



Emerging Trends and Hotspots in Health Monitoring Technologies for Nursing: A Bibliometric Analysis



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Abstract: A bibliometric analysis was conducted to explore the research trends and emerging hotspots in the application of health monitoring technologies within nursing. Literature spanning from January 2021 to January 2025 was retrieved from the Web of Science Core Collection (WOSCC), and CiteSpace software was employed to analyze and visualize research outputs, institutional contributions, author collaborations, high-frequency keywords, and the evolution of keyword clusters over time. A total of 425 articles were identified, revealing a stable global publication output. The United States emerged as the leading contributor, with 138 articles, followed by China with 47. Prominent keywords such as "care," "management," and "remote patient monitoring (RPM)" were found to be indicative of current research foci. Analysis indicates a shift towards home-based care, smartphone integration, digital health solutions, and wearable devices, particularly in managing clinical conditions such as cardiovascular disease (CVD), cancer, and diabetes. The prevailing research trends highlight the importance of remote monitoring and nursing care within home settings, with an increasing emphasis on chronic diseases. Despite the growth in research activity, uneven international development and limited collaborative efforts, primarily within research teams, present challenges to the field's progress. It is suggested that future research should focus on fostering international collaboration between academic, healthcare, and engineering sectors to ensure that monitoring technologies align with clinical needs. Moreover, the establishment of international regulations was recommended to standardize production processes, enhance product reliability, and facilitate the broader application of these technologies in nursing practice.

Keywords: Health monitoring; CiteSpace; Bibliometric; Nursing

1. Introduction

Health monitoring technology refers to the real-time, non-invasive, and continuous monitoring, analysis, early warning, and intervention of human physiological parameters with the help of advanced sensors, communication, and computer technologies (Acosta et al., 2022). In the post-epidemic era, the global transformation toward digitalization is evident, and health monitoring technology has been increasingly adopted (Peters et al., 2022). The World Health Organization (WHO) always emphasizes strengthening the global health system and improving the accessibility, quality, and efficiency of medical services, which provides policy guidance and macro support for the application of health monitoring technology in the nursing field. At present, international research on health monitoring technology is on the rise. However, in the field of nursing application research overall, it is relatively

limited due to the lack of a comprehensive bibliometric analysis. CiteSpace software was employed in this study to conduct a visual analysis of relevant literature from the WOSCC over the past five years, exploring the research landscape, research hotspots and development trends, thereby providing a unique view and reference for health monitoring technologies in nursing applications.

2. Method

2.1 Data Sources and the Search Strategy

WOSCC was used as the literature source in this study, precisely retrieving subject words. The retrieval was: TS = (monitor AND (home OR remote OR ambient OR in-home OR living OR home environment OR living environment OR residential setting OR domestic setting) AND (health* OR care* OR rehabilitation OR wellness OR diagnose) AND (nursing)). In this retrieval, health* was used to cover variants such as healthcare, health-related, and care* included variants such as care for. The period was limited from January 1, 2021, to January 18, 2025.

2.2 Literature Inclusion and Exclusion Criteria

The following inclusion criteria were used:

- (a) The literature type is academic journal papers;
- (b) The literature content is related to the application of health monitoring technology in the nursing field;
- (c) The language is in English.

In addition, the following exclusion criteria were used:

- (a) Literature types are dissertation, conference, news, etc.;
- (b) Literature content has nothing to do with the application of health monitoring technology in the nursing field;
- (c) Repeated literature;
- (d) Lack of literature information.

2.3 Data Analysis

The CiteSpace 6.3.R1 software was used to draw visual maps from the aspects of publishing areas, publishing organizations, publishing authors, high-frequency keywords, the keyword aggregation timeline, etc. Then the research hotspots and development trends of the health monitoring technology in nursing were analyzed.

3. Results

3.1 Literature Search Results

A total of 1,438 related documents were retrieved, and 425 articles were finally obtained after screening. The literature screening process is shown in Figure 1.

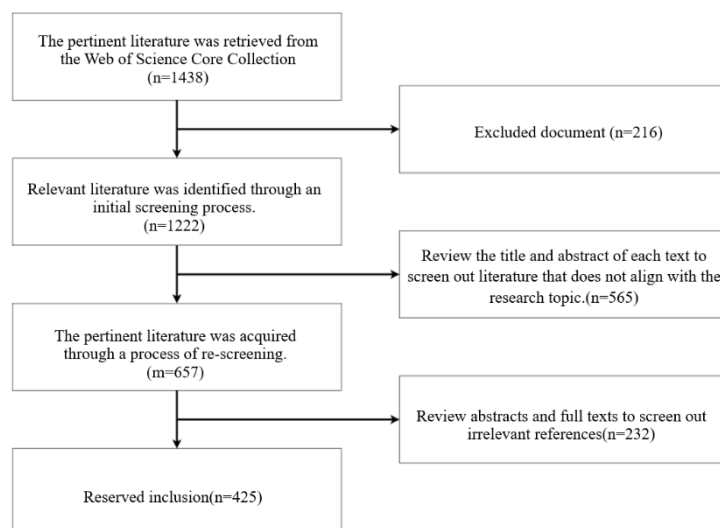


Figure 1. Flowchart of literature selection

3.2 Annual Trends of Publications

As for the number of health monitoring technologies in nursing published, the period from 2021 to 2025 was divided into two stages. A significant upward trend occurred in the first stage from 2021 to 2023. In 2021, the annual publication volume was 88. In 2022, the annual number of articles increased rapidly to 115 articles compared with the previous year. In 2023, the annual publication volume was 118, reaching the peak in the past five years. An overall stable trend occurred in the second stage from 2024 to 2025. In 2024, the annual number of 100 articles tended to be stable. As of January 18, 2025, the number of publications in 2025 was 4.

3.3 Distribution of Countries or Regions

As for the global distribution from 2021 to 2025, 425 articles concerning health monitoring technologies in nursing were published in 67 countries. The CiteSpace co-occurrence analysis of 67 nodes (N = 67) and 191 lines (E = 191) with a density of 0.0864 was obtained. Modularity Q = 0.5052 indicates that the community structure is significant and the clustering effect is good. Weighted mean silhouette = 0.7705 indicates that the network is highly homogenous and the clustering is efficient and convincing. Through the visual analysis, it can be seen that the research cooperation among countries is frequent. For example, the centrality of the USA is 0.65, indicating that it has cooperation with many countries in the publication of papers in this field, as shown in Figure 2. According to the CiteSpace software, the top ten countries published in the research direction from 2021 to 2025 were analyzed, as shown in Table 1.

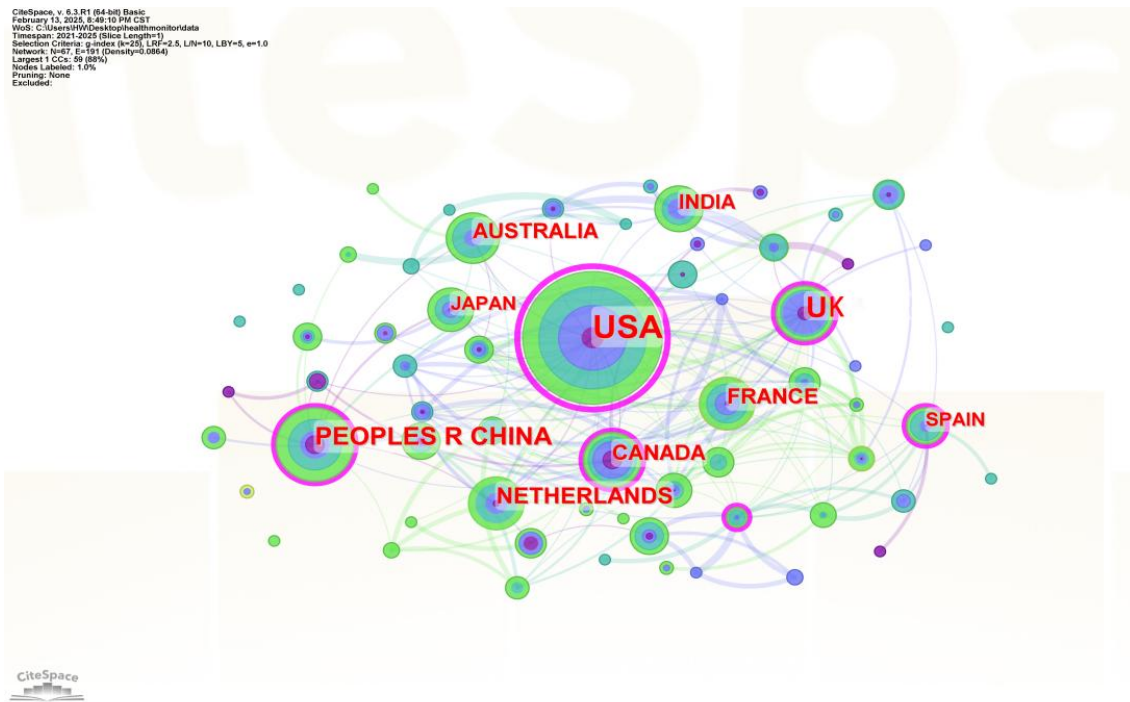


Figure 2. National cooperative knowledge map of health monitoring technology in nursing (2021-2025)

Table 1. Top ten countries with the most publications in nursing (2021-2025)

Ranking	Country	Number of Publications (%)	Centrality
1	USA	138 (32.5)	0.65
2	People's Republic of China	47 (11.1)	0.11
3	UK	28 (6.6)	0.20
4	Netherlands	28 (6.6)	0.06
5	Australia	26 (6.1)	0.09
6	Canada	24 (5.6)	0.14
7	France	23 (5.4)	0.08
8	India	20 (5.2)	0.08
9	Japan	16 (3.8)	0.03
10	Spain	15 (3.5)	0.12

3.4 Author Collaborative Analysis

In this study, the CiteSpace software was used to map the author cooperative network of 378 authors with 157 nodes (N = 157) and 239 lines (E = 239) with a density of 0.0195, as shown in Figure 3. According to the data shown in this figure, the modularity Q = 0.8627 indicates that the structure of the delineated group of authors is significant and clustered well. It can be seen that most of the relevant studies are the outcomes of their respective research groups with close cooperation within the groups, but there are few contacts between the groups. According to the analysis of CiteSpace software, the top seven authors published in the research direction from 2021 to 2025 are shown in Table 2.

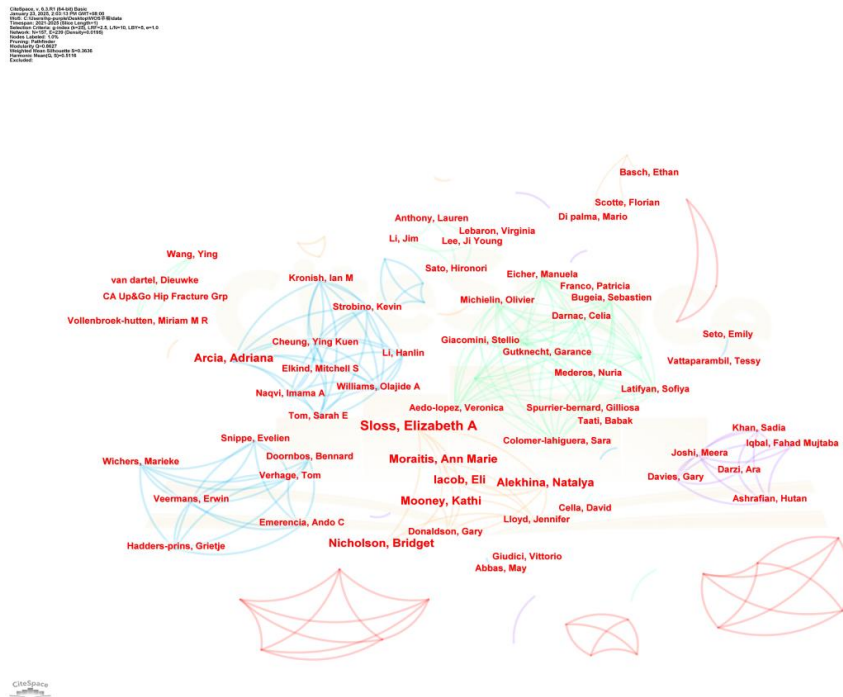


Figure 3. Knowledge map of health monitoring technology in nursing (2021-2025)

Table 2. Author information of related studies of the health monitoring technology in nursing (2021-2025)

Ranking	Author	Number of Publications (%)
1	Sloss, Elizabeth A.	4 (0.9)
2	Arcia, Adriana	3 (0.7)
3	Nicholson, Bridget	3 (0.7)
4	Moraitis, Ann Marie	3 (0.7)
5	Alekhina, Natalya	3 (0.7)
6	Iacob, Eli	3 (0.7)
7	Mooney, Kathi	3 (0.7)

3.5 Distribution of Keywords

The CiteSpace software was used to obtain the keyword co-occurrence map for analysis, as shown in Figure 4. The circle nodes in the graph represent the frequency of keywords, and the larger the dot, the more frequency of keywords. According to the analysis of the CiteSpace software, the top ten keywords ranked in the research direction from 2021 to 2025 are shown in Table 3. The high-frequency keywords are “care,” “management,” “RPM,” “remote monitoring,” “health,” “technology,” “quality of life,” “nursing home,” “mortality,” etc., which are currently the main hotspots of health monitoring technology in the field of nursing. Centrality is a key indicator in analyzing the importance of keywords. The greater the centrality is, the greater the importance and influence of the node in the research. In the top ten high-frequency keywords, “mortality,” “quality of life,” and “care” have relatively high centrality, indicating that they have strong importance and great influence in this field. Prominent words refer to the keywords that are frequently used in a certain period and can represent the hot words in a research field to predict the research hot words and development trends in this field. Further analysis of keywords yielded 12 prominent words, as shown in Figure 5. It can be seen that the main research focuses on “therapy” and “telehealth” from 2021 to 2023, and it gradually changes to focus on “home” and “outcome” from 2023 to 2025.

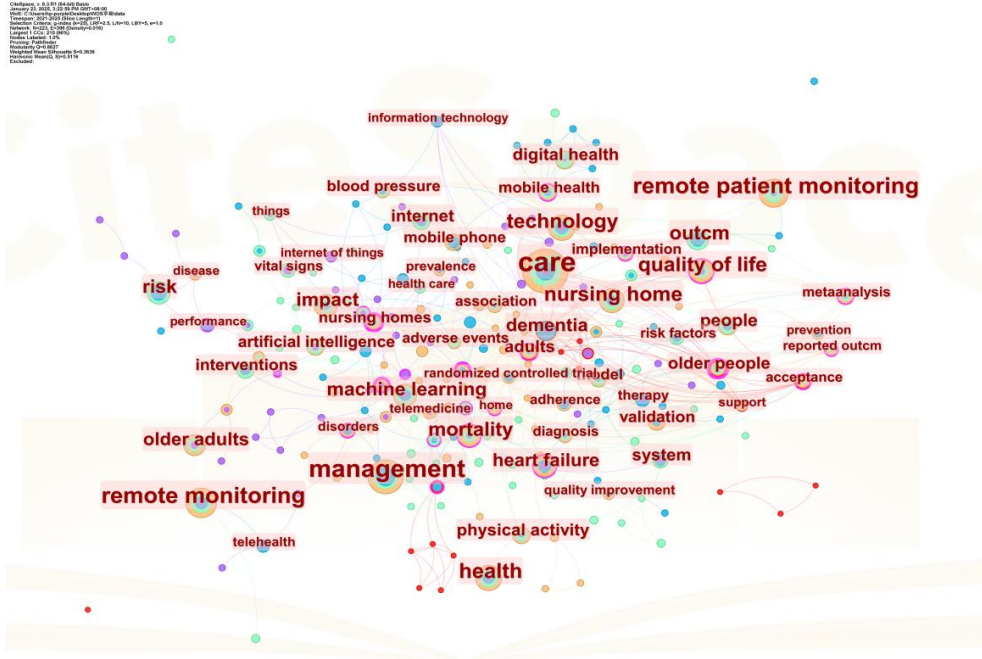


Figure 4. Co-occurrence map of high-frequency keywords in the related research of the health monitoring technology in nursing (2021-2025)

Table 3. Top ten high-frequency keywords for the health monitoring technology in nursing (2021-2025)

Ranking	Keyword	Number of Publications (%)	Centrality
1	Care	74 (6.75)	0.09
2	Management	43 (3.92)	0
3	RPM	31 (2.83)	0.02
4	Remote monitoring	31 (2.83)	0.02
5	Health	23 (2.10)	0
6	Technology	22 (2.01)	0
7	Quality of life	21 (1.91)	0.11
8	Nursing home	21 (1.91)	0.03
9	Mortality	19 (1.73)	0.18
10	Outcome	18 (1.64)	0.02

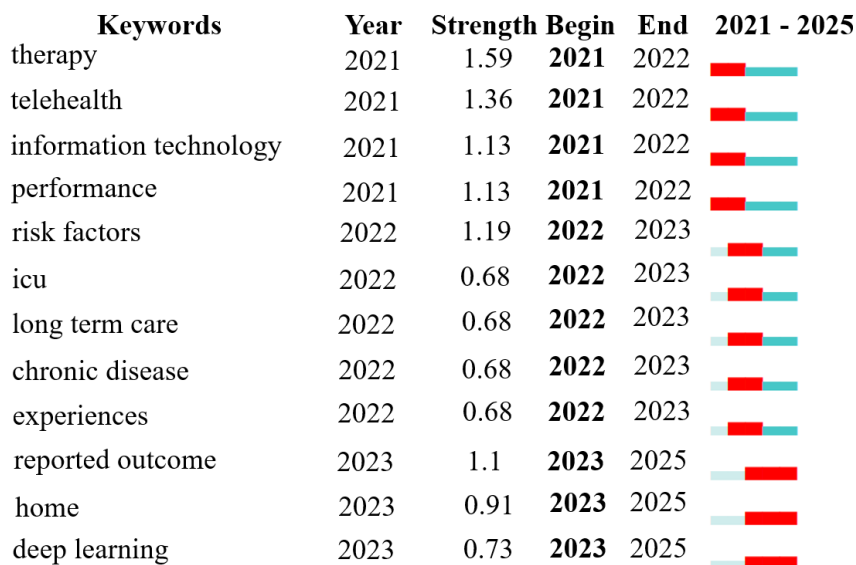


Figure 5. Top 12 keywords with the strongest citation bursts related to health monitoring technology in nursing (2021-2025)

3.6 Keyword Clustering Timeline

The clustering timeline atlas of keywords was visualized using the CiteSpace software, as shown in Figure 6. The timeline shows the changes and trends of global research topics in this field in the past five years, and the keyword clustering reflects the research hotspots. The cluster labels for this study included # 0 artificial intelligence (AI), # 1 nursing homes, # 2 mobile phone, # 3 digital health, # 4 clinical practice, # 5 heart failure, # 6 mobile application, # 7 chronic disease, and # 8 clinical trial. In the early stage of the research, "technology" and "machine learning" were taken as the main research directions. Over time, the research direction in this field has gradually focused on home care, smart devices, digital health, wearable devices, and other fields, and applied to heart disease, cancer, and other clinical diseases.

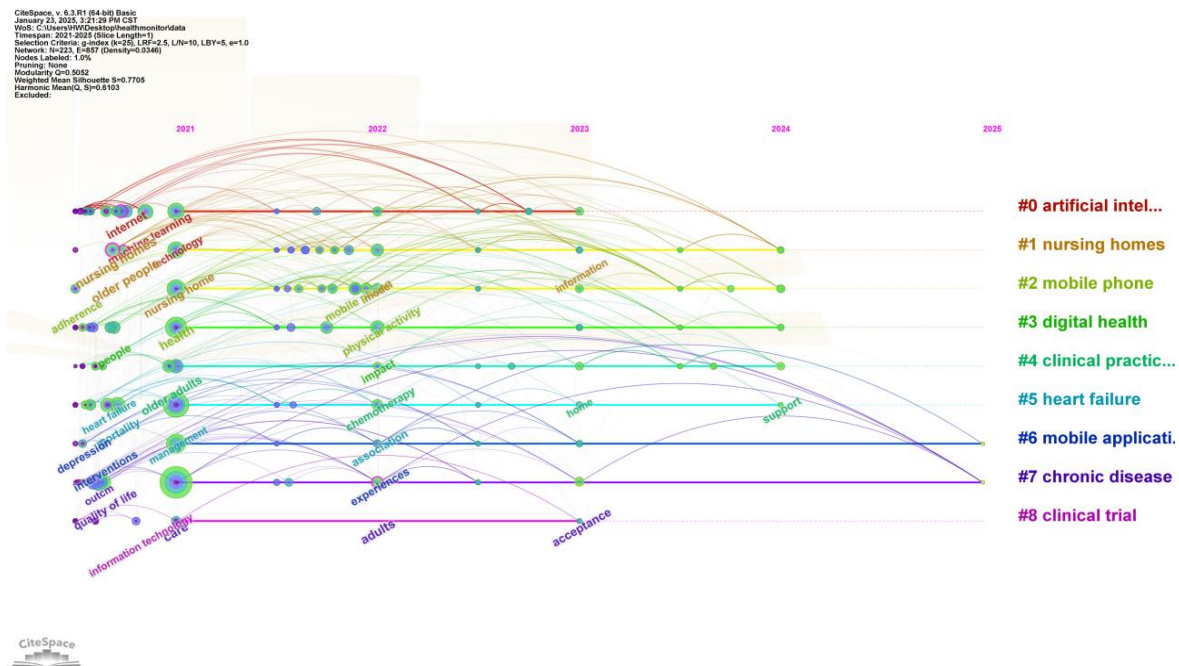


Figure 6. Keyword clustering timeline map of the health monitoring technology in nursing (2021-2025)

4. Discussions

4.1 Current Research

In terms of the development status of international research, the annual publication volume and distribution trend of research can reflect the research status and development trend of a certain field to a certain extent. According to this study, the rapid development of the health monitoring technology in 2021-2023 may be caused by the unprecedented attention to health during the epidemic, the increased demand for disease monitoring and prevention and control, and the increased investment in the health monitoring technology by the governments and enterprises in various countries. The rapid development of related technologies, such as the Internet of Things (IoT), big data, and AI, has provided strong technical support for the health monitoring technology, leading to the continuous emergence of wearable devices and telemedicine monitoring systems. In the post-epidemic era, the health monitoring technology has shown steady development. It is possible that due to the outbreak being under control, the need for health monitoring has shifted from acute to normalized. At the same time, the rapid development of the technology accumulated in the early stage needs time to digest, integrate, and improve to achieve more in-depth and more extensive applications.

And the development of international research is unbalanced, with little cooperation between researchers. The results of this study show that the number of published countries is small and the publications are mainly concentrated in developed countries and some developing countries with more developed economies and high medical levels. It can be seen that the development of relevant research in the world is quite different, and the distribution of research resources is uneven. In the 425 articles included in the literature through the analysis of the co-occurrence map, although there are obvious author groups, the groups are relatively scattered, and the number of articles is related to the cooperation behavior. Therefore, the cooperation between research teams needs to be strengthened.

4.2 Research Hotspots and Frontiers

In the context of telemedicine, home care is faced with the challenge of improving service quality and optimizing facilities. It is the key to promoting the high-quality development of home care services with modern means (Shahriari et al., 2024). Elderly patients highly accept home telemonitoring with satisfaction. This technology can improve health awareness, identify health deterioration early, and support timely intervention (Pecina et al., 2011). Telemonitoring research is focused on the cardiovascular field, and wireless devices or smartphone applications are the most popular strategy (Farias et al., 2020). Although remote monitoring has shown great potential in improving the effectiveness of patient care and treatment, its application in postoperative care and surgical pathology is yet to be evaluated.

4.2.1 Nursing home care

The global elderly population has increased significantly, and an aging population has become a key trend. In this context, the professional care services in nursing homes have received wide attention. The use of AI in clinical geriatric nursing work can assist nurses in accurately monitoring the condition changes of elderly patients and bring convenience to clinical nursing work. Most nursing homes use smart health services, mainly including chronic disease management, smart care, fall monitoring, and wireless positioning. Portable health monitoring devices and data management service platforms are the most widely used tools (Meng et al., 2021). However, the effectiveness of smart medicine in nursing homes may be influenced by factors such as financial input, attitudes of employees and residents towards new technologies, and national policy support.

4.2.2 CVD

CVD is the leading cause of death worldwide, with about 20.5 million deaths occurring worldwide in 2021, accounting for one-third of the total deaths (World Heart Federation, 2023). Real-time monitoring of heart health is expected to significantly reduce the risk of heart attacks and injuries, while the integration of smart technologies and mobile health platforms can provide strong support for timely prevention and response to heart events (Christle et al., 2020). Most healthcare systems lack continuous supervision of complex data flows, and this is only partially achieved in high-intensity sites such as coronary care and intensive care units (Shiwani et al., 2023). Wearable devices and IoT technologies are promising in CVD monitoring. Future research needs to focus on long-term implementation and longitudinal data collection, and the development of complex machine learning algorithms can help accurately predict cardiovascular events (Shiwani et al., 2023).

4.3 Application and Development Trend of Research

(a) Future research trend. In the nursing field, the development of the health monitoring technology has attracted much attention. Research trends point to integrating wearable devices (Cingolani et al., 2023), biosensors (Zang et al., 2015), and electronic medical record data (Ding et al., 2021) to comprehensively assess patient health. Technology optimization facilitates early disease prediction and personalized care program development. Interdisciplinary collaboration aims to develop monitoring technologies that are more consistent with clinical needs and improve the quality and efficiency of care.

(b) Improvement of laws and regulations. At the international level, it is necessary to unify data security and privacy protection standards and clarify data processing rules to ensure patient information security (Cingolani et al., 2023). By unifying data security standards, the General Data Protection Regulation (GDPR) improves the security and privacy protection of health data, promotes technological and management innovations in healthcare organizations, and facilitates the development of cross-border healthcare services (OJC, 2018). ISO/IEC 27001 (2022), as a standard for information security management systems, was recommended to strengthen the security control of emerging technologies further, refine privacy protection and data governance requirements, and enhance the standard's flexibility and operability. Technology access and regulatory regulations could be formulated and the approval of health monitoring equipment and software could be standardized to ensure product quality and reliability.

(c) Promotion of the technology implementation. Medical institutions should invest in the introduction of advanced monitoring equipment and systems, optimize workflow, and ensure that new technologies are integrated into routine care. The RPM technology, for example, is an option for delivering care in the home and keeping patients and providers connected to address ongoing healthcare issues, integrating health monitoring technology into nursing practice. Mayo Clinic developed a nurse-led RPM program (Coffey et al., 2022) for disease and post-procedural management to improve patient experience for ambulatory disease management. The industry cooperates with medical institutions to carry out pilot projects and clinical validation to accelerate technology transformation (Battelino et al., 2023). By adopting the health monitoring technology in nursing practice, it can enhance nursing efficiency, improve nursing quality, enhance patient engagement and reduce nursing costs, providing patients with more personalized and precise nursing services. These efforts enable health monitoring

technologies to reach their potential in the field of care and improve the quality of care services and patient health globally.

4.4 Limitations

In this study, only one database was utilized, which may have resulted in the exclusion of some relevant studies. However, the WOSCC is regarded as one of the most comprehensive databases, encompassing many of the world's leading academic journals. Additionally, this study was restricted to publications in English, which may have led to the oversight of high-quality research published in other languages.

5. Conclusion

In conclusion, WOSCC was utilized as the literature source in this study and the CiteSpace software was employed to objectively analyze the current status, development trends, and hotspots of the health monitoring technology in the nursing field over the past five years. The findings indicate a steady increase in the number of international research publications in related fields. Currently, the research focus of the health monitoring technology in nursing primarily centers on remote monitoring, nursing home care with emerging trends towards CVD, cancer, chronic disease, and other fields. The development across countries is uneven, and collaboration among researchers remains limited, primarily occurring within individual research teams. Future studies should emphasize collaboration among research teams and foster closer ties between nurses to ensure that monitoring technology better meets clinical needs. Additionally, international laws and regulations on the health monitoring technology should be further developed to standardize production processes, enhance product reliability, and promote the application of products.

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Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflict of interest.

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