years, perceptions of people with disabilities have significantly evolved across different communities, moving away from the term "disability" as a negative label.

ANALYSIS OF PREVIOUS RESEARCH

Previous research highlights the significant historical and cultural variations in attitudes toward disability and rehabilitation. Historically, attitudes toward people with disabilities have deep cultural roots [3]. According to research, attitudes toward disability varied greatly across eras and cultures. In ancient Greece and Rome, the sick and disabled were often socially excluded, while early Christian doctrine viewed illness as a means of purification and grace. During the Reformation, figures like Luther and Calvin stigmatized disability. In the 19th century, Social Darwinism justified the denial of state aid to the disabled and poor, viewing them as impeding natural selection [12].

Attitudes toward disability differ widely across the world. In Africa, for instance, traditions and beliefs about disability range from reverence to exclusion [20]. In Scandinavian countries, social responsibility ensures support for all citizens, while in less developed nations, individuals with disabilities may face isolation and exclusion [9]. Negative perceptions, such as seeing disability as a curse, often lead to social exclusion. Addressing these prejudices is crucial for full acceptance and integration of people with disabilities into society.

The term "rehabilitation" has a long history. Its first recorded usage in the context of health was in 1940, during World War II, when rehabilitation became essential for returning soldiers to work. Initially focused on physical injuries, particularly limb injuries, rehabilitation expanded after the war to include psychological and social aspects [8]. Rehabilitation services evolved rapidly after World War II, especially for spinal cord injuries. Innovations such as metal prosthetics and standardized processes transformed the field [12]. Centers like those established by Ludwig Guttmann revolutionized care for spinal cord injuries, leading to improved life expectancy and better integration of disabled individuals into society.

By the mid-20th century, rehabilitation extended beyond physical recovery to address broader aspects of well-being, including mental health and social reintegration. However, despite significant progress, rehabilitation was often undervalued by medical professionals until the late 20th century, when holistic models began to gain recognition [13]. The bio-psychosocial model proposed by George Engel in 1977 marked a significant shift, emphasizing the integration of physical, psychological, and social factors in rehabilitation. Rehabilitation centers play a critical role in supporting individuals recovering from injuries, illnesses, or trauma, particularly those affected by military conflicts, natural disasters, or violence. Over time, the need for well-designed rehabilitation spaces has grown as an essential aspect of healthcare systems. Historically, rehabilitation environments have evolved from basic care facilities into complex centers focused on holistic recovery, incorporating physical, mental, and emotional well-being. However, in Ukraine, the development of rehabilitation infrastructure is still in its early stages, requiring innovative design solutions to meet the growing demands of patients, especially military person [19].

The importance of designing effective rehabilitation centers depends on their ability to provide an environment that is conducive to recovery, safety and comfort.

In addition to providing functional spaces for therapy, rehabilitation centers should also consider psychological factors that affect the well-being of patients [13]. Proper design can accelerate recovery, improve patient morale, and facilitate reintegration into society. Globally, many rehabilitation centers are already implementing advanced principles of universal design, inclusive spaces, and ergonomic considerations to meet these needs. However, the current Ukrainian system has not developed to fully support these goals [10].

The research problem addressed in this research is the lack of sufficient rehabilitation centers that meet modern design standards, particularly in the context of military recovery [9]. As the number of people requiring rehabilitation services grows, so does the need for well-planned, efficient, and inclusive spaces [18]. This paper aims to address the challenges in designing rehabilitation centers by exploring existing global practices, identifying key design principles, and developing modern solutions that cater to the specific needs of Ukrainian facilities [19].

The objective of this research is to propose a comprehensive environment design for the "LIFE TREE" sports and rehabilitation center. This design should focus on enhancing the quality of rehabilitation, taking into account both functional and psychological aspects. By addressing these challenges, this paper aims to contribute to the creation of more effective rehabilitation centers that foster holistic recovery and improve the quality of life for patients and their families [10].

Methods. The research methodology involved collecting site-specific data to analyze the feasibility and requirements for constructing a sports and rehabilitation center in Avangard village, Odesa region. The primary data sources included land characteristics, climate information, community demographics, and infrastructure availability, that were gathered through government records, cadastral databases, and local climate statistics [17].

The project involved representatives of local authorities, civil society and environmental experts in the data collection process. Their input was crucial in assessing the needs and expectations of the local population, especially with regard to medical and rehabilitation services [18].

Data Collection Instruments were collected combination of instruments, including:

– Site Surveys: Conducted to assess the topography, geology, and ecological conditions of the land;

– Demographic Analysis: Population information were obtained from local census records to understand the community's size and its potential demand for the center's services;

– Climate Reports: Historical climate data were used to evaluate the suitability of outdoor rehabilitation activities throughout the year.

The collected data were analyzed using a SWOT (Strengths, Weaknesses, Opportunities, Threats) framework to determine the project's potential success and challenges [17]. This method helped identify key factors influencing the development of the center, such as its location, community needs, and environmental conditions. The results were used to create a strategic plan that considers both internal and external factors affecting the project.

Research. The rehabilitation approach at the sports-rehabilitation center is based on a systematic, scientific framework designed to ensure a comfortable recovery process for every individual. Specifically aimed at military personnel and their families, the center located in ASTG (Avanhardivska settlement territorial community) creates a universal environment for recreation, addressing the unique needs of this target audience while promoting community development [17].

Concept and symbolism of the "LIFE TREE" embodies growth, resilience, and renewal, reflecting the strength and adaptability of military personnel transitioning to civilian life. This theme is intricately woven into the center's layout and the facade design of its buildings. A prominent tree in the medical center's interior symbolizes the project's core idea a "place of strength" where military personnel can access support and resources for recovery. This tree also emphasizes family, fostering moral and physical rehabilitation [13].

Key features of the center include a medical-diagnostic department, a sports complex, a residential block, diverse physical therapy options, and psychological support. Each section is functionally rich, allowing for a phased implementation of the project in three stages [1]. Safety considerations have led to the inclusion of an interconnected shelter system with dedicated exits beyond designated yellow lines [2].

The center's design is based on the principles of sustainable development and uses energy-efficient technologies, such as energy-saving lighting and renewable energy sources, aimed at reducing operating costs and minimizing environmental impact. Benefits include solar panels, rainwater collection, and eco-friendly building materials, all contributing to a healthier environment for users and aiding their physical and psychological recovery [4].

Universal design principles are fundamental to creating an inclusive environment [5]. Adhering to universal design rules, the center prioritizes family comfort through eco-friendly materials, social rehabilitation spaces, and varied therapy options. This design not only supports sustainable community development but also fosters social resilience and integration.

Rehabilitation Principles:

The primary rehabilitation principles include:

– Effectiveness: efficient methods yielding desired results for patients;

– Safety: techniques that avoid adverse consequences;

– Individual Approach: tailored processes considering each patient's unique needs;

– Systematic Approach: structured rehabilitation ensuring gradual improvement;

– Scientific Basis: methods grounded in proven research;

– Monitoring and Evaluation: continuous assessment of rehabilitation outcomes.

Facility Layout and Features. The sports and rehabilitation complex comprises three blocks with multidisciplinary zones. The residential block provides accommodation with a minimum of 6 m² per person. The sports-recreation block includes versatile gyms, adaptive pools, and recreational areas such as open terraces and saunas. The medical-diagnostic block features specialized rooms and a research division for comprehensive rehabilitation services, including balneology and kinesiology [6].

The landscape design prioritizes accessibility and inclusion, featuring barrier-free access

and amenities for all visitors, including those with disabilities. Pathways, recreational areas, and eco-friendly surfaces enhance the user experience while promoting sustainability [7].

Safety features and connectivity and modular design. A key design aspect relevant to the ongoing war in Ukraine is the separate exit beyond the yellow lines, ensuring quick egress during emergencies [11]. This is facilitated by a system of walkways connecting all three blocks, creating a secure environment for both rehabilitation visitors and the surrounding community, which functions as a dual-purpose space [13]. Underground walkways connect the three buildings, providing seamless movement regardless of weather conditions and during air raid alerts. The use of modular furniture allows for adaptable spaces, ensuring effective utilization based on user needs [14].

The residential block organization is meticulously designed to embody barrier-free principles and universal design, ensuring that military personnel and their families experience maximum comfort and accessibility [15].

Key features of this block include:

– Dual-purpose rooms: each room is designed to perform multiple functions, which provides flexibility in use. For example, the space can be adapted for both living and therapeutic purposes to satisfy the specific needs of residents during their rehabilitation [4];

– Accessible Stairwells and Elevators: all stairwells are equipped with platforms and ramps to accommodate individuals with mobility impairments. Elevators are spacious and designed with tactile indicators to assist visually impaired users, ensuring easy access to all floors;

– Common Areas: shared spaces encourage social interaction and community building among residents [6]. These areas include lounges, game rooms, and outdoor terraces, all designed to be inclusive and inviting;

– Amenities: the block offers a range of amenities to enhance residents' daily lives, including laundry facilities, a community kitchen, and a dedicated space for family visits. These amenities contribute to a sense of normalcy and support families during their rehabilitation program;

– Safety Features: emergency shelters and clear evacuation routes are integrated into the design, ensuring that residents can safely navigate the space during emergencies [10].

The sports and recreation block is designed with inclusivity in mind, catering to users of all abilities.

– Adaptive Pools: equipped with lifting devices, these pools allow individuals with varying physical abilities to participate in aquatic activities. The design promotes water therapy and rehabilitation through accessible swimming options;

– Multi-level sports pools: These pools are designed for both competitive and recreational athletes, providing a wide range of activities from rehabilitation exercises to organized sports. Each level is designed to meet different training needs, increasing versatility [11];

– Inclusive Changing Rooms: are spacious and equipped with features such as accessible showers and changing tables, ensuring comfort for all users, including those with disabilities and their caregivers;

– Relaxation Areas includes a hammam and a panoramic balcony, offering serene spaces for recovery and leisure. These areas are designed to promote relaxation and well-being, with calming environments that aid in post-exercise recovery [13];

– Multiple Fitness Studios for activities such as yoga, pilates, and group fitness classes provide diverse options for physical activity. Equipment is selected for ease of use, and classes are adapted to meet the varying needs of participants.

The medical-diagnostic block is specifically tailored to support medical activities, focusing on patient comfort and recovery [15].

Key elements include:

– Specialized Consultation Rooms that equipped with state-of the-art medical technology and staffed by qualified specialists who can provide comprehensive care. Each room is designed to be welcoming and calming to reduce patient anxiety [16];

– Inclusive Facilities the block incorporates universal restrooms and waiting areas designed for accessibility, ensuring that all patients, regardless of their physical abilities, feel comfortable and supported during their visits [18];

– Recreational Areas designed for post-procedure relaxation are integrated throughout the block. These areas provide patients with opportunities to unwind and recuperate in a soothing environment, promoting mental and emotional well-being;

– The complex treatment space offers opportunities for various types of therapy, including balneology and physiotherapy, creating a comprehensive approach to rehabilitation. Treatment facilities are designed for privacy and comfort, with adjustable lighting and climate control;

– The favorable environment is organized around a conceptual rainwater harvesting system. Layout encourages patient flow,

minimizing stress. Natural light and greenery are integrated into the design, creating a healing atmosphere conducive to recovery and rehabilitation [15].

Together, these blocks create a harmonious and functional environment that supports the needs of military personnel and their families, facilitating their recovery and reintegration into community life. Energy efficiency and Green Technologies is crucial for operational viability, lowering costs, conserving resources, and ensuring user comfort [14]. The integration of green technologies, such as vertical landscaping and solar panels, enhances sustainability and sets a benchmark for future developments.

In summary, the energy-efficient design of the sports rehabilitation complex not only reduces operational costs but also promotes sustainability and user comfort. Its comprehensive approach creates a supportive environment for the rehabilitation of military personnel and their families, facilitating their reintegration into community life [12]. It has been determined that when designing rehabilitation centers, it is essential to focus on the various types of functional impairments in patients and their impact on the design and decoration of these facilities. This helps to adapt the environment to ensure optimal rehabilitation conditions.

Additionally, attention has been given to the design and layout of both the exterior and interior spaces of rehabilitation centers. This is crucial for creating a comfortable and safe environment for patients, promoting their speedy recovery and reintegration into society [1]. Emphasis is placed on the importance of integrating specialized zones for different types of rehabilitation procedures, tailored to the specific needs of various patient groups. This approach enables an individualized and effective treatment process. Infrastructure and space organization of the rehabilitation center play a key role in ensuring the success of patient rehabilitation [4].

Moreover, this complex highlights the necessity of adhering to principles of accessibility and a barrier-free environment for all user categories, including individuals with disabilities. This is vital for ensuring equal opportunities and social inclusion. Such an approach helps to create a welcoming and inclusive environment where every individual can receive the support and assistance they need for their health and physical recovery [5].

A general review of the regulatory framework governing the design and operation of rehabilitation centers in Ukraine underscores the importance of adhering to quality and safety standards in this field. Taking into account the classification of rehabilitation centers, the types of functional impairments, and their impact on design, as well as the specifics of landscaping and interior design, helps to create an environment conducive to successful rehabilitation and improving the quality of life for patients [2]. Particular attention is paid to the integration of modern technologies and innovative approaches in the design of rehabilitation centers. The use of the latest developments in medicine and rehabilitation can significantly ease the recovery process and provide more effective treatment outcomes [6].

Important aspects of the design and organization of rehabilitation centers have been identified, contributing to the creation of optimal conditions for health recovery and the social reintegration of patients.

DISCUSSION

The high cost of the project requires a phased approach, with construction divided into three stages. This allows for gradual investment and enables parts of the facility to be commissioned earlier. Recreational services in the residential block, such as spa treatments and fitness programs, can generate revenue during the initial phases, helping to fund later stages of construction and support the facility’s operations. While the phased approach mitigates financial risks, future research should explore its long-term economic viability and the role of revenue-generating services in sustaining such large-scale projects [17]. Given the organization of the center on the basis of sustainable development goals, it will serve as a center for providing and creating numerous jobs for community residents, and all spaces can be used in the future for the purposes and activities of the community's ASTG.

RESULTS

Features such as modular design, universal accessibility, and eco-friendly materials reflect current global trends in rehabilitation facility design. However, the analysis also underscores the challenges in implementing such projects in Ukraine, particularly due to financial constraints and the need for phased construction. Nevertheless, the "LIFE TREE" center is poised to serve as a model for future rehabilitation initiatives, providing not only physical and mental recovery for its patients but also contributing to the development of local infrastructure and employment opportunities.

CONCLUSIONS

This study examined the historical development of rehabilitation centers, analyzed modern interior design solutions, and explored current trends in rehabilitation facility design. Key findings include the importance of functionality, aesthetics, and comfort in interior spaces. The research highlighted the need for energy-efficient technologies such as solar panels, rainwater harvesting, and modular furniture to create adaptable environments. Special emphasis was placed on inclusivity and accessibility for all patient groups, particularly those with mobility challenges. The findings demonstrate that a comprehensive approach to design, considering energy efficiency and sustainable goals, modern materials, and patient-centered care, is essential for creating effective and sustainable rehabilitation centers [18].

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АНОТАЦІЯ

Гнатюк Л., Журавльова К. Дизайн середовища реабілітаційного центру

Дизайн середовища реабілітаційного центру звертається до нагальної потреби у спеціалізованому просторі для підтримки людей, які постраждали від військових конфліктів, катастроф та насильства. Оскільки реабілітаційні центри в Україні все ще перебувають на стадії розвитку, ця робота зосереджена на вдосконаленні дизайну та функціональності таких центрів.

Метою є *створення комплексного середовища, яке підтримує повне одужання пацієнтів, з акцентом на ергономічних стандартах, універсальному дизайні та інклюзивності.*

Дослідження *окреслює виклики, з якими стикаються при проєктуванні реабілітаційних центрів, та пропонує сучасні рішення, що підвищують ефективність реабілітаційних процесів.*

Результати: *робота містить детальний аналіз світових проєктів реабілітаційних центрів, досліджує відповідні принципи проєктування та визначає ключові вимоги до створення таких об'єктів. Основним прикладом для дослідження є спортивно-реабілітаційний центр «LIFE TREE», для якого було розроблено концепцію дизайну інтер'єру. Концепція включає архітектурні плани, візуалізації та специфікації матеріалів.*

Методологія *дослідження поєднує ретельний огляд світових практик, ергономічних досліджень та теорій дизайну. Новизна дослідження полягає в підході до інтеграції психологічних факторів поведінки пацієнтів з функціональними проєктними рішеннями.*

Наукова новизна *роботи полягає в її потенціалі для покращення реабілітаційних середовищ, що принесе користь як пацієнтам, так і персоналу.*

Практична значущість. *Результати цього дослідження підкреслюють нагальну потребу в сучасних, добре обладнаних реабілітаційних центрах в Україні, особливо для військовослужбовців. Аналіз даних про місце розташування запропонованого реабілітаційного центру «ДЕРЕВО ЖИТТЯ» в селищі Авангард Одеської області виявив кілька ключових факторів. Топографія та клімат підходять для проведення реабілітаційних заходів на відкритому повітрі, а демографічний аналіз показав значний місцевий попит на такі послуги. Запропонований проєкт відповідає міжнародним стандартам реабілітації, зосереджуючись на сталості, енергоефективності та інклюзивності.*

Ключові слова: реабілітаційний центр, дизайн інтер'єру, функціональні зони, відновлення військових.

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