# A Systematic Review of Investigations into the Physical Environmental Qualities in Chinese Elderly Care Facilities

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## ABSTRACT

This systematic review summarized findings from 36 articles on physical environmental qualities in Chinese elderly care facilities, including five topics: 1) assessment methods, 2) physical environmental factors, 3) safety, 4) overall satisfaction and 5) health. There was a lack of effective methods to support both design decision-making and environmental assessment of elderly care facilities by architects and engineers. These studies reviewed can be found with a low potential to develop practical design strategies due to the lack of strong evidence. It is still necessary to carry on investigations into methods/frameworks/strategies to improve environmental qualities in elderly care facilities in China.

**Keywords:** Systematic review, Physical environmental quality, Environmental design & assessment, Elderly care facilities, China

## INTRODUCTION

The physical environment has been emphasized as one key component of quality of life by World Health Organization (1997). Many studies exposed that there were significant effects of physical environment on the mental and physical health of residents in care facilities (Cohen-Mansfield 2001; Gesler et al. 2004; Janssen 2014). China has become an aging society since 2000 and currently there is an increasing need for elderly care facilities (Han et al. 2020; NBS 2021). Several national regulations have been recently produced in China to support the development and assessment of elderly care facilities (MOCAC 2021; SAMR 2018; MOCAC 2019). However, there is a clear lack of knowledge of how to practically plan and effectively evaluate the physical environment in Chinese care facilities. This paper presented a systematic review of studies of environmental qualities in elderly care facilities in China, with an aim to expose the current situation of design technologies in elderly care facilities and identify the gaps in planning, developing, and managing these facilities.
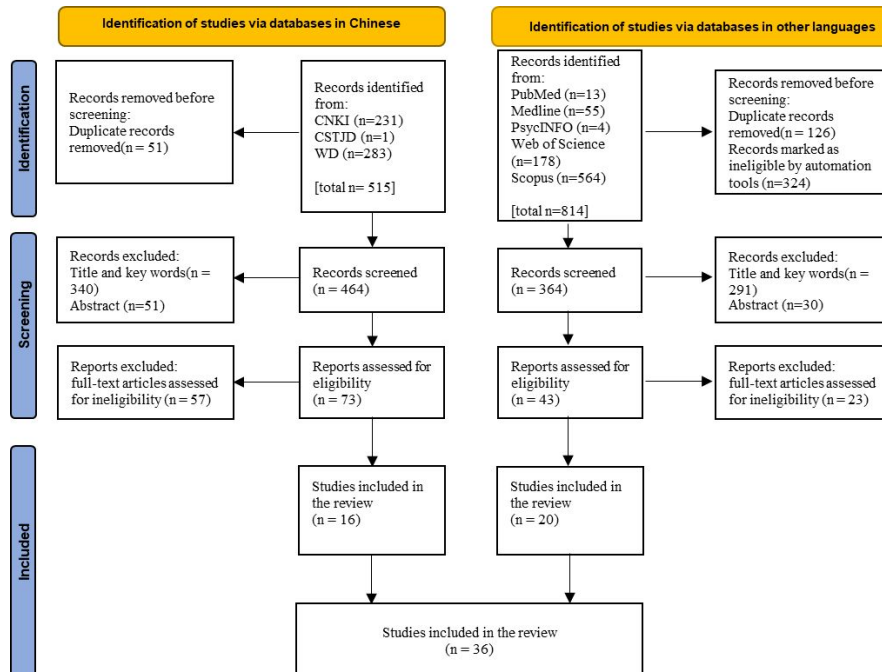
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**Figure 1**: Flow chart of the search process (adapted from Moher et al. 2009; Page et al. 2021).

## METHOD AND MATERIALS

### Design

A systematic review (Figure 1) was implemented according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) (Moher et al. 2009; Page et al. 2021).

## SEARCH STRATEGY AND STUDY SELECTION

A systematic literature search from 1990 to 2021 was performed in two types of databases: 1) databases in Chinese: China National Knowledge Infrastructure (CNKI), Wanfang Data (WD), China Science and Technology Journal Database (CSTJD), 2) databases in other languages: PubMed, Medline, PsycINFO, web of science, and Scopus. The search period was chosen because it covers the timespan when methods of assessing environmental quality emerged (Preiser et al. 2015).

A Boolean search strategy was applied based on a combination of the following terms (inc. potential synonyms/appropriate free-text): Older people, Senior citizen, Care facility, Nursing home, Elderly care, Physical environment, Environmental design, Health facility environment, China, Assessment, Building evaluation, Assessment method. Terms and their synonyms/ free-text were searched by MeSH and PsycINFO.

To be included in the review, papers should focus on Chinese elderly care facilities, older people, and physical environment. Literatures were excluded

**Table 1**. Literature inclusion and exclusion criteria.

| Item | Inclusion criteria | Exclusion criteria |
| --- | --- | --- |
| Subject | Older people Gender: both male and female Care facility | Non older population, such as child, middle-aged. Only male or female, etc.. Residential care, such as staying at home, living in a normal neighborhood, etc.. |
| Domain | Built environment, indoor or outdoor environment | Studies out of the built environment, such as nursing, social work, medicine, etc.. |
| Scoping | Chinese care facilities | Care facilities in other countries. |
| Content | Physical environmental qualities | Practice case studies, such as the design case for a build, landscape, etc.. |

if they only focused on other countries' care facilities or assessment of management systems or nursing care (Table 1).

## SEARCH OUTCOMES

The title and abstract scan first resulted in 1329 papers that were subject to meeting the inclusion criteria. Duplicates were removed and thus 1152 articles were kept in. After the titles and abstracts have been screened in terms of inclusion and exclusion criteria (Table 1), 116 articles were found to meet the inclusion criteria. With a further full-text evaluation, 36 articles were finally selected for this review.

## RESULT

### Characteristics of the Included Studies

Thirty-six articles were reviewed, which were written in Chinese (n = 16) and English (n = 20). Over half of these studies (n = 19) were published between 2020 and 2021. The included studies used questionnaires, interviews, or physical instruments to assess environmental qualities. The sample size of participant ranged from 44 to 1457. All articles could be categorized into five themes: assessment methods (n = 11), physical environmental factors (n = 11), safety (n = 5), satisfaction (n = 7), and health (n = 2).

### Assessment Methods

Eleven articles described different instruments to assess physical environmental qualities in elderly care facilities (Table 2). The assessment methods varied in aim.

Four studies investigated the assessment instrument translated into Chinese, which have been examined in Chinese care facilities as reliable and valid. However, the cultural impact was found clear. Further studies within different cultural contexts would improve the application of one instrument TOPAS (Li et al. 2021). Only one study adopted the newest Chinese national standard to evaluate public and private non-profit nursing homes (Hua et al. 2021).

**Table 2.** Studies: assessment method.

| Author | Instrument | Aim | Methods | Samples | Main Findings |
|---|---|---|---|---|---|
| Li *et al.* (2021) | TOPAS | QoL. | Survey. | N = 285 | Reliable and valid. |
| Leung *et al.* (2004) | Self-define | QoL. | Survey. | N = 44 | Cultural impact found. |
| Yu *et al.* (2017) | Self-define | QoL. | Survey. | N = 242 | Proposed provision of care services. |
| Mu *et al.* (2021a) | Self-define | IEQ, QoL. | Survey. | N = 1457 | Significant effect of IEQ. |
| Jia and Wang (2017) | Self-define | Satisfaction. | Survey. | N = 100 | Correlation between age and environment. |
| Hua *et al.* (2021) | Chinese national standard | General. | Survey. | N = 232 | Higher qualities in private nursing homes. |
| Sun (2020) | Self-define | POE | Observation - & survey. | | Not clear. |
| Qi (2019) | QBSE, QSSCC, QSE | Satisfaction. | Survey. | N = 470 | Satisfaction differences in services and facilities. |
| Yao (2020) | Self-define | POE | Observation - & survey. | | Lack of elderly friendly facilities. |
| Ke and Li (2015) | TESS-NH | Validation | Survey. | - | Reliable and valid. |
| Fang *et al.* (2020) | PCQ-P | Validation | Survey. | N = 402 | Reliable and valid. |

Other studies used self-define instruments to evaluate the quality of life (Leung et al. 2004; Yu et al. 2017; Mu et al. 2021a), satisfaction (Jia and Wang 2017) and conduct the post occupancy evaluation (POE) (Sun 2020; Yao 2020) (Table 2).

## Physical Environmental Factors

Eleven articles discussed physical environmental factors, such as acoustic, lighting, thermal, and air flow (Table 3).

The indoor environment was the focus of elderly care facilities. Four articles studied the acoustic environment. In terms of indoor thermal comfort, the seasonal factor was critical (Yu et al. 2020; Zheng et al. 2021).

## SAFETY

Five articles assessed the safety issues in care facilities (Table 4). Four studies investigated factors that result in falls, while one article evaluated the general safety of care facilities. Main environmental safety factors were found as indoor lighting and mobility services (Jiang et al. 2021; Liu et al. 2018; Yan et al. 2019).

## OVERALL SATISFACTION OF CARE FACILITIES

Seven studies examined overall satisfaction of environmental qualities in care facilities (Table 5). Two of them focused on the satisfaction of physical environment (Wang et al. 2015; Yu 2020). Other studies indicated that the

**Table 3.** Studies: physical environmental factors.

| Author | Environmental factors | Methods | Space in care home | Main findings |
|---|---|---|---|---|
| Cui *et al.* (2020) | Acoustic. | Measurement & survey. | Common room. | Strong correlation with humidity, weak correlation with temperature. |
| Mu et al. (2021b) | Light, acoustic, thermal. | Survey. | Indoor. | Lighting and acoustic environment were critical; comfortable temperature 20-26°C. |
| Zhan *et al.* (2021) | Light, acoustic, thermal. | Survey. | Indoor. | High impact of air temperature, low impact of view and lighting. |
| Yu *et al.* (2020) | Thermal. | Measurement & survey. | Indoor. | Seasonal variations of thermal environment. |
| Xie *et al.* (2020) | Acoustic. | Measurement & survey. | Care units. | Strong preferences for natural sounds; main source of noise was from nursing station. |
| Mu *et al.* (2021c) | Acoustic. | Measurement & survey. | Activity hall. | Poor acoustic environment. |
| Yang *et al.* (2021) | Lighting. | Measurement & survey. | Common room, bedrooms. | Factors affecting sunlight demand were found. |
| Ni (2021) | Air flow. | CFD. | Outdoor. | Shadow wind region area proportion should be decreased. |
| Zheng *et al.* (2021) | Thermal. | Measurement & survey. | Indoor. | Seasonal differences of operative temperature. |
| Liu (2021) | Thermal. | Measurement & survey. | Indoor. | Thermal performance variations. |
| Qin (2020) | Acoustic. | Survey. | Common room | Physiological and psychological impact of background sound. |

**Table 4.** Studies: safety.

| Author | Risk | Samples | Environmental factors for the risk |
|---|---|---|---|
| Jiang *et al.* (2021) | Fall. | N = 739. | Inadequate/inappropriate handrails, unsafe floors and poor lighting. |
| Liu (2019) | General. | N = 600. | General facilities. |
| Liu *et al.* (2018) | Fall. | N = 87. | Unsafe floor, poor lighting, and lack of handrails. |
| Mu *et al.* (2014) | Fall | N = 166. | General living environment. |
| Yan *et al.* (2019) | Fall | N = 278. | Air temperature (the most) and lighting (the least). |

satisfaction was influenced by facilities and services in normal nursing homes (Zhu 2020; Chen 2010), while health care service, security, and air quality were main factors that influenced satisfaction in a nursing home (Chen 2016).

**Table 5.** Studies: overall satisfaction

| Author | Items | Methods | Samples | Main findings |
|---|---|---|---|---|
| Yu *et al.* (2017b) | General. | POE. | N = 284. | Qualities of care home facilities affecting satisfaction. |
| Wan *et al.* (2019) | General. | Survey. | - | Staffing, facilities, service and environment affecting satisfaction. |
| Wang *et al.* (2015) | Physical environment. | Measurement & survey. | N = 240. | High level of satisfaction with the light environment. |
| Yu *et al.* (2020) | Physical environment. | Survey. | N = 309. | Biggest impact from thermal environment. |
| Zhu (2020) | General. | Survey. | N = 113. | Higher satisfaction found in facilities and service. |
| Chen (2010) | General. | Survey. | N = 70. | Influenced by facilities, service. |
| Chen (2016) | General. | Survey. | N = 206. | Influenced by health care, security, and air quality. |

**Table 6.** Studies: health.

| Author | Variables | Methods | Samples | Main findings |
|---|---|---|---|---|
| Jueng *et al.* (2020) | SOC | Survey | N = 104 | Interactive effects between personal and environmental factors on SOC. |
| Leung *et al.* (2017) | QoL | Survey | - | Physical health was influenced by facilities. |

## Health

Only two articles assessed the relationship between physical environmental qualities and residents' health, including sense of coherence (SOC) and QoL (Table 6). Physical health was significantly influenced by activities of daily living, the number of staff in care homes (Jeung et al. 2020), and facilities, such as accessibility, doors, windows, and signage (Leung et al. 2017).

## DISCUSSIONS AND CONCLUSION

Several findings can be drawn from the results. 1) There was a lack of Chinese literatures of physical environmental qualities in elderly care facilities in China. Most studies focused on environmental assessment methods and physical environmental performance, but not the human-centered environmental factors (e.g., safety, health, satisfaction) in care facilities. 2) A total

of 36 articles were included in this review, which a practical design/assessment method cannot be achieved from due to the limitation of available studies (e.g., small sample sizes, no general application, etc.). A key strength of this systematic review was the selected literatures that have included a broad range of environmental factors and can reflect the current situation in China. In addition, the studies in this review covered a wide range of research fields, including medicine, management, and engineering, and environmental design. There are some limitations of this review. First, sample sizes and types of care facility studied were limited. Second, some studies investigated specific locations in China, which cannot be applied to the whole region due to cultural, economic and social differences.

In general, the physical environment qualities in Chinese elderly care facilities were not properly investigated, especially for the effective methods to support decision-making at various design stages and environmental assessment by architects/designers and building engineers. Even though over half of the studies focused on general assessment methods or physical environmental factors, it can be found that they held a low potential to develop design strategies due to clear limitations such as small sizes, poor survey design, etc. Thus, it is necessary to conduct more investigations into methods/frameworks/strategies for planning and evaluating physical environment in elderly care facilities in China.

## ACKNOWLEDGMENT

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