

# Evidence-Based Design Application of Water Landscaping for Rehabilitation Gardens for Patients with Mental Disorders

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**Abstract:** The aim of the article is to explore the influence of the water landscape design of a rehabilitation garden for patients with mental disorders on the recovery effect of patients, intending to provide a better rehabilitation environment for patients with mental disorders. Based on literature research, this article reviews three aspects of evidence-based design theory, the concept of water landscape in rehabilitation gardens, and the types of water features in rehabilitation gardens. The results show that well-designed water features can significantly improve patients' psychological state and reduce anxiety and stress, and that water landscape design in rehabilitation gardens is an effective rehabilitation tool that can facilitate the recovery process of patients with mental disorders. Future designs should take into full consideration patients' needs and preferences, as well as best practices in waterscape design, to maximize its positive impact on patients' recovery.

**Keywords:** Mental disorders; Rehabilitation gardens; Waterscapes; Evidence-based design

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## 1. Introduction

Mental health problems have become a major issue affecting global public health. A survey by the World Health Organization (WHO) shows that 1 billion people worldwide are currently suffering from mental disorders, and the number is increasing at a rate of 5% to 10% per year<sup>[1]</sup>. Data from the "2020 China Mental Health Survey Report" show that there are about 16.54 million patients with severe mental illness in China, of which 18.1% have received hospitalization, and of these 18.1%, only 37.2% have received effective treatment. Therefore, it is imperative to investigate ways to improve the quality of life of patients with mental disorders and provide them with a favorable rehabilitation environment<sup>[2,3]</sup>. In recent years, more and more research has begun to focus on the relationship between the environment and mental illness. The Institute of Medicine of the National Academy of Sciences of the United States of America and other institutions put forward the concept of "environmental design," emphasizing the impact of environmental design on human beings, the concept that human behavioral activities are caused by the combined effects of various factors in the environment, and these factors will have an impact on physiological, psychological and social behavior, so to understand the characteristics of human

behavior we need to explore the environmental factors behind it <sup>[4]</sup>. At the same time, Sun and others <sup>[5]</sup> found that as environmental psychology can provide clinicians with a basis for diagnosis, environmental psychologists are also able to change the environment through research design to alleviate or cure certain diseases. In addition, as an interdisciplinary research method, evidence-based design (EBD) refers to designers applying design principles based on scientific evidence to the actual design practice process <sup>[6]</sup>, which carries out a rigorous and scientific design argumentation process from data collection, analysis, evaluation, and validation, which is conducive to enhancing the science, validity, and reasonableness of the design, and making the outcome more in line with the needs of users <sup>[7]</sup>. Yue and others <sup>[8]</sup> proposed that the design concept of a water landscape in the rehabilitation garden for patients with mental disorders aims to create an environment that is tranquil, harmonious, and helpful for spiritual healing through the introduction of natural elements. This study utilizes an evidence-based design methodology to design and modify the water landscape of rehabilitation gardens for patients with mental disorders, aiming to assess the recovery effect of patients before and after the modification through empirical research and to explore the role of water landscape design in promoting the recovery of patients with mental disorders.

## 2. Evidence-based design theory

Evidence-based design (EBD) is a design method developed in the late 1980s that is based on data and guided by scientific evidence, which is a change from the traditional designer's "experience + inspiration". Evidence-based design is a design activity based on a large amount of research and information and requires a scientific and systematic approach to obtain reliable arguments to provide a basis for design decisions. The basic principles of evidence-based design include (1) evidence-based design, which means that we should rely on effective research to prove whether the proposed design solution can achieve the expected results. Therefore, for the creation of new things, there must first be sufficient research to demonstrate their feasibility, and they can only be applied after they have passed the practical test; (2) using interdisciplinary research methods, combining social sciences and natural sciences, and adopting multidisciplinary cross research methods, applying the knowledge of architecture, landscape ecology, psychology and other disciplines to the research; (3) adhering to the idea of human-centered design, and paying attention to people's feelings while seeking to solve problems while paying attention to human feelings and experiences; (4) focusing on interdisciplinary collaborative research, emphasizing communication and cooperation between different disciplines, and integrating the knowledge and skills of related professions through interdisciplinary collaborative approaches to provide support for the design; and (5) establishing a reasonable evaluation system to objectively evaluate the quality, effectiveness and social impact of the design project, and to continuously revise and improve it.

At present, evidence-based design has become a globally recognized design method. Some well-known foreign architectural firms such as Arup Engineering Consultants, HOK, and KPF have begun to implement the process of evidence-based design as part of their design work <sup>[9]</sup>. More and more architectural design firms in China have also begun to experiment with evidence-based design <sup>[10]</sup>. For example, the Shanghai Interior Decoration Industry Association conducted research on "indoor space health design research and application." This research involved various aspects such as lighting, color, materials, furniture, electrical appliances, and air environment. After conducting a literature review and field research, a substantial amount of research data was collected through questionnaires. Following statistical analysis, conclusions were drawn, representing a typical evidence-based design process <sup>[11]</sup>.

### **3. Rehabilitation garden water landscape design application research**

#### **3.1. Rehabilitation garden water landscape concept definition**

As a medium, water can improve mental health by influencing people's cognition, emotion, and behavior. Domestic and foreign research on water landscape mainly focuses on 2 aspects: (1) combining water landscape with a specific environment and analyzing its influence on residents' mental state; (2) exploring the law of human activities under natural conditions according to the theory of human-natural system. In recent years, scholars at home and abroad have been paying more and more attention to the design of water features in rehabilitation environments, believing that water features can play a therapeutic role. Compared with the general population, patients with mental disorders suffer from cognitive decline and memory loss, but they still have a certain degree of perception and judgment and are able to perceive changes in the external environment and respond accordingly. Therefore, in order to meet the physical and mental needs of the patients, the physiological characteristics and psychological conditions of the patients should be taken into account in the design and a reasonable layout should be carried out on this basis. For example, for younger children, you can set up children's pools or small fountains and other facilities to enhance their perception of water; for the elderly, you should choose more safe and comfortable forms of water features, such as bridges, walkways, sculptures, etc., to reduce the risk of falling.

#### **3.2. Rehabilitation gardens water feature types**

##### **3.2.1. Natural type water features**

Zhang <sup>[12]</sup> found that for patients with mental disorders, the natural environment can help them relieve anxiety and stress, and natural water features can also be integrated with the garden landscape to form a unique spatial atmosphere. For example, in the rehabilitation garden of Bournemouth Psychiatric Hospital in the United Kingdom, designers use ponds, streams, and wetlands to provide patients with a place of rest and relaxation, and these environments promote dopamine secretion, which in turn improves patients' emotional states.

##### **3.2.2. Water sculptures and features**

Qin <sup>[13]</sup> pointed out that patients with schizophrenia often show symptoms of inattention, impulsive behavior, or hyperactivity. Therefore, some organizations choose to use water sculptures and features to attract the attention of patients, thereby achieving therapeutic effects. For example, St. Mary's Hospital in San Antonio, Texas, U.S.A. has designed several interactive fountain installations in its gardens, which simulate the process of falling raindrops employing music and light changes, accompanied by a special sound of water flow, as a way of relieving patients' anxiety.

##### **3.2.3. Artificial fountains and waterfalls**

Lin <sup>[14]</sup> found that artificial fountains and waterfalls are usually used to create an atmosphere with a strong visual impact. However, this form of water feature may cause discomfort to patients, so attention should be paid to the speed of water flow, sound level, and height when designing. For example, the McGill University Rehabilitation Center in downtown Vancouver, Canada, has set up two large waterfalls in the garden with soothing music, aiming to reduce patients' depression and anxiety and improve their quality of life.

##### **3.2.4. Streams and small ponds**

Wang <sup>[15]</sup>, taking the project of a retirement resort as an example, pointed out that streams and small ponds give a peaceful and comfortable atmosphere, which is suitable for patients with mental disorders who like to be quiet and alone. For example, the "Green House" rehabilitation garden of Paris La Défense Psychiatric Hospital in

France adopts this design technique, which not only provides a place for patients to walk and relax but also sets up a pavilion for patients to rest.

### **3.2.5. Landscape pond**

Liang <sup>[16]</sup>, based on the Home for the Disabled, found that landscape ponds are common small water features. They provide a strong sense of privacy and concealment and are utilized in various scales of parks and community green spaces, enhancing the landscape on multiple levels and adding natural interest. For example, the Social Integration Garden in Berlin Scheineberg, Germany, uses landscape ponds as one of the main forms of water features.

## **4. Conclusion and prospects**

Due to their special characteristics, patients with mental disorders need to be cared for more professionally during the rehabilitation process. In rehabilitation treatment, landscape environment is one of the important means of rehabilitation, which helps patients to recover their health by providing diversified spatial experiences. Water is one of the most easily perceived substances, and when people are near the water, they will have emotional experiences such as “calmness” and “relaxation”. The garden environment has a crucial influence on the daily rehabilitation of patients with mental disorders. Artificial and natural water features are the two most common types, each with its own advantages and disadvantages. In the natural environment, the water body is large in size, and the water body interacts with plants, animals, and other elements to form a complete ecosystem. Compared to artificial water features, natural water features have better healing effects, but can be dangerous for people with mental disorders. In addition, patients with mental disorders in different cultures have different perceptions of water, so it is important to take into account the local cultural background and the psychological needs of the patients in the design and to tailor the design to the local conditions and flexibility.

From a practical point of view, most rehabilitation gardens are equipped with different forms of artificial water features, such as fountains, waterfalls, water curtains, springs, etc. Natural water features are mostly found in urban green spaces and are not suitable for large-scale application in rehabilitation gardens due to their complicated requirements on terrain. However, with the improvement of people’s living standards, people are more concerned about health issues, especially those with mental illness. Therefore, the use of natural water bodies as water feature elements in rehabilitation gardens will become one of the future development trends. At present, there are fewer studies on water feature design for rehabilitation gardens for patients with mental disorders in China, but relevant results point out that water feature design can improve patients’ emotions and enhance their mental toughness. Future research can be carried out in the following aspects: (1) study the difference in the impact of different water features on patients with mental disorders; (2) explore the impact of specific environmental factors (such as light and noise) on the psychological healing effect of the water feature; (3) the use of artificial intelligence technology to assist in the design of water features. For example, combining brain imaging technology with computer vision technology, using face recognition algorithms to realize emotion recognition, perception recognition, and other functions, analyzing patients’ emotional changes by monitoring brain waves, and providing a scientific basis for the arrangement of water features in rehabilitation gardens; (4) formulate corresponding standards to regulate the construction of water features in rehabilitation gardens; (5) improve the service-supporting facilities of the rehabilitation garden and strengthen the connection between the water feature and mental health rehabilitation.

## Disclosure statement

The authors declare no conflict of interest.

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