

Introduction

Dementia is a significant global health concern, particularly affecting the elderly population. As the global population ages, the prevalence of dementia is expected to increase, presenting substantial challenges to healthcare systems worldwide.

Traditional approaches to dementia care often involve manual monitoring and intervention, which can be resource-intensive and insufficient in addressing the complex needs of dementia patients. In recent years, the integration of artificial intelligence (AI) into healthcare has emerged as a promising avenue for enhancing the diagnosis, management, and overall care of dementia patients.

While numerous studies have explored the potential of various AI technologies in dementia care, the breadth and diversity of these applications necessitate a comprehensive examination to understand their overall impact in improving dementia care outcomes.

This systematic review aims to fill this gap by describing the specific mechanisms and features of AI technologies, evaluating the effectiveness of AI interventions in dementia care, specifically focusing on elderly ageing in home settings, and providing insights for future development and implementation.

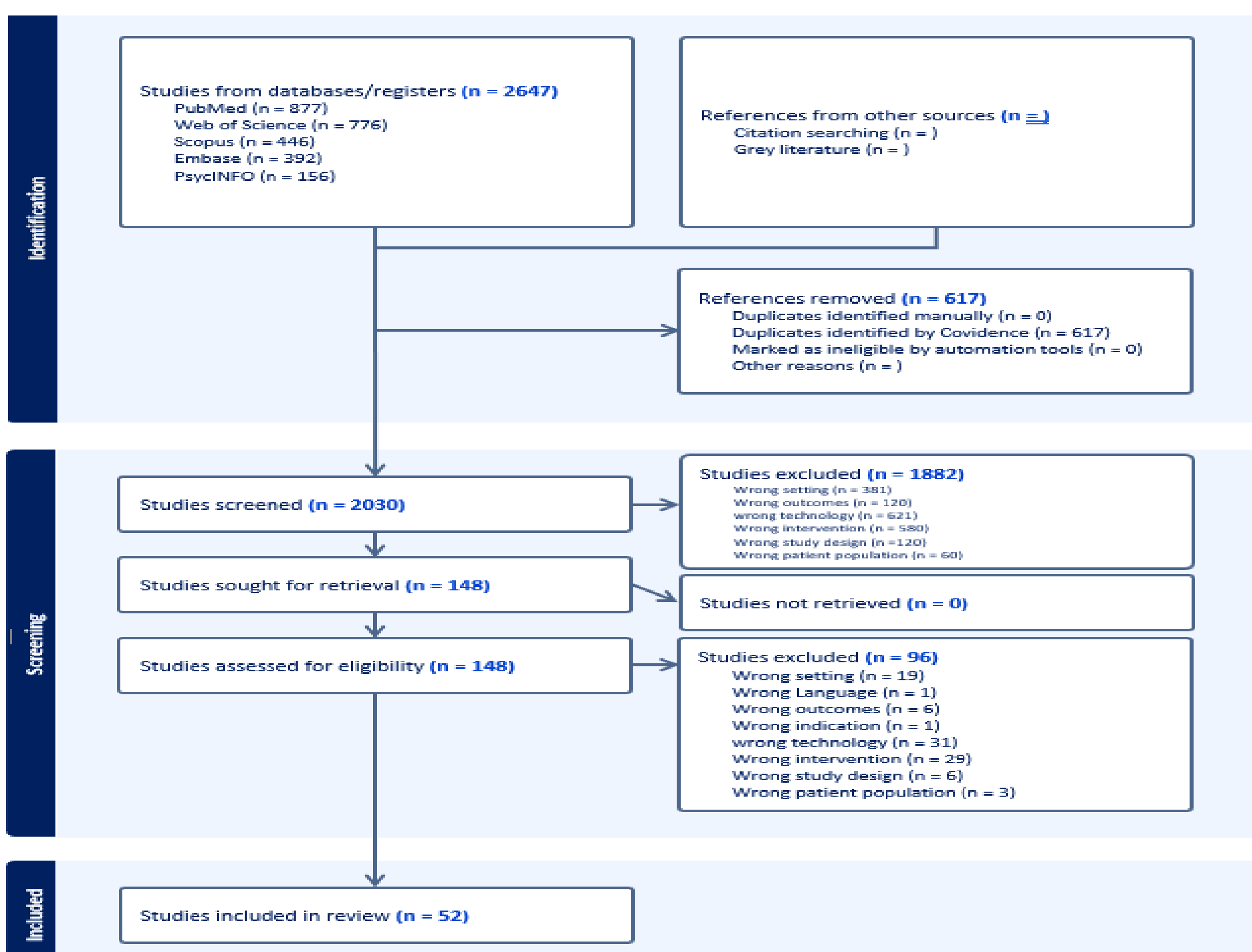
Methods

Search and Screening: Eligible studies were searched on multiple databases, including PubMed, Web of Science, Scopus, Embase, and PsycINFO, using keywords such as "artificial intelligence," "dementia," "elderly," and "quality of life," up to July 30, 2024. Studies (randomized controlled trials, cohort studies, nonrandomized controlled trials, and case-control studies) were included if they involved elderly participants (aged 60 years and older) diagnosed with dementia, utilized AI-based tools or technologies, and reported measurable outcomes related to quality of life, cognitive function, emotional well-being, or daily living. Exclusion criteria included studies focusing on non-AI interventions or non-dementia populations.

Quality Assessment: Quality appraisal was conducted using tools like the Cochrane Risk of Bias Tool for randomized controlled trials and the Newcastle-Ottawa Scale for observational studies.

Data Extraction and Synthesis: Key information like study design, sample characteristics, intervention type, duration, and intervention effects was extracted from each study. Due to methodological and outcome heterogeneity, findings were synthesized narratively rather than quantitatively. Subgroup analyses explored specific intervention types, such as robotic companions and cognitive training tools, and their distinct impacts on dementia care outcomes.

Figure 1: PRISMA Flowchart of Literature Searching and Screening



Results

A total of 52 studies published between 2010 and 2023 were included in this review (Fig 1.).

Characteristics of Reviewed Studies: The included studies were conducted in United States (n=15), China (n=10), United Kingdom (n=7), Canada (n=5), Australia (n=5), and various European nations (n=10). Study designs consisted of RCTs (n=32, duration of 6-24 months), non-RCTs (n=10, duration of 6-18 months), cohort studies (n=6, duration of 12-36 months), and case-control studies (n=4, duration of 9-24 months).

Risk of Bias & Evidence Quality: 80% of RCTs had low risk of bias, but 20% showed concerns in allocation concealment and reporting. According to GRADE assessment, AI's impact on cognition and mobility had high certainty, while long-term benefits had moderate certainty due to limited longitudinal studies.

AI Interventions Types and Mechanisms: AI applications in dementia care included:

- **Machine learning (n=20)** for predictive analytics, early detection, and personalized care, leading to improved fall prediction and cognitive decline monitoring.
- **Generative AI (n=12)** provided virtual companions and customized cognitive exercises, which enhanced memory recall, problem-solving, and reduced loneliness.
- **Deep learning (n=10)** was primarily used for speech and image recognition, aiding in biomarker-based dementia detection and disease progression monitoring.
- **Robotics and IoT (n=10)** supported mobility, daily activities, and real-time health monitoring, with IoT-enabled smart home systems providing timely medication reminders and emergency alerts.

Impact of AI Applications on Dementia Care:

- **Physical Health Outcomes:** AI-assisted rehabilitation enhanced mobility (n=15) and reduced hospitalizations by 20-35% (n=18) through continuous health monitoring and timely medical interventions.
- **Mental and Cognitive Outcomes:** AI-driven cognitive training improved memory and problem-solving by 15-40% (n=14). AI companions and virtual assistants reduced loneliness and depression (n=12), enhancing emotional well-being.
- **Social and Caregiver Support:** AI-facilitated communication increased social engagement (n=10), and AI-based caregiver tools reduced burden by improving care planning and decision-making (n=8).

Challenges and Concerns: While AI shows promise in dementia care, challenges and concerns remain. **Data privacy concerns (n=18)** arise from handling sensitive patient data. **Algorithm bias (n=12)** affects AI accuracy across different populations. **Acceptance issues (n=15)** persist due to caregiver and patient hesitancy in adopting AI tools. **High costs and accessibility barriers (n=10)** limit widespread AI implementation.

Conclusion

AI interventions hold substantial potential in addressing the multifaceted needs of elderly individuals with dementia by improving patient outcomes and supporting caregivers. However, addressing ethical and practical challenges is essential to fully leverage this potential. Future research should focus on the long-term impacts, cost-effectiveness, and the development of inclusive and user-friendly AI technologies to ensure equitable access and maximize benefits.

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References

Introduction

As the risks of chronic diseases related disabilities rise with age, the need for long-term care (LTC) is expected to increase considerably as the global population continues to age. This is especially the case in low- and middle-income countries, where nearly 80% of the world's elderly population lives.

Workforce staffing and quality are key determinants of LTC service quality, directly affecting resident outcomes. Previous studies from developed countries like the United States and Canada have reported that higher staffing levels and better-trained workforce are associated with better long-term care service quality and improved health outcomes. However, there is limited evidence from LMICs like China.

This review study aims to examine the status of workforce staffing and quality in Chinese LTC facilities and their impact on the service quality and residents' health outcomes.

Methods

Literature Search and Screening

Electronic databases (PubMed, Scopus, CNKI, Embase, Cochrane Library, Web of Science, WANFANG, and AgeLine) were searched for eligible studies published from January 2016 to June 2024. This systematic review followed Cochrane guidelines and the PRISMA principles.

Eligibility Criteria: Original studies published in English or Chinese were selected using the PICO framework:

- **Population:** residents aged 60+ in LTC facilities in China.
- **Intervention:** LTC workforce staffing and quality measured by staffing levels, staff composition, training, education, residence, working experience, and professional skills.
- **Comparator:** Not applicable.
- **Outcome:** LTC service quality measured by indicators like resident satisfaction and symptom management.

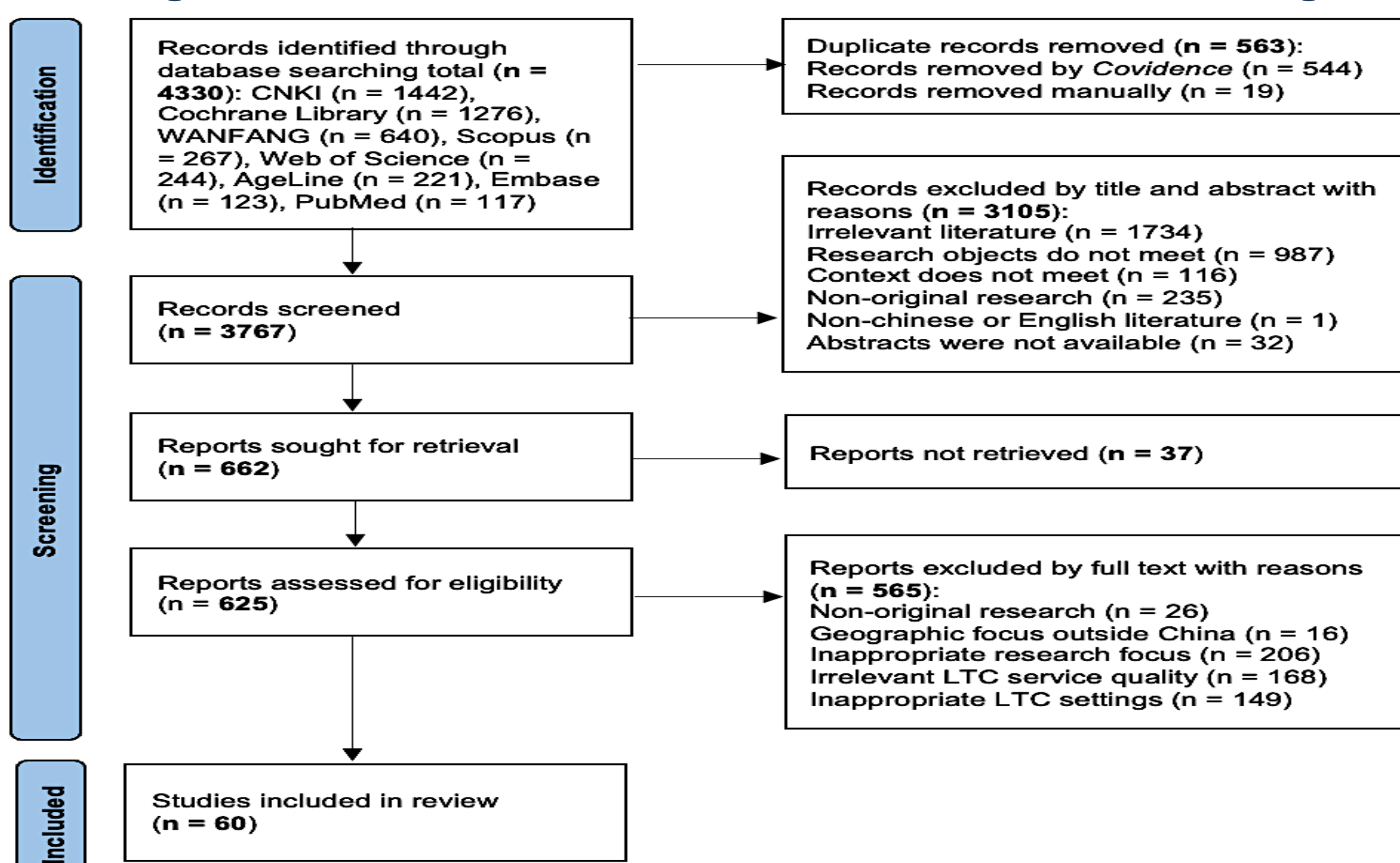
Risk of Bias Assessment

The GRADE (Grading of Recommendations Assessment, Development, and Evaluation) framework was used to evaluate study quality, considering study design, risk of bias, inconsistency, indirectness, imprecision and publication bias.

Data Extraction and Synthesis

Key information like author, year, study design, sample characteristics, workforce staffing and quality measures, service quality outcomes were extracted from each study. The impact of workforce staffing and quality on LTC service quality and residents' health outcomes were summarized and reported.

Fig 1. PRISMA Flowchart of Literature Search and Screening



Results

A total of 60 studies met the inclusion criteria and were included in this review (**Fig. 1**). These studies were majorly conducted in economically advanced provinces like Shanghai (n = 8), Hunan (n = 6) and Guangdong (n = 5).

Using the GRADE framework, seven studies were rated as high quality, 20 as moderate, and 33 as low, with majority of the articles rated low in study design and imprecision.

Workforce staffing in Chinese long-term care facilities was often inadequate, with an average daily working hours of over 12 and staff-to-resident ratios as low as 1:5. Education levels among the workforce were low and professional training was lacking. Professional training generally focused on basic care without geriatric specialization. Geographic disparities in staffing and workforce quality across China's provinces were evident, with Jiangsu and Shanghai leading in LTC workforce training and staffing.

Higher staffing levels and better staff-to-resident ratios were consistently associated with improved LTC service quality, including better residents' satisfaction (n = 31), functional outcomes (n = 2), and lower rates of care accidents (n = 11). Workforce quality, particularly systematic training and higher educational levels was positively correlated with improved symptom management (n = 6) and harm-free care (n = 14).

Conclusion

Current workforce staffing and quality in Chinese long-term care facilities are suboptimal, and significant geographic disparities existed. Future policies and interventions need to focus on increasing the overall workforce and its quality and reducing the geographic disparities of long-term workforce development across regions, by enforcing the staffing and training standard implementation, and developing monitoring and evaluation system.

Similar to findings from developed countries, this study shows a consistent correlation between staffing indicators and LTC service quality in China, underscoring the importance of adequate staffing levels, hierarchical management, and systematic training in improving care quality.

However, the majority of the reviewed studies were cross-sectional studies with moderate to low quality. Future research should examine the long-term effects of workforce staffing and quality on LTC outcomes with rigorous designs. Moreover, future studies could explore the effectiveness of AI tools for LTC workforce development, and examine the cultural influences on LTC staffing models in China.

Acknowledgement

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Introduction

With the rapid increase of aging population and the decline of informal unpaid carers (particularly female family members) in LMICs like China, the demand for “Hu Gong” (informal paid personal care provider) is increasing significantly in recent years. The development of high-quality “Hu Gong” is essential to meet the increasing long-term care needs and ensure the well-being of the ageing population.

While multisectoral engagement of resources across public, private, and civil-society organizations are required for effective workforce development, little is known about the role and engagement of different sectors in developing the informal paid carers in LMICs like China.

This study aims to examine how multisectoral collaboration was encouraged in developing Hu Gong workforce by reviewing provincial-level policies in China.

Methods

Search and screening: Provincial-level policy documents related to Hu Gong were searched and selected from the government website in 23 provinces, 5 autonomous regions, and 4 municipalities of China directly under the Central Government up to July 30, 2024. The selection included two steps:

- **Keyword-Based Search:** The terms “护工” (informal paid personal care worker) “养老护理员” (elderly caregiver) and the names of each province were searched in the Chinese search engine Baidu, and if there were any two keywords in the documents, they were downloaded as PDF format.
- **Document Review and Selection:** eligible policy documents were screened and selected if they were:
 1. published between 2000 and 2024;
 2. specifically addressed Hu Gong-related policies;
 3. issued by provincial-level government authorities.

Quality Assessment

Each policy document was evaluated based on three main themes (policy design, support and implementation tools, and monitoring and evaluation) and 12 subcategories, using a structured scoring system:

- 3 = High: The policy provides a detailed description of relevant content.
- 2 = Medium: The content is unclear or indirectly mentioned, requiring reviewer interpretation.
- 1 = Low: There is no mention of the relevant content, and no inference can be made.

Data extraction and synthesis

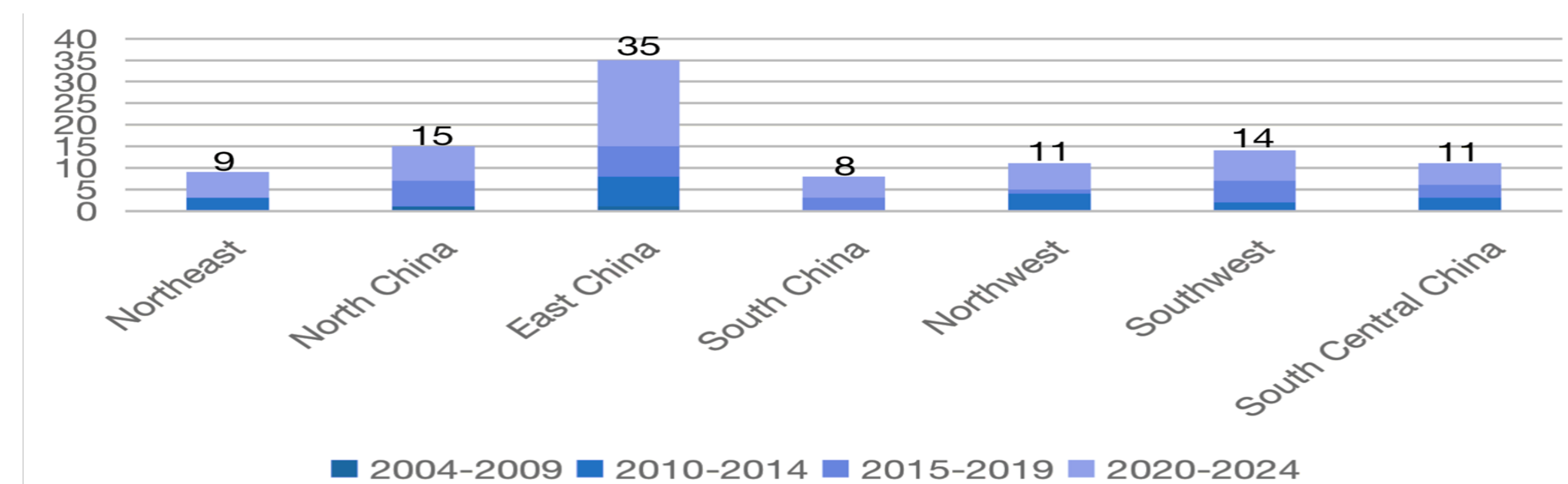
Key information like title, published year, the names, roles of different sectors, collaboration mechanisms was extracted and summarized from each policy document.

To analyze regional variations, China was divided into six geographical regions: Northeast, North, East, South, Northwest, Southwest and South-Central China. A bar chart was used to compare the timeline of Hu Gong-related policy releases across these six regions. Additionally, the total number of Hu Gong-related policies in each province was visualized on a China map using Tableau.

Results

A total of 102 government documents were retrieved, among which 69 policy documents were included in this review. **Policy Distribution Across Regions:** East China has the most policies across Chinese regions from 2004 to 2024 (**Fig. 1**).

Figure 1 Number of policies among Chinese Regions from 2004 to 2024



Policy Quality Assessment: The quality scores of the 69 selected policies ranged from 17 to 33 (on a scale of 12-36), with 24 policies rated as overall high quality, 24 as moderate, and 21 as low. Majority of the reviewed policies were rated low in participation, transparency, and effectiveness.

Commonly Mentioned Sector Entities:

- Public sector entities: Provincial Civil Affairs Department and Provincial Human Social Security Department.
- Private sector entities: Hu Gong vocational training programs, elderly care institutions, and domestic service enterprises.
- Civil society organizations: universities, colleges, and technician training schools.

Multisectoral Collaboration Encouragement: Among the 69 reviewed policy documents, three-sector collaborations were mentioned in 42 documents, and two-sector collaborations were encouraged in 23 documents.

Roles of Different Sectors: the policies specified the responsibilities and roles of different sectors as:

- Public sectors were expected to majorly charge for formulating policies, issuing certifications, and providing training guidelines and financial support to other sectors.
- Private sectors were responsible for providing training and job opportunities to Hu Gong personnel.
- Civil society organizations were majorly responsible for developing relevant courses and majors to train students for Hu Gong-related careers.

Conclusion

This study revealed the development of the Hu Gong policies that encourage multisectoral cooperation was relatively recent in LMICs like China. The findings underscored the need to improve these policies in terms of increasing transparency, effectiveness and participation, and reducing the geographical disparities.

Future research and practices are needed to further understand the collaborative mechanisms among different sectors in developing the Hu Gong workforce and evaluate the effects of relevant policies on workforce development and wellbeing improvement among the elderly.

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References

Introduction

Globally, the need for long-term care is expected to increase considerably as the population continues to age. This is especially the case in low- and middle-income countries, where nearly 80% of the world's elderly population lives. Historically, long-term care for older population substantially relies on informal unpaid carers (particularly female family members). However, with the decline of informal unpaid carers due to the changes in family size, migration, female labor force participation, among others, institutional-based ageing (e.g., nursing home) has become increasingly popular.

In China, this trend is growing due to rapid demographic shifts and urbanization. According to the Ministry of Civil Affairs, China had over 40,000 elderly care institutions in 2023, with more than 8.3 million residents. However, there are significant regional disparities in access to care, with urban areas generally having better facilities than rural regions.

This study aims to evaluate China's regulatory landscape for elderly care institutions by systematically reviewing national policies, with the hope to identify the gaps in current policy development and provide insights for improving relevant policies to ensure the well-being of populations ageing in institutional settings in LMICs like China.

Methods

Search and screening: Eligible policy documents were retrieved from three main sources: The national standard disclosure system, the Ministry of Civil Affairs of the People's Republic of China (PRC), and the Central People's Government of the PRC, using the keywords like “elderly care institutions”, “elderly care communities”, and “elderly care services” up to December 2024.

Inclusive/exclusive criteria: Policy documents were included if they focused on the use, development, and operation of senior care institutions (like nursing homes for those over 65). A nursing home is defined as a legally registered institution providing full-time accommodation and nursing services for the elderly, with more than 10 beds.

Quality assessment: The quality of the policies was evaluated based on various criteria, including clarity, accountability, equity, feasibility, utility, propriety, and accuracy.

Data extraction and synthesis: Key information, including policy name, category, issuing authority, supervisory department, date of issuance, status, target audience, content summary, and anticipated impact, was extracted from each policy.

The policies were classified using the WHO Health System Building Blocks Framework for a structured analysis. Specifically, policies were categorized into “governance”, “workforce”, “service delivery”, “financing”, “health information system”, and “access to essential medicines.” The analysis identified trends, gaps, and areas for improvement in management, service quality, safety, and financial regulations, with regular cross-referencing to legal databases for accuracy.

Results

A total of 40 national policy documents focusing on senior institutions published since 2012 were included in this review.

Most policies were scored high in accountability, with clear responsibilities for agencies, but low in propriety and accuracy, highlighting challenges in implementation and monitoring. While some policies were comprehensive, others lacked clarity, leading to inconsistencies in interpretation and enforcement across regions.

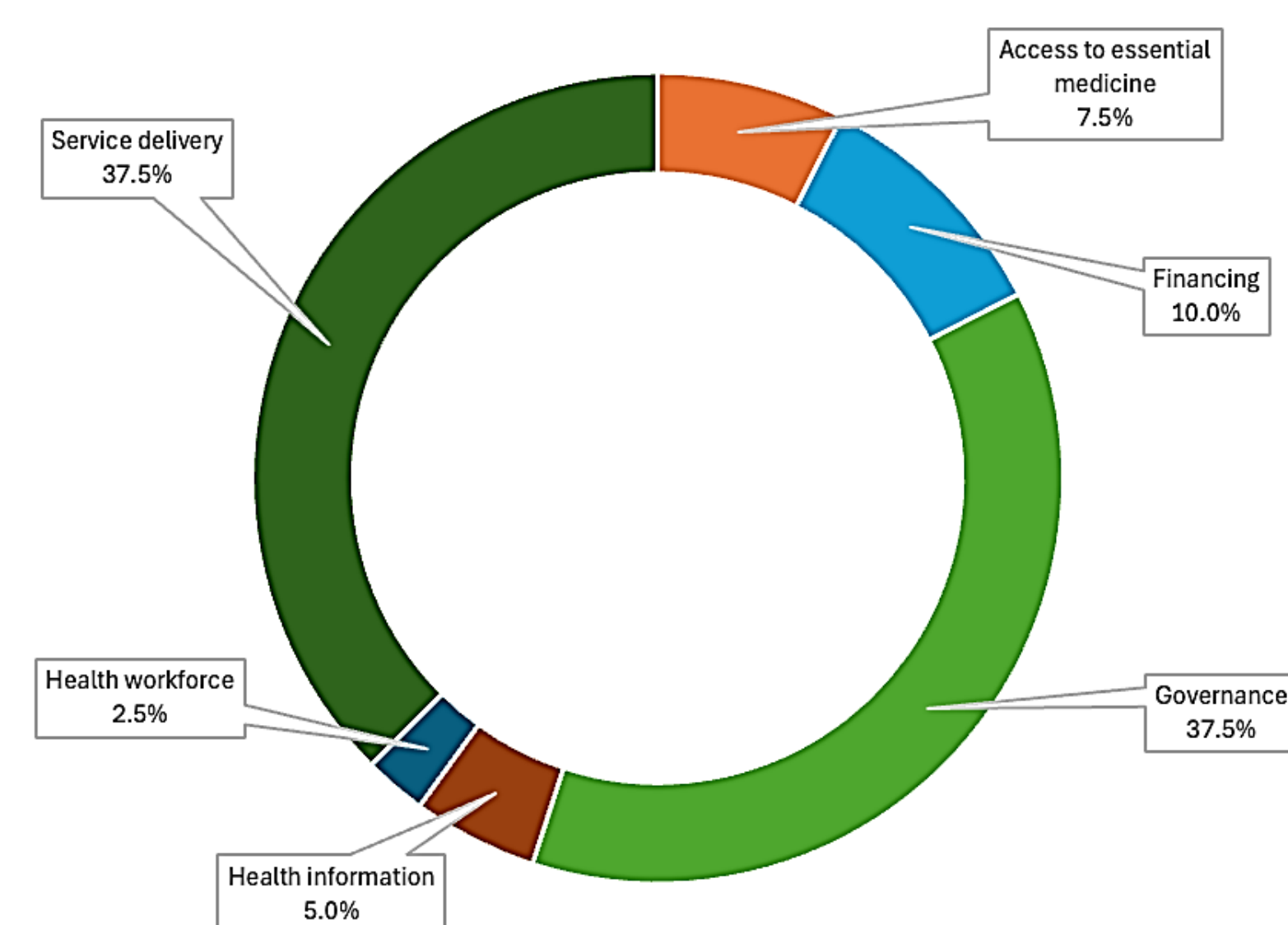


Figure 1: Policies Categorized by WHO Health System Six Building Blocks

The included policies were categorized using the WHO Health System Building Block Framework, as follows (**Fig. 1**):

- **Governance (n=15):** Focused on regulatory oversight and government roles but lacked enforcement mechanisms.
- **Health Workforce (n=1):** Addressed staffing, training, and workforce shortages.
- **Service Delivery (n=15):** Focused on operational guidelines, service standards, and safety protocols.
- **Financing (n=4):** Related to funding mechanisms and elderly care insurance, with varying levels of details.
- **Health Information Systems (n=2):** Focused on data collection and transparency in elderly care institutions.
- **Access to Essential Medicines (n=3):** Addressed medicine availability and integration with healthcare services.

Conclusion

Compared to countries like Japan and the U.S., China's policy for senior care institution development and enforcement have been relatively delayed. Moreover, this study highlighted the policy gaps in financing and health workforce, key for sustainable institutional elderly care in China.

The quality assessment revealed that while policies showed high accountability, weaknesses in propriety and accuracy could hinder effective implementation and consistency. Future efforts should clarify directives and improve enforceability to enhance care quality and equity, ensuring a more effective long-term care system for China's aging population.

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Thanks to the Duke BASS Connections project, the DKU Summer Research Scholars Program, and the DKU Community Health Service Lab for their support.

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