



Analysis of New Sanatorium Models Based on Restorative Environment Theory—Taking WOS Data as an Example (2000-2025)

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Abstract. Against the backdrop of an increasingly rapid aging population, the mental health and quality of life of the elderly have become a focus of social attention, and the traditional nursing home model needs to be revitalized in various aspects. Therefore, this study employs quantitative and qualitative analysis methods, utilizing CiteSpace 6.4 R1 literature visualization software to systematically review relevant literature in the nursing home field. Taking WOS data from 2000 to 2025 as an example, it analyzes the research hotspots of new nursing homes. Furthermore, it proposes a new nursing home model adapted to the future elderly using restorative environment theory. The study found that keyword clustering indicates that mental health-oriented environmental design has become a research focus in the nursing home field. Time trend analysis reveals that research from 2000 to 2025 can be divided into three segments. Finally, combining restorative environment theory, a new nursing home model is proposed, namely, a combination of a natural healing environment and an intelligent care system. Therefore, the planning, design, and operation management of future nursing homes should actively draw on the integrated mind-body care model, and the government needs to pay more attention to community-integrated elderly care, while society needs to invest more in social support to promote intergenerational integration.

Keywords: Nursing Home, Restorative Environment, CiteSpace, WOS

1 Introduction

The world is currently experiencing an aging crisis. According to WHO data, the population aged 60 and above is projected to increase from 1.1 billion to 1.4 billion between 2023 and 2030, accounting for over 15% of the global population. Furthermore, official statistics show that by the end of 2024, China's population aged 60 and above reached 310 million, indicating that it has entered a deeply aging society. Against this backdrop, nursing homes have become a persistent research focus. Nursing homes began to emerge in the 1850s, initially serving a specific group and focusing on providing treatment and rehabilitation for chronic diseases. With technological advancements and improved living standards, nursing homes have taken on new roles. For example, they

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have evolved from early employee sanatoriums to today's integrated medical and elderly care facilities. This reflects the five levels of Maslow's hierarchy of needs, from the initial satisfaction of physiological needs to the highest level of spiritual fulfillment.

Many scholars have also conducted various analyses of sanatoriums. For example, in terms of the renovation of sanatoriums, Zhang Xiaochun and Huang Yuting (2021) explained that the medical equipment in sanatoriums needs to be better matched with the space of sanatoriums in order to achieve better utilization [1]. In terms of the model and social adaptation of sanatoriums, Liu Yishi (2025) analyzed the model of sanatoriums and found that the establishment and space of sanatoriums are closely related to the national political system. He also proposed that the current sanatorium model suitable for China should be a model that combines mainstream, mixed, undercurrent and modernism [2]. Some scholars have also conducted mathematical evaluations of the satisfaction of sanatoriums. For example, Huang Jinxin, Dang Yaoguo, Ye Jing, et al. (2024) conducted an index system analysis of the satisfaction evaluation of sanatoriums. Their research showed that the environment and medical care are closely related to the satisfaction of sanatoriums [3].

In summary, current research on nursing homes is fragmented, with issues such as scattered topics, significant overlap in research, and insufficient systematic analysis, lacking a comprehensive understanding of the discipline's development path and cutting-edge trends. This study aims to better clarify the development trends and future research directions of nursing home research. Therefore, it utilizes existing literature to systematically analyze the knowledge structure and development trajectory of nursing home research, and employs CiteSpace 6.4 R1 for literature visualization analysis. Based on this, and incorporating restorative environment theory, it constructs a theoretically supported new nursing home model, integrating research directions, identifying academic gaps, and making theoretical contributions to the field of elderly care.

2 Analysis Methods and Data Sources

2.1 Research Methods

This study uses a combination of quantitative and qualitative research methods. For quantitative research analysis, the study uses the bibliometric tool CiteSpace for visualization analysis. CiteSpace is a quantitative visualization data software for literature visualization analysis, which can identify hot spots, evolution paths and cutting-edge trends in the research field [4]. By using this tool, data can be systematically sorted out, a large number of documents can be visualized intuitively, and a map can be formed, thus clearly revealing the development and clustering reflected in the documents. In addition, the study also adopted the qualitative analysis research method. Qualitative analysis is the core method for deeply understanding phenomena, meanings and experiences in humanities and social sciences such as sociology, psychology, and art. It focuses on exploring deep logic and context through interpretation and induction [5]. The study selects several representative cases for interdisciplinary investigation, integrating sociological structural perspectives, psychological experience dimensions and artistic expression forms to form an integrated understanding. On this basis, the

restorative environment theory is introduced as a theoretical support. This theory emphasizes the positive reshaping effect of the environment on individual psychological recovery and cognitive emotions. This study applies the theory from two dimensions: psychological pattern transformation and environmental improvement. It analyzes how environmental interventions in case studies promote psychological state transformation and overall well-being improvement, thereby ensuring the systematic nature and depth of the analysis.

2.2 Data Sources and Data Collection

The data for this study came from the Web of Science (WOS) database. For data retrieval/collection, the search method on WOS was to limit the keywords to "sanatorium" and the time period to 2000-2025, subsequently exporting plain text.

3 Trend Analysis of AI Product Interaction

Fig 1 and Fig 2 are derived from LLR co-occurrence keyword clustering and time dimension analysis.

3.1 Keyword Clustering Analysis of Sanatoriums

LLR clustering was performed on the 500 most relevant literature data on nursing home research from 2000 to 2025, with a maximum number of clusters limited to 9: nursing home resident (#0), nursing home (#1), caregivers experience (#2), family member (#3), nursing home placement (#5), environmental correlate (#6), and advanced dementia living (#9) (Fig 1).

Further analysis revealed that the top three clusters were nursing home resident (#0), nursing home (#1), and caregivers experience (#2). Within the nursing home resident (#0) cluster, hot topics included nursing homes, green house concept, and quality pain management. This cluster reflects a profound transformation in the nursing home model from traditional institutional care to humane, high-quality care in the context of an aging society. From a political and policy perspective, nursing homes, as the foundation, represent the existing large-scale institutional elderly care system. The rise of the green-house concept responds to the deinstitutionalization of long-term care reform policies in Europe and the United States. This model, through small, family-like living units, aims to improve residents' autonomy and quality of life, representing a concrete practice of the policy advocacy of shifting from medical management to life support. From the perspective of the times and changing attitudes, society's attention to the dignity and quality of life of the elderly has reached a certain level. This makes quality pain management a core issue. It is not only a medical issue, but also a human rights and ethical issue. Especially against the backdrop of an increasing number of dementia patients, accurate pain assessment and management are directly related to residents' basic life experience and dignity. Looking at the evolving needs of the elderly population, contemporary seniors and their families' expectations for nursing homes have gone beyond

basic survival guarantees. They demand a home-like environment and a pain-free, dignified life.

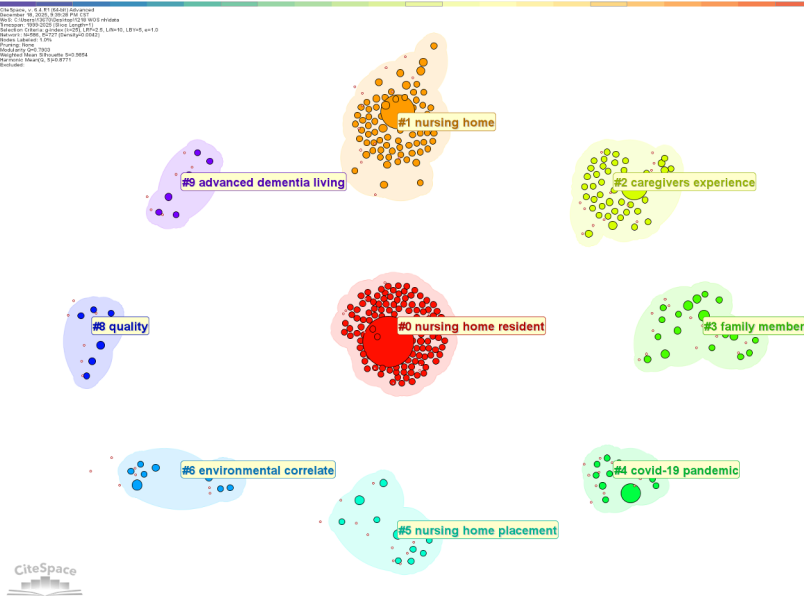


Fig. 1. Keyword clustering (co-occurrence) analysis (WOS) of sanatoriums

For nursing home (#1), its hot topics include nursing home resident, consistent assignment, complex intervention, and Flanders Belgium. In the nursing home (#1) research cluster, the keywords nursing home resident, consistent assignment, complex intervention, and Flanders Belgium appear frequently, reflecting a shift in research focus in this field in recent years from facility management to resident-centered comprehensive care models. This trend can be summarized in three dimensions. From a political and policy perspective, reforms to long-term care systems in many European and American countries emphasize deinstitutionalization and humanistic care, driving research to focus on how to establish stable care relationships through consistent assignment to improve residents' psychological security and quality of life. The Flanders region of Belgium, as a pioneering area for EU aging policies, has a long-term care insurance system and high-quality datasets for complex intervention research. In terms of the historical context, the accelerating global aging and the COVID-19 pandemic have highlighted the physical and mental vulnerability of nursing home residents. Therefore, this research focuses on designing and validating complex interventions encompassing environmental, social, and clinical dimensions in specific areas, such as Flanders, based on consistent assignment, with the aim of achieving a truly resident-experience- and outcome-oriented care transformation.

For caregivers experience (#2), its hot topics include acute infection, report card, cognitive impairment, and a multiphase emergency response. From a political and policy perspective, the report card system reflects the trend of the regulatory system strengthening the transparency and accountability of the quality of elderly care

institutions. The government drives institutions to improve the quality of care through standardized assessments and public disclosure of results, especially focusing on core safety indicators such as acute infection control, which directly constitutes the normative framework and source of pressure for caregivers' daily work. In combination with the background of the times, especially the global impact of COVID-19, acute infection and a multiphase emergency response have become prominent hot topics. The epidemic has exposed the vulnerability of elderly care institutions, making infection control upgrade from routine care to an emergency management system that concerns survival [6]. Focusing on the characteristics of the elderly population, cognitive impairment is a common reason for admission to nursing homes. The care needs of such elderly people are complex, communication is difficult, and they are often more sensitive to changes in the environment, such as isolation measures taken due to emergency response, which can easily trigger behavioral and psychological symptoms [7]. Caring for them requires a high degree of professionalism and patience, and the core challenge lies in balancing these complex needs with mandatory public health measures such as acute infection control.

3.2 Research Trends Analysis of Sanatoriums

The overall analysis reveals that from 2000 to 2025, research has shown a trend centered on nursing homes and their residents, with a recent focus on elderly people with dementia, who have higher requirements for environment, quality of life, and overall experience (Fig 2). The evolution of research hotspots can be categorized into sustainable research and intermittent research based on temporal continuity.

For ongoing research, three main areas are included. In the nursing home resident (#0) cluster, the focus has shifted from overall functional status assessment to specific disease management, psychological and social needs, and finally to individualized quality of life and autonomy. The reasons for these changes are as follows: First, early research was dominated by the biomedical model, with overall functional status assessment serving as a fundamental indicator for measuring nursing effectiveness and resource allocation. This was closely related to the research paradigm at the time, which centered on institutional management and care efficiency. Second, with population aging and the prevalence of comorbidities, research naturally deepened to specific disease management, especially common clinical problems such as cognitive impairment and acute exacerbations of chronic diseases. This reflects the research community's response to the complex medical needs of nursing home residents, aiming to optimize clinical pathways and reduce readmission rates. Subsequently, the research perspective expanded significantly, incorporating psychological and sociological dimensions, and began to systematically focus on residents' psychological and social needs, such as depression, loneliness, and social participation. Finally, current research frontiers further focus on individualized quality of life and autonomy.



Fig. 2. Keyword Research Trend Analysis of Sanatoriums

Within the nursing home (#1) cluster, the focus has shifted from institutional entities to resident subjects, humanistic experiences, and finally to a healing environment. The reasons for these changes are as follows: Early research treated the nursing home itself as the core object of governance and management, focusing on its systems, operations, and macro-policy effects. This reflects the field's origins in addressing the practical needs of social elderly care infrastructure and institutional development. As research deepened, the focus shifted to nursing home residents (#0) and advanced dementia living (#9), marking a shift from a focus on the institution to the residents themselves. Further outward expansion to include caregivers' experiences and family members indicates that academia recognizes nursing homes as a social ecosystem comprised of residents, professional caregivers, and family members. Research began to systematically focus on the interactions, emotional labor, and subjective experiences of all parties involved, closely related to the integration of sociological and psychological perspectives. At the current stage, research, through strong correlations with environmental correlates, demonstrates a crucial leap from the social relations dimension to the physical and psychological environment dimension, aligning with the influence of theories such as restorative environments.

In the caregiver's experience (#2) cluster, the evolution has shifted from individual capabilities and relationships to systemic stress and management, public health crisis response, and finally to structural and ethical reflection. This evolution can be summarized in four stages. Early research focused on caregivers' individual caregiving abilities, particularly their skills in managing complex conditions such as cognitive impairment, and their communication and collaboration with family members. With the standardization of the elderly care industry, the focus shifted from individual capabilities to caregivers' work stress, burnout, and quality management experiences under standardized and accountable systems. The third stage is marked by the prominence of acute

infections and multi-stage emergency responses, directly corresponding to the global COVID-19 pandemic. Current research is beginning to intersect with clusters related to environmental factors and the lives of elderly people with dementia, indicating that research is shifting from responding to specific crises to a deeper reflection on the structural environmental support for caregiving work and how to build a sustainable and humane caregiver support system while ensuring the quality of life for vulnerable groups such as those with dementia.

4 New Sanatorium Theoretical Model

In today's aging society and the rising awareness of health, the role of nursing homes is gradually shifting from basic medical care facilities to a more holistic lifestyle environment that promotes holistic physical and mental well-being. This study draws on current popular environmental psychology research, particularly the "restorative environment theory, " and uses it as the core to construct a new nursing home model. This model aims to systematically create a therapeutic atmosphere that effectively relieves stress, restores energy, and improves quality of life through multiple dimensions, including psychological support, environmental design, and facility configuration.

4.1 Restorative Environment Theory

The restorative environment theory posits that specific environments can help people recover from psychological fatigue and stress. These environments typically possess several key characteristics : first, detachment, meaning the environment allows people to temporarily escape from daily worries and sources of stress; second, attractiveness, meaning the environment easily captures people's attention; third, richness, meaning the environment provides ample and gentle content to occupy people 's minds without causing boredom or burden; and fourth, compatibility, meaning the environment matches individual desires and different goals, making people feel comfortable. This theory provides clear design guidance when constructing new sanatorium models. Its specific application lies in planning the entire sanatorium as a comprehensive environment possessing these four characteristics. For example, detachment is achieved through specific site selection and rational layout; attractiveness is achieved by introducing natural landscapes; richness is achieved by organizing diverse activities; and compatibility is achieved by providing personalized options. Therefore, this theory is not only a design concept but also a core framework connecting psychological needs, spatial planning, and operational activities.

4.2 New Sanatorium Model

Based on the above theories, the core of the new nursing home model is to construct a living community that transcends traditional care and aims to proactively promote physical and mental recovery. Its design philosophy is mainly reflected in the following three interrelated levels: First, the spatial environment is consciously shaped into a

functional environment with healing properties. For example, the design connects the indoor and outdoor environments to form a safe circular walkway, with seating and greenery along the way to encourage people to walk and linger, thus directly utilizing the appeal of natural landscapes to alleviate stress. Second, this model highly values social and psychological support. By organizing activities such as "memory sharing sessions" or "pair gardening," opportunities for social connection are purposefully created to alleviate loneliness and enhance residents' sense of belonging and self-worth. Finally, facilities and activities are oriented towards functional recovery and enjoyment of life. Specifically, this includes setting up a safe hydrotherapy pool with a constant water temperature of 32-34 degrees Celsius for physical therapy, and planning different daily activity schedules such as crafts and music appreciation, which serve sensory stimulation, physical function maintenance, and social interaction (Figure 3). Through the systematic integration of environment, social interaction, and activities, this model transforms the nursing home into an organic environment that actively supports holistic health recovery.

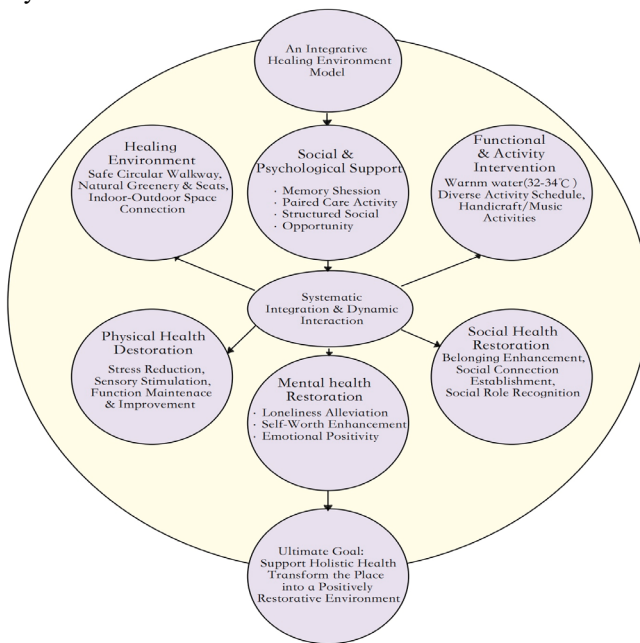


Fig. 3. Schematic diagram of the new sanatorium

5 Findings and Conclusions

This study, through a systematic review by CiteSpace, reveals that current research focus in the field of convalescence has shifted significantly from traditional medical care to a comprehensive concern for the therapeutic effects of psychology and the environment. Analysis indicates that successful new convalescence models are integrative

solutions that construct an ecosystem that proactively supports physical and mental well-being through carefully designed multi-sensory natural environments, activities that promote social connection, and environmental facilities aimed at restoring daily living functions.

Gradual integration with intelligent technologies. For example, artificial intelligence can be used to analyze residents' activity patterns, effectively and personally recommending rehabilitation activities or issuing early warnings of health risks; environmental sensors can automatically adjust indoor lighting, temperature, and humidity to match the day-night cycle. However, intelligent technologies must also be accompanied by strict ethical considerations, including establishing clear data privacy protection policies and regularly reviewing algorithms to prevent discrimination or over-surveillance, ensuring that technology always serves human dignity and autonomy. Finally, it must be pointed out that the conclusions of this study have certain limitations. The article mainly analyzes literature collected in the Web of Science (WOS) database between 2000 and 2025, and may not fully cover important research results in other languages or databases. In addition, this study focuses on the construction of theoretical models, and its practical effects still need further verification with more field research and practical data. Therefore, future research can further explore literature from multiple databases and further explore existing theoretical directions.

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