

Window Views of Wards in Foreign Hospitals

LI Siyi¹, SHAO Danjin², WANG Xiaobo^{1*}

(1. School of Architecture and Art, North China University of Technology, Beijing 100144, China; 2. China Academy of Building Research, Beijing 100013, China)

Abstract Through the collection and systematic analysis of documents related to window views of hospitals, it is found that natural window views had a significant impact on patients' health benefits. The research focused on three aspects: "shortening length of stay", "pain reduction" and "improvement of recovery rate", mainly covering three types of patients: "heart patients", "postoperative patients" and "patients of rehabilitation centers". Based on the above analysis, summary and sorting, new directions and perspectives of hospital environment design and research under the concept of comprehensive health of people's physiological, psychological and social adaptation will be obtained to provide references for the research and practice of health architecture, rehabilitation architecture, biophile design and other fields.

Keywords Window views, Wards, Research review, Medical buildings, Natural environment

DOI 10.16785/j.issn.1943-989x.2024.3.008

With the establishment of the concept of comprehensive health of people's physiological, psychological and social adaptation, it is generally recognized that emotions can affect physical and mental health. In the field of healthy architecture, space environment has been widely concerned in the fields of architecture, medicine, psychology and so on because it can affect people's emotions. As the main factor of patients' exposure to the external space environment during hospitalization, the window views of a ward is closely related to the health benefits of patients^[1-2]. At the same time, a large number of studies have shown that increasing the opportunity for people to get close to nature is an important way to promote public health, and making patients contact with nature with the help of window views is also one of the measures to improve ward environment.

The theoretical basis of the health benefits of ward window view on patients is mainly the biophilia hypothesis. The term "biophilia" was first coined by psychoanalyst Eric Fromm in his book *The Anatomy of Human Destructiveness* to describe a love of life and living things^[3]. Later, it was adopted as a concept by the biologist and ecologist E. O. Wilson in his book *Biophilia*, in which it is stated that all humans share a common affinity for the natural world due to heredity^[4]. This concept has inspired architects and designers to incorporate natural elements into the design of the built environment for "biophile design"^[5].

Windows are gaps in the walls that connect the indoor and outdoor environments, symbolizing a connection to life and the world outside the hospital, promoting indirect interac-

tion with nature, and allowing patients to feel that life is meaningful. It is precisely because patients are physically fragile that their perception of a positive environment may be more sensitive and important. Windowless wards lack direct contact with the external environment, which is considered to be an increasingly serious sensory deprivation in medical institutions^[6].

In the past 40 years, many factors affecting the health and recovery of patients in hospital wards have been discussed. In this paper, the impact of ward window views in medical buildings on the health benefits of patients is studied, and through the review of relevant studies, foreign research results are discussed to provide empirical reference for future research, so as to improve the design of ward window views in medical buildings with patients' health promotion as the primary goal.

1 Document review

1.1 Document retrieval of window views of wards

In Web of Science, Scopus, Google Scholar and other databases, cross combination Cross combination retrieval was conducted by using "TS=((hospital) AND ("window scene" OR window view*OR Healing environment OR a view of nature OR Natural scenery) AND (patient OR health OR recovery OR health effect))" as the retrieval formula. In this study, Professor Ulrich's landmark document^[7] and other highly relevant documents^[8-10] were also used as citation indicators for advanced retrieval, and supplementary documents were obtained to make the retrieval process more scientific and comprehensive.

1.2 Document screening and counting

The rules followed in the document screening process and the reasons are as follows: ① documents need to have a clear experimental process, research methods and measurement indicators to judge the integrity of an experiment; ② the research content should involve the impact of window views of wards on the health benefit of patients, which is consistent with the theme of this study; ③ the documents that have no text and have not been formally published were excluded.

According to the retrieval method mentioned above, a total of 691 documents were retrieved, from which 231 duplicate documents were eliminated. After 68 documents meeting the requirements were selected according to the title and abstract as well as the screening rules, the full text quality was checked one by one, and 19 documents meeting the screening criteria and research needs were finally selected and included in the scope of review (Fig.1).

1.3 Review of documents

The statistical table of overview of the 19 documents included for reference is listed, and the types of research design, specific research content, exposure methods, etc. are paid close attention to (Table 1). These documents constitute the main knowledge base of the impact of window views on patients' health benefits. Therefore, the research methods of the documents are further summarized, such as whether the measurement indicator is the physiological data of patients or the length of stay of patients' case information, and whether the evaluation of patients' health benefits is conducted by using subjective perception scale

or mathematical statistical analysis models (Table 2). After summarizing the contents of various studies, it is found that the comparison between natural and architectural window views were mainly studied in most documents (Fig.2).

1.4 Measurement indicators of documents

The main measurement indicators are emotional indicator and length of stay. The pain index, satisfaction and recovery rate are also concerned. In addition, there are corresponding indicators for patients' symptoms, such as the sleep quality of patients with head injury, incidence of elderly patients' falls in hospital, and mortality of severe patients (Fig.3). In general, there are relatively abundant measurement indicators in the existing studies, but more diversified and unified indicators can also be used to assess the impact of hospital window views on patients' health benefits.

2 Research on "ward window views"

2.1 Vision of ward window views

Among the relevant research results, Professor Ulrich's paper "View through a window may influence recovery from surgery" published in *Science* in 1984 is of milestone significance^[7]. The study linked the perceived beneficial effects in the natural environment to quantifiable differences in patients' length of hospital stay, dosage of analgesics used, frequency of negative emotions, and recovery

rate. It is found that patients who could see natural landscape through windows were discharged from the hospital after 7.96 d after surgery, while patients who could only see a brick wall were discharged 8.70 d after surgery, with a delay rate of 8.6%. The average number of records of patients' negative emotions in the natural window group was 1.13, and that in the brick wall group was 3.96, that is, the frequency increased by 3.5 times. Within one week after surgery, the use frequency of powerful analgesics reduced in patients who saw a natural window view. This discovery set a precedent for evidence-based design^[20]. Environmental design can relieve the pressure of patients and improve the effect of medical care, and also inspire subsequent scholars to explore the impact of built environment on human health from a more diversified perception perspective.

This finding has been also confirmed in other somatic patients, such as women who underwent caesarean section^[20] or pneumonia^[12] and coronary artery patients^[8], but the effect varies with gender and diagnosis, and there are more positive effects on subjective physical health in women and negative effects on mental health in men. Inspired by Professor Ulrich's pioneering research, a team from the Center for Human Development and Family Research at Pennsylvania State University replicated the relationship between length of stay and window views in 244 psychiatric inpatients with affective disorders^[25], and

assessed whether the window views of wards affected length of stay. The difference is that psychiatric samples represent a group of individuals who often experience longer and repeated hospitalizations, which makes their potential response to window views more specific. In this study, SPSS is used to analyze the data in a multiple linear regression framework, and the results show that the green natural environment outside windows has a positive impact on patients' recovery.

Wang Chaihui et al. conducted a study in the obstetrics department of three tertiary hospitals in Taipei City and New Taipei City to explore the impact of urban window views on the postpartum recovery and nursing quality of cesarean women^[20]. Patients were randomly assigned to 46 different hospital wards with different window views, and a total of 296 women underwent a cesarean surgery and used patient-controlled analgesics (PCA) to control pain after surgery during the 10-month data collection period. The results of PCA dosage and BFI showed that higher satisfaction of window views significantly reduced the dosage of analgesic drugs and overall pain perception, pain severity, as well as pain interference with other people's relationships, enjoyment of life and mood (REM).

Professor Stephen verderber took human-window interaction in physical medicine and rehabilitation environment as the research object, and studied the shortcomings of windows, vision, lighting and space in these aspects^[9]. About 250 people (125 staff and 125 inpatients) participated in the experiment, and non-metric multidimensional scaling (NMDS) was used to analyze 21 cognitive dimensions and evaluate 56 photos of window views. Patients rated ideal window views from the visual dimension according to their preference. Through the analysis of satisfaction and related behaviors, it was again confirmed that the views that patients most wanted to see from windows of their wards were trees and lawns.

2.2 Ward windows

Roxana Jafarifroozabadi et al. of Lawrence University of Technology in the United States took 2,319 patients in the cardiac intensive care unit (CICU) of a medical center in South Carolina as the research object^[14], adopted the stepped-variable selection method (GLM model) to analyze the effects of three types of ICU wards (mainly including window wards without external views, window wards with outdoor views and daylight, and windowless wards) on patients' length of stay under different lighting

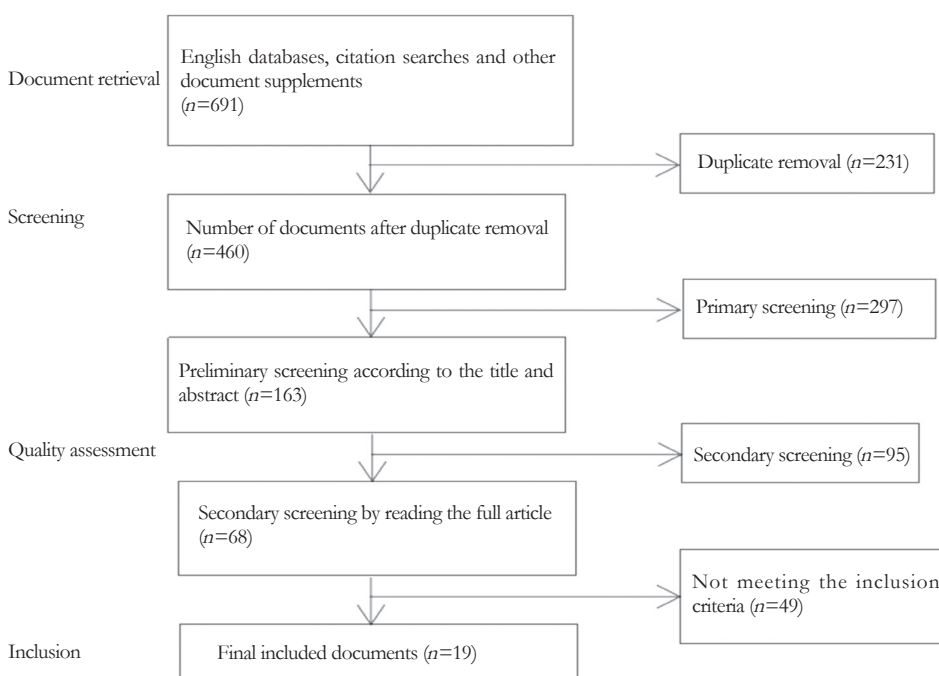


Fig.1 Process of document screening

and viewing conditions, and studied patients' clinical characteristics and medical treatment based on patients' electronic health records (EGRs). The results show that patients in the room with daylight and window views had the shortest length of stay in the hospital, and patients in the room without window had the longest length of stay. Therefore, the wards with window views had a positive effect on patients, and closed window views had a negative effect on patients. This conclusion is consistent with the findings of Zaal et al., and patients with a history of anxiety disorder had shorter length of stay in wards with daylight and window views^[27]. It is also consistent with the results of supportive

theoretical design of Ulrich et al.^[7,26].

Thus, Hannah Wunsch et al. hypothesized that receiving care with a window in an ICU might improve outcomes for critically ill patients with acute brain injury. A secondary analysis of a prospective cohort study was conducted in 7 ICUs with windows and 5 windowless ICUs at Columbia University's Intensive Care Department^[13]. The information of 789 patients with subarachnoid hemorrhage (SAH) at admission from August 1997 to April 2006 was prospectively recorded, and followed up them for one year to assess their mortality and recovery status. Among them, 455 patients (accounting for 57.7%) received treatment in the room with

windows, while 334 patients (42.3%) received treatment in the windowless room, and the two groups were balanced in terms of clinical features. At the time of discharge, 3 months, and one year, the results of multivariate logistic regression analysis show that there was no difference between the window and windowless groups in patients' mortality, recovery rate, or prognostic indicators. Rachel Kohn, MD, et al., conducted a retrospective cohort study of 6,138 patients in a 24-bed medical ICU and 6,631 patients in a 24-bed surgical ICU at an academic hospital in Philadelphia, Pennsylvania from July 1, 2006 to June 30, 2010, and explored the impact of exposure to natural light or more pleasant

Table 1 Summary of basic information of the documents

Titles	No.	Authors	Year	Regions	Types of research design	Research content	Exposure methods	Ward types	References
Windows in the intensive therapy unit	1	Philip Keep	1980	UK	Descriptive research	Translucent windows and no windows	Ward window views	ICU	[11]
View Through a Window May Influence Recovery from Surgery	2	Roger S Ulrich	1984	USA	Retrospective cohort study	Natural and architectural window views	Ward window views	General wards	[7]
Dimensions of person-window transactions in the hospital environment.	3	Stephen Verderber	1986	USA	Descriptive research	Window views and no windows	Photos of ward window views	ICU	[12]
The effect of window rooms on critically ill patients with subarachnoid hemorrhage admitted to intensive care	4	Hannah Wunsch	2011	USA	Case-control study	Window views and no windows	Ward window views	ICU	[13]
The Impact of Daylight and Views on ICU Patients and Staff	5	Mardelle McCuskey Shepley	2011	USA	Descriptive research	Natural and architectural window views	Ward window views	ICU	[14]
Health benefits of a view of nature through the window a quasiexperimental study of patients in a residential rehabilitation center	6	Ruth Kjaersti Raanaas	2011	Norway	Descriptive research	Panoramic and blocked windows	Ward window views	Rehabilitation centers	[8]
Effect of intensive care unit environment on in-hospital delirium after cardiac surgery	7	Benjamin G. Aronson	2012	Canada	Retrospective cohort study	Window views and no windows	Ward window views	ICU	[15]
Patients' recovery experiences of indoor plants and views of nature in a rehabilitation center	8	Ruth Kjaersti Raanaas	2013	Norway	Descriptive research	Natural window views	Ward window views	Rehabilitation centers	[6]
Do Windows or Natural Views Affect Outcomes or Costs Among Patients in ICUs	9	Rachel Kohn, MD	2013	USA	Retrospective cohort study	Window views and no windows	Ward window views	ICU	[16]
Room for caring: patients' experiences of well-being, relief and hope during serious illness	10	Connie Timmermann	2015	Denmark	Descriptive research	Natural window views	Ward window views	ICU	[17]
The effect of nature as positive distractibility on the Healing Process of Patients with cancer in therapeutic settings	11	Elham Emami	2018	Iran	Descriptive research	Natural and architectural window views	Ward window views	General wards	[18]
Windows, views, and health status in hospital therapeutic environments.	12	Stephen Verderber	2018	USA	Descriptive research	Window view and dimensions	Ward window views	Rehabilitation centers	[19]
Impact of window views on recovery—an example of post-cesarean section women	13	CHIA-HUI WANG	2019	Taiwan	Case-control study	Different window views	Ward window views	Nursing wards	[20]
Lower Incidence of In-Hospital Falls in Patients Hospitalized in Window Beds Than Nonwindow Beds	14	Junko Iwamoto RN	2019	Japan	Retrospective cohort study	Window views and no windows	Ward window views	General wards	[21]
Design Models for Single Patient Rooms Tested for Patient Preferences	15	Clarine J. van Oel	2020	Netherlands	Descriptive research	Panoramic horizontal and vertical windows	Ward 3D model	General wards	[22]
Exploring the Relationship between Window View Quantity, Quality, and Ratings of Care in the Hospital	16	Sahar Mihan-doust	2021	USA	Descriptive research	Window views and no windows	Photos of ward window views	Rehabilitation centers	[23]
Hospital Admission to a Window-Side Bed Does Not Prevent Delirium A Retrospective Cohort Study of Older Medical Inpatients in General Wards	17	Daiki Aomura	2021	Japan	Retrospective cohort study	Window views and no windows	Ward window views	General wards	[24]
On the relation between a green and bright window view and length of hospital stay in affective disorders	18	Anna Mascherek	2022	Germany	Retrospective cohort study	Natural and architectural window views	Ward window views	Psychiatric wards	[25]
The impact of daylight and window views on length of stay among patients with heart disease: A retrospective study in a cardiac intensive care unit	19	Roxana Jafarifiroozabadi	2022	USA	Retrospective cohort study	Natural and architectural window views	Ward window views	ICU	[14]

landscape through windows on the recovery and cost of critically ill patients^[16]. It was found that there was no difference in ICU mortality or in-hospital mortality, and ICU readmission rate or delirium rate between patients admitted to wards with and without windows. In summary, the retrospective analysis of patients admitted to ICU did not show differences in short- or long-term functional outcomes after treatment in a room with or without windows, and a further study is needed to identify other critically ill patient populations and explore whether these high-risk patients may benefit from natural window views.

Sahar Mihandoust et al. conducted a quantitative exploratory study by collecting the experimental data of 652 patients of various types in rehabilitation centers, including previous length of stay, perception of ward windows, and perception of nursing quality^[23]. A Mann-Whitney test was used to analyze the experimental data, and the results show that window views had a significant relationship with patients' environmental perception, stress relief, and nursing environment. Among them, 90% of the patients said that ward environment was conducive to relieving their pressure by seeing green space from the window, and 92% of the patients believed that the hospital nursing environment was conducive to their rehabilitation. Therefore, ward windows affected

not only the health of patients but also the satisfaction of patients and the experience during hospitalization, and the environment design of wards, the setting of beds, and the quality of window landscape all play an important role in shaping the experience of patients.

2.3 Characteristics of ward window views

The built environment of medical institutions has been the focus of environmental behavior research. Professor Stephen Verderber of Tulane University and Professor David Reuman of the University of Michigan Institute for Social Research conducted the study at physical therapy rehabilitation units (PMR) of six hospitals in Chicago^[19]. The analysis of experimental data reveals that patients who lacked the ability of free choice benefited less from window views and had poor health status. Thus, in the process of hospital architectural design, window views, window height, window distance and intelligent design have an important impact on patients.

Clarine J. et al. for the first time tried to quantify the experience of ward windows by using 3D model design to visualize wards. 240 patients participated in the discrete selection experiment to explore their satisfaction with various designs of hospital wards and enable patients to better participate in the design of medical institutions^[28]. According to the analysis of the self-rating

depression scale (SAS) filled in by the patients, they preferred horizontal panoramic windows to vertical windows. Panoramic views are more attractive to the patients who were bedridden or not. Firstly, window views have a greater range of visibility. Secondly, it is easier to track and pay attention to events through window views, which is a relaxed functional mode, and it indicates that the patients prefer to stay in touch with the outside world. As early as 1973, Professor Lawton pointed out that the living environment can provide patients with environmental news^[22], which may be more important for those with cognitive decline, and the clues that the environment outside medical buildings provides to people in terms of perception and behavior are considered to be perceptual attributes of medical institutions, and have functional significance for people. Hence, supportive design plays a role in cognitive processes such as spatial memory, which may be relevant to patients experiencing stress as a result of hospitalization^[29].

Ruth Kjørsti Raanaas, a researcher at the Norwegian University of Life Sciences, took 278 patients with coronary heart and lung diseases as research objects, and tracked and observed the window views of the wards where the patients lived. Furthermore, the SF-12 health survey scale was used to record the patients' health status to obtain the relationship between their recovery speed and different window

Table 2 Summary of research methods of documents

No.	Patients' symptoms	Experimental population	Measurement indicators	Scale	Statistical analysis
1	Head injury	150	Sleep disturbances and hallucinations	—	—
2	Cholecystectomy	46	Length of stay, frequency of negative emotions, intensity of labor pains (VAS)	—	—
3	Heart disease	2,319	Satisfaction, emotional indicator, and electronic health records (EGRs)	—	Non-metric multidimensional scaling (MDS)
4	Subarachnoid hemorrhage	789	Prognostic indicators of critically ill patients	—	Variable regression model
5	Heart disease and pneumonia	110	Length of stay, and pain perception	—	Independent <i>T</i> test
6	Coronary heart disease and lung disease	278	Satisfaction, health, and happiness	SF-12 health survey scale	One-way ANOVA
7	Heart disease	1,010	Delirium prevalence	—	Multiple logistic regression model
8	Various types of patients	16	Emotional indicator	—	—
9	Clinical epidemiology	6,138	Length of stay, and mortality	—	Variable regression model
10	Patients with a serious disease	12	Happiness, relief, and hope	—	—
11	Cancer patients	80	Anxiety and pain level	State trait anxiety inventory (STAI)	Mann-Whitney test
12	Accident trauma	237	Rehabilitation prospect, and emotional indicator	—	Variable regression model
13	Caesarean section	296	Emotional indicators, and patient-controlled analgesics (PCA)	Pain perception scale (BFI)	—
14	Elderly patients	2,767	Incidence of falls in hospital	—	Independent <i>T</i> test
15	Various types of patients	240	Happiness	Self-rating depression scale (SAS)	—
16	Various types of patients	652	Satisfaction, and quality of care	—	Mann-Whitney test
17	Elderly patients	1,556	Delirium prevalence	—	Wilcoxon–Mann–Whitney test
18	Affective disorder	244	Length of stay, and recovery rate	—	Linear regression model
19	Heart disease	2,319	Length of stay, and health	—	Mann-Whitney test and GLM model

views (panoramic windows, partially blocked windows, and completely blocked windows) [8]. It was found that a good window view could enhance patients' self-perceived levels of physical and mental health as well as subjective well-being, and improve their emotional state. Besides, window views were also related to patients' emotional and behavioral activities,

and patients who could see panoramic window views spent more time in wards than those with blocked window views. The improvement of patients' mental health by window views during rehabilitation was also affected by the combination of gender and diagnosis, and different groups had different responses. In terms of gender division, the negative effects

of blocked window views were more reflected in the physical health level of female patients and the mental health level of male patients. In terms of diagnostic outcomes, the surrounding natural landscape had a more positive impact on the mental health of people with lung diseases than those with heart diseases.

3 Practice of alternative windows

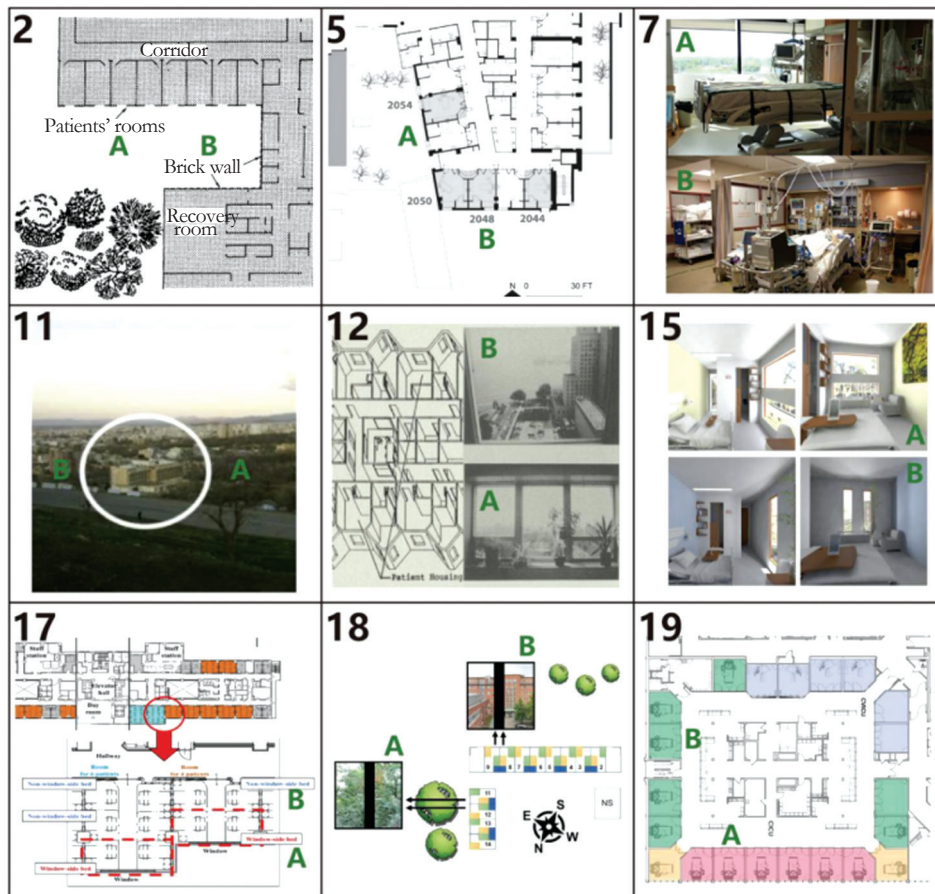
3.1 Alternatives to windows

It has been proved that exposure to real nature can increase the positive impact on health [3], but it is not always possible to contact real nature, especially in the medical and nursing environment of hospitals. In the case that the architectural status quo cannot be changed on a large scale and natural window scenery is lacking, natural substitutes and virtual nature can break through indoor and outdoor spatial limitations, and are widely used in research and practice. For example, the application of simulated natural window views [30], pro-nature corridors [11], virtual reality (VR) [31-32], natural artworks [33] and others in the medical environment will promote patients to get closer to natural elements.

Many hospitals have been exploring more ways to solve this problem. For instance, curtains printed with natural landscape have been widely used in wards; simulated skylight lighting fixtures that can display natural scenes and the sky have been used in some examination rooms; some LED liquid crystal displays and natural environment hanging pictures have been used in many medical environments (such as waiting areas, wards, etc.) to provide patients with active natural intervention [34] (Fig.4).

3.2 Application-oriented research and practice

At present, there is a lack of unified and



A: Experimental group B: Control group

Fig.2 Summary of research content of documents

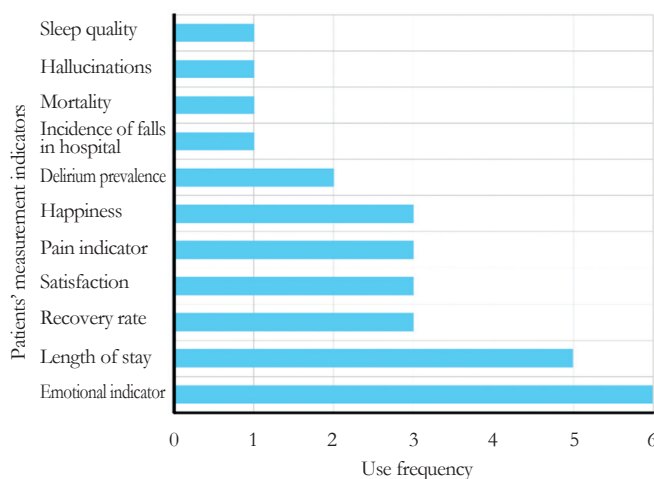


Fig.3 Statistics of measurement indicators of documents



Fig.4 Use of natural landscape for intervention in medical institutions [34]

comprehensive evaluation indicators for the restorative evaluation of natural window views. In existing studies, physiological indicators (electronic health recorder PCA^[12], labor intensity VAS^[7], etc.), emotional indicators (trait anxiety scale STAI^[13], self-rating depression scale SAS^[28], pain perception scale BFI^[23], etc.) were used. There is an urgent need to establish a restorative evaluation system of physical and mental health that integrates physiology, emotion and perception and a comprehensive restorative indicator to comprehensively assess the restorative effect of the environment.

At the same time, the relationship between individual characteristics and natural preferences needs continuous and in-depth research. Individuals differ in age, gender, personality, natural experience and other aspects, and these individual characteristics may affect their natural preferences. The same natural environment can bring different experiences to people. The study of the relationship and law between individual characteristics and their natural preferences provides the possibility to give individuals the natural types they are likely to prefer.

Natural environment has the potential of health promotion, but the actual application of natural intervention in hospitals is very rare, which is directly related to the lack of natural intervention strategies. Exploring natural intervention strategies that can be integrated into daily care is an important part of ensuring the continued effectiveness of the natural environment, which deserves further discussion. Architecture alone may not cure disease, but the design of medical buildings can use biophile design principles as a tool to improve patients' treatment environment and benefit patients' health.

4 Conclusions and prospects

In medical institutions, window views are only a small part of many factors affecting patients' satisfaction and health status, but windows may be a key auxiliary to special treatment at some stages. Exploring the role of patients' visual perception on health benefits has become a hot topic in evidence-based medicine, clinical psychology, cognitive science and other disciplines, and also provides a new perspective for researchers in the fields of health architecture, rehabilitation architecture and biophile design. In this study, the effects of ward window views on patients' health benefits were systematically studied, and the following conclusions are drawn.

(1) According to the summary of 19 docu-

ments, the natural landscape outside the window is closely related to the shortening of length of stay^[18], the reduction of pain^[7], relaxation and positive emotions^[6], the increase of satisfaction with nursing quality^[23], and the reduction of the incidence of falls in hospital^[21].

(2) When the immersion time of natural exposure is reduced, the effect may be suppressed, so this effect seems to be amplified by increasing the immersion and exposure time. Probably like any other drug or treatment, the dose is important. In order to produce a meaningful therapeutic effect by exposure to nature, patients must be exposed to nature for as long as possible. In medicine, this is called a dose-response relationship.

(3) Across all studies, whenever descriptive studies (surveys or interviews) are conducted, patients consistently expressed a preference for the presence of nature in the healthcare environment^[10,14,17]. Although this preference does not necessarily have any clinical value, it certainly affects patients' happiness and satisfaction with the hospital.

(4) Windows are a key supporting design in medical institutions and a simple and most accessible resource. The treatment of a large number of patients requires long-term or even repeated hospitalization, and it is the most economical way. Therefore, medical managers and architects can maximize patients' visual satisfaction through design, reduce patients' pressure and relieve their pain. In the ward design, the use of window views should be maximized to make patients get a better window view. In the site design, the quality of landscape should be enhanced as much as possible, such as building orientation, landscaping and urban planning.

In follow-up studies, the relationship between ward window views and patients' health benefit can be further explored from the following aspects. ① The impact of different types of window views on patients' health should be studied, such as landmark buildings, historical sites, hydrological landscape and geological landform. ② The impact of window landscape on different groups needs to be studied, such as the elderly, children, etc. ③ Physiological indicators and dose responses are used to conceptualize the effects of exposure to nature, but exposure and immersion time are both important aspects of biophile design. ④ The interaction of window views and other environmental factors should be distinguished, such as indoor air quality, light, sound, etc.

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(To be continued in P47)

disciplinary development, the practice field of landscape architecture has been influenced to varying degrees by humanistic arts and social trends, and in the process of modern and contemporary development, modern construction art is the sublimation of art and science in landscape planning and design; ② The influence of modern construction art on landscape planning and design is mainly reflected in 3 aspects, namely the structured deduction of spatial planning layout, the limitation of spatial form, and artistic ornaments.

With the continuous development and deepening of modern construction art, its application in landscape planning and design has shown enormous potential and broad prospects. Modern construction art has injected new vitality and creativity into landscape planning and design with its unique perspective and techniques. The application of modern construction art in landscape planning and design is not

simply copying and imitating, but requires targeted innovation based on specific site conditions, cultural background, and functional requirements. Only with a deep understanding of modern construction art concepts and mastery of their design methods can its effective application in landscape planning and design be truly realized.

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