

Original Article



Scientometric Mapping of Potential Intersections Between Elder Abuse Research and Digital Health: Identifying Gaps and Emerging Opportunities

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Abstract

Objectives: Elder abuse affects approximately one in six older adults globally but remains underreported and understudied in the context of digital health. Although technologies such as telehealth, virtual reality (VR), artificial intelligence (AI), and mobile technologies have emerging applications in elder abuse research, the evolution and conceptual structure of this field remain unclear. This study aimed to scientometrically map the intersection of elder abuse and digital health research, identify major research themes and emerging technologies, and highlight knowledge gaps and future research directions.

Design: A scientometric analysis of the scientific literature using quantitative bibliometric indicators and network-based visualization techniques.

Setting(s): The Web of Science Core Collection database; no clinical or care setting was involved. **Participants:** No human participants were enrolled. The unit of analysis consisted of scientific publications indexed in the Web of Science Core Collection. Records were eligible if they were English-language original research articles addressing elder abuse or neglect in relation to digital health.

Outcome Measures: Publication trends, research clusters, keyword co-occurrence, international and institutional collaboration patterns, citation patterns, and emerging research themes and technologies were assessed.

Methods: The search strategy combined the terms “elder abuse” or “neglect” with “digital health” across all fields. A total of 3,500 records meeting the eligibility criteria were included. CiteSpace and VOSviewer were used to generate co-occurrence maps, collaboration networks, citation analyses, and citation-burst visualizations to examine thematic clusters, research evolution, and influential contributors. The analysis followed Chen’s scientometric approach, integrating quantitative bibliometric indicators with qualitative interpretation of network structures and thematic evolution.

Results: Seven major research clusters were identified, including mixed-method pilot studies, abuse-related services, community-based surveys, and scoping reviews. The most prominent keywords were abuse, prevalence, risk factors, and neglect. Telehealth, VR, and AI emerged as relatively recent and growing areas of research, indicating an increasing shift toward technology-enabled approaches to elder abuse prevention, education, screening, and intervention.

Conclusions: Elder abuse research remains predominantly focused on traditional epidemiological themes, while digital health is an emerging and increasingly important area. Greater international collaboration and investment in user-centred, ethically sound, and evidence-informed digital technologies are needed to strengthen prevention, early detection, and intervention and to support equitable strategies for safeguarding older adults.

Keywords: Elder abuse, Neglect, Digital health

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Introduction

Ageing is a natural and inevitable process in the human life cycle, accompanied by physical, cognitive, and psychosocial changes that affect the well-being and independence of older adults. This stage of life frequently coincides with chronic illnesses, reduced functional capacity, and limitations in daily activities. Beyond biological aspects, social and economic factors (e.g., retirement, reduced social interactions, and financial challenges) can further influence the quality of life. The combination of these elements increases vulnerability and places older adults at greater risk of neglect and various forms of abuse compared with other age groups.^{1,2} Elder abuse not only violates basic human rights but also has profound health, psychological, and economic consequences. In addition, victims of abuse are more likely to suffer from depression, anxiety, and functional decline, resulting in increased healthcare utilization, hospitalization, and institutionalization. These consequences impose a substantial burden on healthcare systems, families, and caregivers, highlighting the urgent need for early detection, prevention, and supportive interventions³. The proportion of older adults is significantly rising with the rapid growth of the global population, making them the fastest-growing demographic group worldwide. By 2050, the number of individuals aged 65 years and older is projected to reach 1.55 billion, representing nearly 16% of the world's population.⁴ This demographic shift underscores improvements in healthcare and life expectancy while highlighting new public health challenges. One of the most pressing concerns is elder abuse, which encompasses physical, psychological, sexual, financial abuse, and neglect.⁵ According to the World Health Organization (WHO), although one in six people aged 60 years and older experienced some form of abuse in the past year, the majority of cases remain unreported. Elder abuse not only violates fundamental human rights but also imposes a heavy social and healthcare burden globally.⁶ In response, the WHO has launched the Decade of Healthy Ageing (2021–2030), prioritizing strategies such as combating ageism, improving data accuracy, developing innovative interventions, and mobilizing resources to safeguard older adults. Within this framework, digital health has emerged as a transformative enabler.^{7,8} It encompasses a broad range of technologies, including mobile health applications, telemedicine, electronic medical records, wearable devices, robotics, and artificial intelligence (AI), which expand access to healthcare services, enhance the quality of care, and support prevention and intervention strategies. In recent years, digital health technologies have demonstrated substantial potential across multiple health domains. For instance, in dementia care and chronic disease management, telehealth and wearable devices have improved accessibility and continuity of care, while AI and data-driven tools have enabled early detection and personalized interventions. Likewise, virtual reality (VR) and gamified education have been increasingly applied to enhance healthcare training, awareness, and empathy. In the context of elder abuse, VR-based educational programs

have been developed to illustrate real-world scenarios of abuse and neglect, helping caregivers and healthcare professionals recognize early warning signs and respond appropriately. Moreover, immersive VR simulations have been used to train students and care providers to manage the complex physical, emotional, and ethical challenges of elder care, indicating a significant positive impact on knowledge, sensitivity, and professional confidence. Despite these promising outcomes, the integration of digital health into the prevention and management of elder abuse remains limited and underexplored.⁹ Scientometric analysis offers a powerful approach to systematically map and evaluate the knowledge structure of this emerging field. Scientometrics involves the quantitative study of scientific publications, citations, and collaboration networks to identify research trends, knowledge clusters, and influential contributors¹⁰. By applying tools such as CiteSpace and VOSviewer to bibliometric databases, scientometric studies provide valuable insights into the temporal evolution, thematic foci, and research gaps of a scientific domain.^{11,12} Although digital health has been widely explored in various health contexts, research at its intersection with elder abuse remains highly fragmented and lacks an integrated understanding of the field. To the best of our knowledge, no scientometric study has so far systematically examined how digital health technologies are being applied to prevent, detect, or manage elder abuse. This gap limits our knowledge of global research dynamics, influential contributors, and emerging thematic trends in this critical yet underexplored area.

Therefore, the present study seeks to present the first scientometric mapping of the conceptual intersection between elder abuse research and digital health, with a focus on examining emerging themes, gaps, and future directions. More precisely, this study aims to uncover the intellectual structure and evolution of the field by analyzing publication trends, thematic clusters, collaboration networks, and citation patterns. Overall, the findings will provide evidence-based insights to guide policymakers, healthcare providers, and researchers in developing more effective, technology-driven strategies to safeguard older adults and advance the goals of healthy ageing in the digital era.

Materials and Methods

Data Sources and Search Strategy

A scientometric analysis was performed to examine the global research landscape of digital health applications in elder abuse and neglect. Data were retrieved from the Web of Science Core Collection on 20 August 2025. This database comprises high-impact journals from the Science Citation Index, Social Science Citation Index, and Arts and Humanities Citation Index. Moreover, it is widely recognized for its authoritative and high-quality scholarly records.

To identify relevant studies, a search strategy was developed focusing on the key concepts of elder abuse, neglect, and digital health. Specifically, the terms “elder

abuse” (title) or “neglect” (title) and “digital health” (all fields) were searched in article titles, abstracts, and author keywords. Boolean operators (OR) were used to separate terms. In addition, quotation marks were applied for multi-word phrases, and asterisks (*) were employed to capture minor variations, such as plural forms. It should be noted that no restrictions were applied regarding publication type, journal category, or earliest publication date, while the latest year was set to the date of search (20 August 2025). Full bibliographic records, including titles, authors, author affiliations, publication year, source titles, document types, abstracts, author keywords, citation counts, funding sources, reference lists, and conference information (if applicable), were exported as plain text files for further analysis. After applying predefined restrictions, including English language and original research article type, a total of 3,500 eligible records were retrieved and exported for scientometric analysis.

The retrieved records were exported directly from the Web of Science as plain text files containing full bibliographic information, including authors, affiliations, publication year, source titles, abstracts, keywords, citations, and references. Then, these records were imported into CiteSpace (version 6.2.R1) and VOSviewer (version 1.6.20) for scientometric analysis.

The data analysis followed Chen’s methodological framework¹³ and was conducted in two main stages: semantic analysis and temporal analysis. In the semantic stage, VOSviewer was employed to examine keyword patterns, citation bursts, abstract content, and co-authorship networks. In the temporal stage, CiteSpace was utilized to evaluate co-citation frequencies, citation trends over time, and shared references, as well as local citation counts, citation bursts, and centrality (three key indicators).

Data Analysis and Visualization

The scientometric analysis was performed using CiteSpace (version 6.2.R1) and VOSviewer (version 1.6.20). VOSviewer was considered for network visualization and collaboration analysis using the full counting method. Additionally, the association strength normalization method was applied for network visualization. For author collaboration analysis, authors with at least two collaboration links were included in the final network visualization.

Bibliometric and scientometric analyses were conducted using CiteSpace and VOSviewer. Scientometric methods involve the structured examination of scientific data, covering its production, dissemination, and use. These approaches help identify key and emerging trends within a particular research domain by combining the statistical analyses of bibliographic databases with qualitative filters, such as topics, keywords, and abstracts.¹⁴ Moreover, scientometric analysis enables the assessment of research development over time and the evaluation of the geographical and institutional distribution of scientific outputs. Core data in scientometric studies include authors, their publications, references, and received citations.

CiteSpace was used to generate the visual knowledge maps of authors, countries, institutions, and cited references, whereas VOSviewer was employed to illustrate recurrent keywords and research clusters. Scientometric techniques have been increasingly applied across diverse topics to quantify research trends and scientific impact.^{11, 15, 16} While systematic reviews remain valuable for assessing effectiveness and outcomes, scientometric analysis complements them by providing an overarching view of research trends across entire fields, subfields, or specific topics.^{9, 12} The scientometric analysis was performed in sequential stages (Table 1). The process began with defining the research focus, establishing study protocols and selection criteria, followed by data collection. After data acquisition, the records were analyzed, synthesized, and interpreted to identify key trends, patterns, and insights in the field.

For the analysis of keywords and author networks, as well as the visualization of network graphs, VOSviewer version 1.6.20 was utilized with the full counting method. Authors with at least two collaboration links with other authors were retained in the final co-authorship network and considered core researchers for network interpretation.

No publication year restriction was applied during either data retrieval or scientometric analysis. All eligible records indexed in the Web of Science Core Collection up to the search date (20 August 2025) were included to comprehensively capture the historical development, intellectual structure, and emerging trends in digital health and elder abuse research. Each citation was represented as a node, with node size indicating local citation counts, and the full counting method was applied. Further, links between nodes represented the strength of collaboration between authors. CiteSpace (version 6.2.R6) was used to identify frontier research trends and examine subfield specialties. Co-occurring keyword analysis and cluster analysis highlighted emerging themes in the domain. Furthermore, analysis parameters included a one-year slice length and $k=8$, with default settings for text processing and link construction. It is noteworthy that labels generated by the log-likelihood ratio (LLR), latent semantic indexing (LSI), and mutual information (MI) algorithms in CiteSpace were utilized in the cluster analysis. However, certain irrelevant labels, such as “melbourne australia,” which were selected by the algorithm due to the repetition of geographical terms in the texts, were disregarded in the interpretive analysis as they lacked scientific relevance to the research topic. In this study, LLR-based labels were chosen as the primary cluster labels due to their higher accuracy and coherence.

Results

Trend Analysis of Scientific Production

The scientometric analysis conducted using CiteSpace and VOSviewer revealed the temporal evolution of research activity in the field of digital health applications related to elder care and abuse, suggesting an expansion of research activity over time; however, detailed annual publication counts and growth-rate analyses were beyond the scope

Table 1. Stages of a scientometric study

No.	Steps	Description
1	Defining the research focus	Identifying the scope and objectives: the role of digital health in preventing, detecting, and managing elder abuse and neglect.
2	Search strategy	Terms used: “elder abuse” (all fields) OR “neglect” (all fields) AND “digital health” (all fields); searched in titles, abstracts, and author keywords. Boolean operators (OR) and quotation marks for multi-word phrases, with asterisks (*) for variations.
3	Database	Web of Science (WoS) Core Collection; accessed 20 August 2025.
4	Selection criteria	Filter 1: All publication years until 20 August 2025 Filter 2: English language Filter 3: Original research articles Filter 4: Focused on digital health interventions for elder abuse and neglect Total retrieved: [3500]
5	Data extraction	Records exported in text format, including title, authors, affiliations, publication year, journal, document type, abstract, author keywords, citation counts, funding sources, references, and conference info; organized for tables and graphs.
6	Analysis	Conducted using CiteSpace and VOSviewer; included qualitative description and quantitative scientometric analysis. Semantic analysis followed Chen’s methodology to detect research trends, clusters, and emerging topics.

of the present study, coinciding with the emergence of thematic clusters, such as mixed-method studies, scoping reviews, and abuse-related services.

This upward trajectory indicated a gradual transition from descriptive and prevalence-focused investigations toward more applied and intervention-oriented research. The increasing presence of digital health related concepts, such as telehealth, VR, and AI, further demonstrated the integration of technology into elder abuse scholarship. In continuation, keyword co-occurrence maps and cluster analyses generated through VOSviewer and CiteSpace illustrated the thematic evolution, conceptual structures, and research hotspots that characterize this growing scientific domain.

Keyword Co-Occurrence Analysis

Figures 1–3 illustrate complementary aspects of the same keyword network. Figure 1 emphasizes temporal evolution (how topics have changed over time), and Figure 2 highlights spatial intensity and research density (where the main hotspots are). Similarly, Figure 3 visualizes structural clustering and thematic interconnections (how concepts relate). Although some overlap exists particularly in identifying major keywords, such as elder abuse, risk factors, and telehealth, each figure offers a unique analytical perspective within the overall scientometric framework. The analysis demonstrated that elder abuse occupies a central position in the network, having the highest frequency and strongest connections with other research topics. Other highly recurrent keywords included risk factors, prevalence, neglect, older adults, and domestic violence. According to the co-occurrence map, earlier studies primarily focused on descriptive concepts, such as prevalence, mistreatment, and older adults. Since 2017, however, methodological and intervention-related terms (e.g., scoping review, screening, intervention, and community-based study) have become more prominent. Furthermore, terms such as telehealth, VR, and qualitative study appear as emerging topics, particularly after the COVID-19 pandemic. This trend indicates a shift in the field from a purely epidemiological perspective toward intervention-oriented approaches and digital health solutions.

Author Collaboration Analysis

The co-authorship network (Figure 4) revealed that although more than 6,739 researchers have contributed to this field, based on the author co-authorship network generated using VOSviewer, 248 of them met the predefined collaboration threshold (≥ 2 links) and were identified as core researchers. This finding suggests that, while research on elder abuse is steadily expanding, scholarly production remains concentrated among a relatively small group of leading contributors. Among them, Xinqi Dong emerge as highly cited and influential figures, serving as connectors across different clusters. Other key contributors include Tony Rosen and Mark Lachs (renowned U.S. experts in elder abuse and geriatric health), Pamela B. Teaster (a specialist in medical ethics and elder rights), David Burnes and Jo Anne Sirey (focusing on geriatric psychiatry and therapeutic interventions), and Jill Manthorpe (a leading U.K. scholar in social policy and elder care).

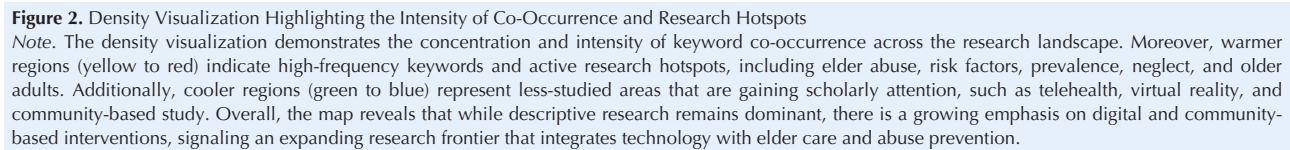
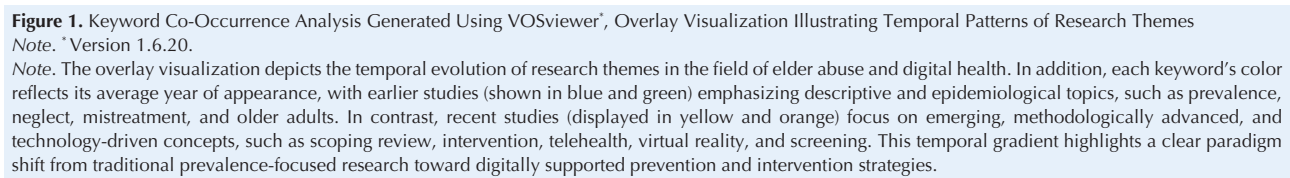
Additionally, European researchers (e.g., Jutta Lindert and Maria Gabriella Melchiorre) play a significant role in shaping international collaborations. Overall, the network clusters highlight interdisciplinary and cross-national collaboration patterns, particularly linking Europe, North America, and Asia, underscoring the global but regionally concentrated nature of research in this domain.

Publication Source and Citation Analysis

Analysis of publication sources demonstrated that the literature on elder abuse is concentrated in a limited number of journals. The top 10 most productive journals accounted for a substantial proportion of the retrieved publications, indicating the existence of several key publication outlets in this field. Journal of Elder Abuse and Neglect ranked first (392 publications), followed by the Gerontologist (337 publications) and the Journal of the American Geriatrics Society (143 publications).

Regarding scholarly influence, citation analysis showed that the Journal of Elder Abuse and Neglect received the highest number of citations (5,756), followed by the Gerontologist (2,775 citations) and the Journal of the American Geriatrics Society (2,684 citations). These findings highlight the central role of these journals in disseminating and shaping the knowledge base on elder abuse research.

The analysis of publication sources confirmed a strong



a highly centralized publication structure in the field. In particular, the *Journal of Elder Abuse and Neglect*, the *Gerontologist*, and *Journal of the American Geriatrics*

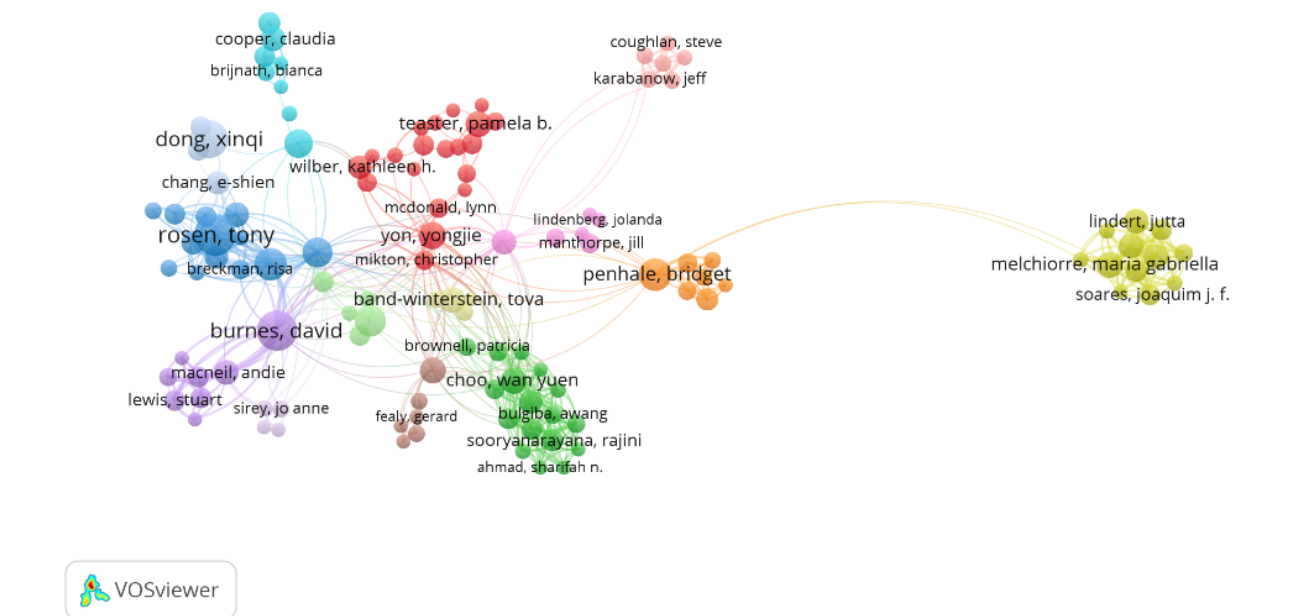




Figure 5. Journal Source Analysis Displaying Publication Distribution Among the Journals

Create Map				
Verify selected sources				
Selected	Source	Documents	Citations	Total link strength
☒	journal of elder abuse & neglect	392	5756	2054
☒	gerontologist	337	2775	886
☒	journal of the american geriatrics society	143	2684	805
☒	journal of interpersonal violence	36	648	387
☒	trauma violence & abuse	12	534	347
☒	journal of adult protection	65	414	310
☒	age and ageing	17	962	295
☒	journal of gerontological social work	35	507	275
☒	clinics in geriatric medicine	26	871	265
☒	journal of applied gerontology	28	371	248
☒	bmc geriatrics	24	225	241
☒	plos one	21	392	226
☒	journal of family violence	18	239	212
☒	international psychogeriatrics	40	410	209
☒	archives of gerontology and geriatrics	17	266	187
☒	international journal of geriatric psychiatry	16	447	179
☒	educational gerontology	28	204	159
☒	bmj open	13	119	144
☒	generations-journal of the american soci...	37	344	139
☒	advances in elder abuse research: practic...	13	47	126

Figure 6. Journal Citation Network Illustrating the Citation Relationships Among the Most Influential Journals in Elder Abuse Research

United States was identified as the leading contributor in terms of both publications and citations, followed by Canada and the United Kingdom. In general, these countries accounted for a large proportion of the total scientific output, highlighting the dominance of North America and Europe in shaping the research landscape on elder abuse. In contrast, contributions from developing regions remained comparatively limited, indicating a significant global research gap and the need for broader international collaboration. The country collaboration

network demonstrated that the United States, China, England, Canada, and Australia constitute the major contributors to research on digital health and elder abuse (Figure 7).

Temporal Evolution and Strongest Citation Bursts

The analysis of citation bursts emphasized the most influential keywords and references in the field of digital health applications to elder abuse. The strongest burst was associated with Pillemer et al¹⁷ in the Gerontologist,

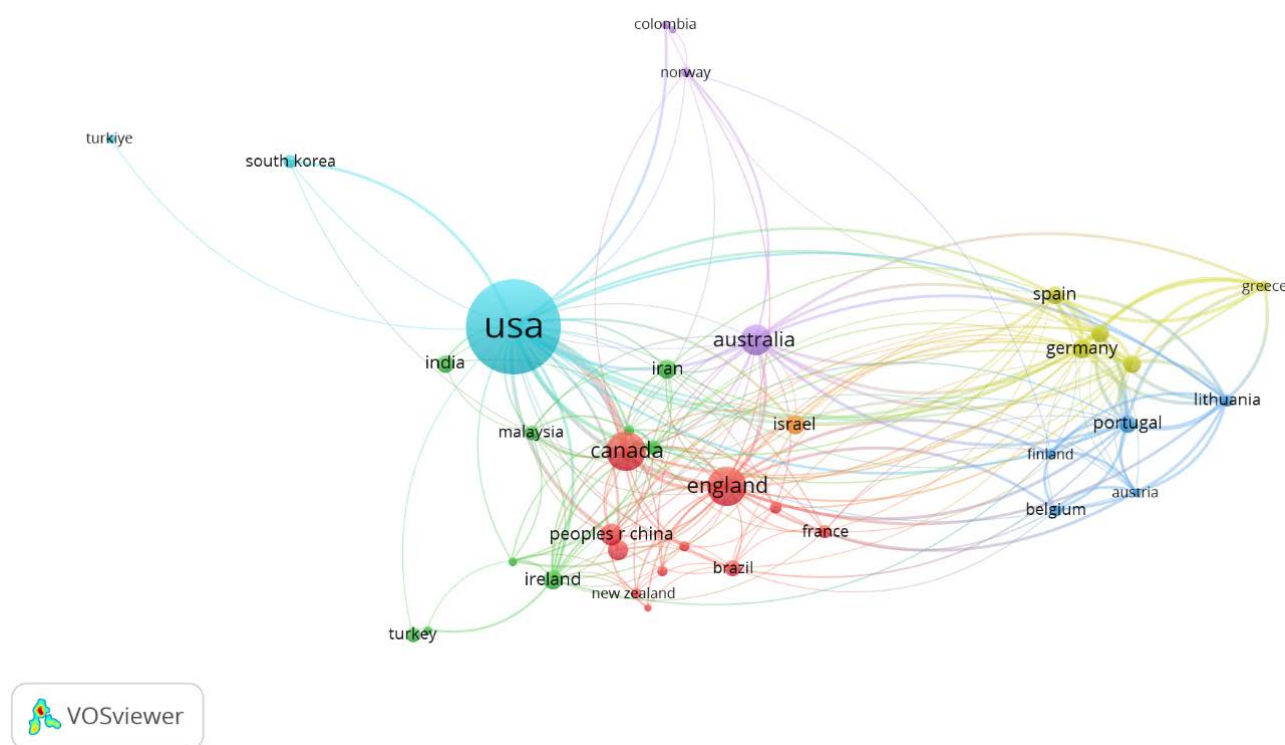


Figure 7. Country-Level Analysis Depicting Geographic Distribution of Scientific Output

which lasted from 2016 to 2020 and reflected the research emphasis on prevalence studies and risk factors during this period. This was followed by bursts for Dong¹⁸ in the *Journal of the American Geriatrics Society* and Lachs and Pillemer¹⁹ in the *New England Journal of Medicine*, both of which significantly shaped the scholarly discourse on elder abuse prevalence and healthcare system responses between 2015 and 2019. From 2017 onwards, keywords such as “scoping review” and “elder abuse” showed sharp citation bursts, marking a methodological shift toward systematic and scoping reviews. Between 2019 and 2021, the bursts linked to Storey²⁰ and Yunus et al²¹ highlighted growing research attention to risk assessment and psychosocial determinants of elder abuse. In more recent years, since 2021, works performed by Du and Chen²² in *BMC Public Health* have demonstrated continuing bursts. Moreover, Kitaw et al²³ in *BMC Public Health* has emerged as a central reference in recent clusters, with influence extending beyond 2023, representing an increasing focus on global systematic reviews and community-based digital health interventions. Overall, the temporal evolution of citation bursts revealed a clear shift from descriptive and prevalence-focused studies (2013–2016) to intervention-oriented and digitally mediated approaches (2017–present), underscoring the growing role of digital health technologies in elder abuse prevention and management.

Keyword Clusters in Digital Health and Elder Abuse Research

The CiteSpace analysis identified seven main clusters representing research themes in this field. Figure 8 shows these keyword clusters, which highlight different topics, such as mixed-method studies, abuse services, European

country comparisons, scoping reviews, sexual abuse, cross-sectional studies, and formal support systems. Collectively, they reflect the multidisciplinary and evolving nature of digital health research on elder abuse.

The network consists of 7 clusters. The largest 7 clusters are summarized as follows:

All clusters had silhouette values above 0.6, indicating satisfactory internal homogeneity and acceptable separation between clusters (Table 2). This demonstrates a reliable thematic structure within the dataset.

The cluster analysis confirmed seven major thematic areas within elder abuse research. Cluster interpretation was based on cluster size, silhouette values, representative terms generated by LSI, LLR, and MI algorithms, and the conceptual relationship between the included publications. Moreover, larger clusters mainly represented established research areas, such as systematic reviews, abuse-related services, prevalence studies, and community-based interventions, while smaller clusters reflected more focused research topics.

Cluster #0 MIXED-METHOD PILOT STUDY

The largest cluster (#0) had 56 members and a silhouette value of 0.664. It was labeled as mixed-method pilot study by LLR. The major citing article of the cluster was Ludvigsson et al (2022.0-JAN), entitled “Responding to elder abuse in geriatric care (Reagera): Educational intervention for healthcare providers: A non-randomized stepped-wedge trial”.²⁵

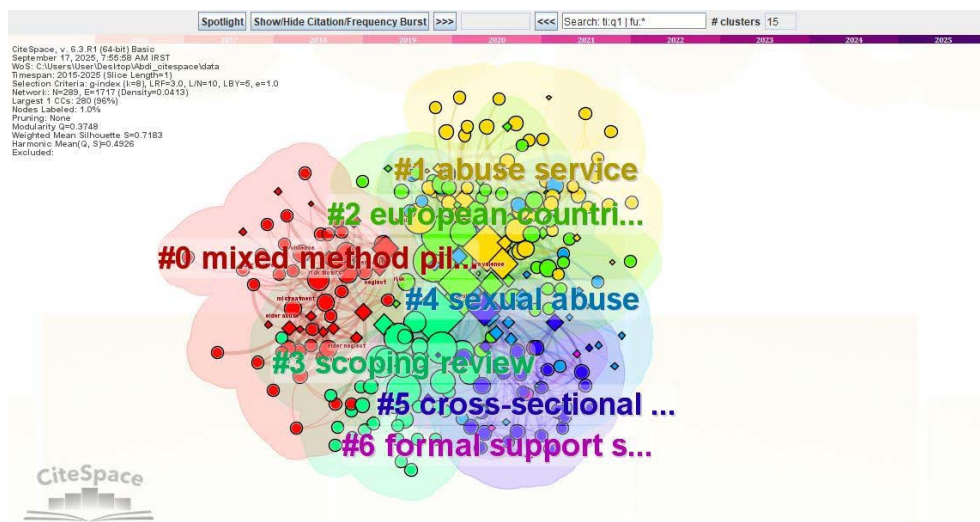
The most cited members in this cluster were 107 violence, 57 older people, and 45 prevention.

Main Label: Mixed-Method Pilot Study (Log-Likelihood Ratio). It should be noted that LSI labeled this cluster as

Table 2. Summary of the Largest 7 Clusters

Cluster ID	Size	Silhouette	Label (LSI)	Label (LLR)	Label (MI)	Average Year
0	56	0.664	Systematic review	Mixed-method pilot study (203.01, 1.0E-4)	Melbourne Australia (0.79)	2017
1	54	0.738	Systematic review	Abuse service (370.37, 1.0E-4)	Melbourne Australia (1.27)	2013
2	50	0.698	Cross-sectional study	European countries (307.44, 1.0E-4)	Melbourne Australia (1.72)	2014
3	43	0.813	Scoping review	Scoping review (497.68, 1.0E-4)	Melbourne Australia (2.68)	2019
4	39	0.653	Cross-sectional study	Sexual abuse (490.46, 1.0E-4)	Melbourne Australia (1.52)	2018
5	31	0.727	Cross-sectional study	Cross-sectional survey (561.69, 1.0E-4)	Community-based study (0.61)	2020
6	7	0.892	Qualitative study	Formal support service (108.36, 1.0E-4)	Systematic review (0.02)	2016

Note. LLR: Log-likelihood ratio; LSI: Latent semantic indexing; MI: Mutual information. Cluster labels are primarily based on the LLR method. Alternative labels generated by LSI and MI slightly differed and were not used in the interpretive analysis. Silhouette: Silhouette analysis can be used to study the separation distance between the resulting clusters. In addition, the silhouette plot displays a measure of how close each point in one cluster is to points in the neighboring clusters and thus provides a way to assess parameters like the number of clusters visually. This measure has a range of [-1, 1].²⁴

**Figure 8.** Keyword Clusters in Digital Health and Elder Abuse Research Major Clusters

“systematic review” and MI as “Melbourne Australia,” which were disregarded in the interpretive analysis due to the limitations of automated labeling algorithms. This cluster (the largest with 56 members and a silhouette value of 0.664) focused on experimental and educational studies employing mixed methods to explore interventions in elder abuse. The key article performed by Ludvigsson et al²⁵ examined the Reagera educational program, which enhances healthcare providers’ capacity to identify and respond to elder abuse. Frequently occurring keywords, such as “violence,” “older people,” and “prevention,” highlight a focus on education and prevention. This cluster provided a promising foundation for integrating digital tools (e.g., online training platforms and virtual simulations) to improve provider training in identifying elder abuse, although the application of digital technologies remains limited in this cluster.

Cluster #1 ABUSE SERVICE

The second largest cluster (#1) contained 54 members and a silhouette value of 0.738. It was labeled as abuse service by LLR, systematic review by LSI, and Melbourne Australia (1.27) by MI.

The major citing article of the cluster was: Lachs and Pillemer (2015.0-JAN), entitled “Elder abuse”.^{19,23} The most cited members in this cluster were: 362 prevalence, 162

older adults, and 81 care.

Main Label: Abuse Service (Log-Likelihood Ratio). This cluster (54 members and a silhouette value of 0.738) centered on services related to elder abuse and systematic reviews. The key article by Lachs and Pillemer emphasized prevalence and care-related aspects, with prominent keywords including “prevalence,” “older adults,” and “care.” This cluster reflects efforts to improve caregiving services and identify abuse cases. Moreover, it holds significant potential for integrating digital technologies (e.g., telehealth and secure reporting systems) to enhance access to services and transparency in reporting, though these technologies have not yet been extensively explored within this cluster.

Cluster #2 EUROPEAN COUNTRIES

The third largest cluster (#2) had 50 members and a silhouette value of 0.698 and was labeled as European countries by LLR. The major citing article of the cluster was the one conducted by Kitaw et al (2025.0-JAN), entitled “Elder abuse without borders: A systematic review and meta-analysis”.²³ neglect (306 citations) and mistreatment (238 citations) were the most cited members in this cluster.

Main Label: European Countries (Log-Likelihood Ratio). This cluster (50 members and a silhouette value of 0.698) was focused on cross-sectional and cross-national studies

in Europe. The key article by Kitaw et al²³ provided a systematic review and meta-analysis on elder abuse, with keywords such as “neglect” and “mistreatment.” This cluster underscores cultural and systemic variations in elder abuse. Additionally, it offers opportunities for leveraging big data analytics in cross-national studies, but the application of digital technologies (e.g., AI or telehealth) remains in its early stages.

Cluster #3 SCOPING REVIEW

The 4th largest cluster (#3) consisted of 43 members and a silhouette value of 0.813 and was labeled as scoping review by LLR. The major citing article of the cluster was Kitaw et al (2025.0-JAN), entitled “Elder abuse without borders: A systematic review and meta-analysis”.²³

Elder abuse (539 citations) was the most cited member in this cluster.

Main Label: Scoping Review (Log-Likelihood Ratio). This cluster (43 members and a silhouette value of 0.813) concentrated on scoping reviews that form the intellectual foundation of elder abuse research. Key articles, such as those conducted by Storey²⁰, emphasized risk factors and European epidemiological approaches, with the prominent keyword “elder abuse” (539 citations). This cluster could benefit from machine learning to analyze extensive data in scoping reviews, but digital technologies have not yet been completely integrated into these studies.

Cluster #4 SEXUAL ABUSE

The 5th largest cluster (#4) had 39 members and a silhouette value of 0.653. It was labeled as sexual abuse by LLR. The major citing article of the cluster was Fu and Chen (2023.0-JAN), entitled “Long-term effects of childhood adversity on the subjective well-being of older adults in urban china: The mediating effect of elder abuse”.²⁶

The most cited members in this cluster were health (131 citations), risk (103 citations), and intimate partner violence (72 citations).

Main Label: Sexual Abuse (Log-Likelihood Ratio). This cluster (with 39 members and a silhouette value of 0.653) addressed the under-explored dimension of sexual abuse in elder populations. The key article by Fu and Chen²⁶ examined the effects of childhood adversity on elder abuse in China, with keywords such as “health,” “risk,” and “intimate partner violence.” This cluster has significant potential for using VR technologies in education and awareness-raising about sexual abuse, though such applications remain in their early stages.

Cluster #5 CROSS-SECTIONAL SURVEY

The 6th largest cluster (#5) included 31 members and a silhouette value of 0.727 and was labeled as cross-sectional survey by LLR. The major citing article of the cluster was Kitaw et al (2025.0-JAN), entitled “Elder abuse without borders: A systematic review and meta-analysis”.²³ In this cluster, risk factors (194 citations), population (43 citations), and association (23 citations) were the most cited members.

Main Label: Cross-Sectional Survey (Log-Likelihood Ratio). This cluster (with 31 members and a silhouette value of 0.727) centered on questionnaire-based research exploring the prevalence and risk factors of elder abuse. The key article by Kitaw et al²³ emphasized systematic analysis, with keywords such as “risk factors” and “population.” This cluster could also benefit from mobile applications and anonymous reporting systems to modernize data collection and abuse screening, but these technologies have not been widely adopted so far.

Cluster #6 FORMAL SUPPORT SERVICE

The 7th largest cluster (#6) encompassed 7 members and a silhouette value of 0.892. Furthermore, it was labeled as formal support service by LLR, qualitative study by LSI, and systematic review (0.02) by MI.

The major citing article of the cluster was Zhang (2019.0-JAN), entitled “Perceptions of elder abuse and neglect by older Chinese immigrants in Canada”.²⁷ The most cited members in this cluster were elder neglect (14 citations) and help seeking (11 citations).

Main Label: Formal Support Service (Log-Likelihood Ratio). This cluster (the smallest with 7 members and a silhouette value of 0.892) focused on formal support services and qualitative studies, such as Zhang²⁷, which investigated perceptions of elder abuse among Chinese immigrants in Canada. Keywords included “elder neglect” and “help-seeking.” This cluster offers opportunities for integrating electronic health records and intelligent monitoring systems into formal support services, though these technologies have not so far been widely studied in this cluster.

Notably, none of the identified clusters were exclusively centered on digital health technologies. Finally, the absence of technology-specific clusters indicated that digital health has not yet developed into an independent research domain within elder abuse studies, but rather appears as an emerging and interdisciplinary component embedded within broader themes such as prevention, screening, education, and support services.

Discussion

This scientometric investigation systematically mapped and interpreted the global research landscape at the intersection of elder abuse and digital health. By combining bibliometric indicators with network visualization, this study identified the intellectual structure, thematic clusters, and temporal evolution of this emerging field. Additionally, the study not only quantified publication trends but also uncovered conceptual linkages between traditional elder abuse research and the rapidly expanding domain of digital health innovation. This discussion, therefore, interprets the main findings within a broader theoretical and practical context, highlighting how digital health technologies are beginning to reshape prevention, detection, and intervention strategies for safeguarding older adults worldwide. Likewise, this scientometric study provided a comprehensive overview of the research

landscape on elder abuse, revealing a field that remains largely grounded in descriptive and epidemiological inquiries but is progressively evolving toward digital and intervention-oriented paradigms. The findings indicated that while traditional themes, such as prevalence, risk factors, neglect, mistreatment, and service delivery, still dominate, the application of digital health technologies, including AI, VR, and telehealth, remains limited. This finding is further supported by the cluster analysis, where no technology-specific cluster emerged, suggesting that digital health remains a developing rather than established research domain in elder abuse studies. This imbalance underscores a critical gap between knowledge generation and digital innovation in elder abuse research.

Analysis of Keywords Co-Occurrence

The interpretation of the co-occurrence map demonstrated that, although a substantial body of research has focused on measuring and describing the phenomenon, there remains a clear need for more interventional studies, evaluations of the effectiveness of educational and policy programs, and translational research that bridges evidence with clinical practice and policymaking. Moreover, expanding multinational studies and placing greater emphasis on the experiences of family caregivers and vulnerable populations, particularly individuals with dementia, are critical. Similarly, emerging areas, such as the use of novel technologies (e.g., VR), may provide new pathways for identification and intervention. Co-authorship analysis revealed that scholarly output is growing but concentrated among a small core of researchers, including Rosen et al.⁵, Dong¹⁸, Lachs and Pillemer¹⁹, Manthorpe and Samsi²⁹, Teaster et al.³⁰, Burnes et al.³¹, Sirey et al.^{32, 33}, Turner D³⁴, Henderson et al.³⁵, and Melchiorre et al.^{36, 37} While this concentration has fostered coherence, expanding collaboration across regions and disciplines is needed to strengthen policy-relevant and comprehensive approaches to elder abuse.

Furthermore, the seven clusters identified through scientometric mapping provided a comprehensive overview of the intellectual and thematic landscape within the field of elder abuse research. Cluster 0, focusing on mixed-method pilot studies, showcased educational interventions, such as the Reagera program, which effectively train healthcare providers to recognize and address elder abuse through structured learning frameworks.²⁵ The potential for incorporating digital training tools into these programs is significant, as it could enhance both scalability and accessibility, thereby reaching a broader audience of healthcare professionals.

Cluster 1 emphasized abuse services, where systematic reviews and service-oriented studies currently dominate the discourse.¹⁹ However, there is an emerging opportunity to integrate telehealth solutions and secure digital reporting systems, which could revolutionize service delivery by making it more efficient and responsive to the needs of victims. In cluster 2, European cross-national studies revealed the systemic and cultural differences in the

prevalence of elder abuse across various nations.²³ In addition, the application of big data analytics in this context could facilitate more robust cross-national comparisons and contribute to the development of harmonized global policies aimed at combating elder abuse. In cluster 3, scoping reviews played a pivotal role in consolidating epidemiological evidence and identifying risk factors associated with elder abuse.²³ The integration of advanced technologies, such as machine learning and natural language processing, could significantly enhance the synthesis of complex datasets, leading to more nuanced insights. Meanwhile, cluster 4 addressed the critical yet underexplored area of sexual abuse, linking childhood adversity to increased vulnerability in later life.²⁶ Innovative solutions, including VR-based educational tools, could raise awareness and improve prevention strategies in this sensitive area. Further, cluster 5 highlighted the importance of cross-sectional surveys in mapping prevalence and identifying risk factors, suggesting that modernizing these methodologies through digital data-collection platforms and anonymous mobile surveys could yield more accurate and timely data.²³ Finally, cluster 6 focused on formal support services, with studies examining perceptions and help-seeking behaviors among immigrant populations.²⁷ The integration of electronic health records and intelligent monitoring systems could enhance detection and referral processes within these support networks, ultimately improving outcomes for vulnerable individuals. Collectively, these clusters underscore the critical role of digital health integration in advancing the field of elder abuse research and intervention.

Digital Health Integration

Recent technological innovations have appeared as emerging technology-related directions within elder abuse research, although their integration remains limited. As regards VR, interactive simulations enhance awareness, sensitivity to abuse indicators, and clinical competencies, providing safe and repeatable training environments for prevention, screening, diagnosis, and rehabilitation. Concerning AI, reported applications include health data analytics, natural language processing, and AI-supported monitoring approaches; however, their effectiveness and clinical utility in elder abuse contexts require further validation. Although AI has been proposed as a potential approach, its application in elder abuse remains limited and needs further validation. Mobile health and telehealth-related tools have been reported as potential approaches for empowerment, reporting, and support; however, these applications remain relatively limited within the current elder abuse literature. Moreover, the Mood 60+ game³⁸, VOICES³⁹ tablet program, and DETECT⁴⁰ platform empower older adults and caregivers while facilitating timely interventions by professionals. In addition, immersive technologies, such as VR simulations, enhance awareness and sensitivity to abuse indicator while strengthening clinical and caregiving competencies.⁴¹⁻⁴³ By providing an interactive, safe, and repeatable environment,

VR offers significant potential for training across various forms of abuse, including prevention, screening, diagnosis, and rehabilitation.^{44, 45} Through the simulation of clinical and educational scenarios, VR helps improve professionals' diagnostic and response skills, including those of physicians, nurses, and social workers, enabling them to manage the complex conditions of older adults more effectively.^{46, 47}

The global context underscores the urgency of these efforts. According to the WHO (2024), one in six older adults over the age of 60 experienced abuse in 2024, yet only one in 24 cases was reported. Research suggest that the number of victims may reach 320 million by 2050.⁶ Within the Decade of Healthy Ageing (2021–2030), WHO also emphasizes combating ageism, improving data collection, and fostering innovative solutions.^{7, 8} Empowering older adults by enhancing self-efficacy, skills, and access to user-friendly digital tools is recognized as a critical protective factor.^{2, 48} In this regard, digital health, in line with the WHO's Global Strategy on Digital Health, aligns with global policy frameworks and provides effective, flexible, and applicable solutions at different levels for managing abuse and neglect.⁴⁹ Simultaneously, the scientometric analysis revealed structural gaps in the field. Research contributions remain geographically concentrated in North America, Western Europe, and Australia, with limited representation from the Global South. Addressing this imbalance requires expanding international collaboration to ensure inclusivity and global relevance. Overall, the findings of this study demonstrated that digital health currently represents an emerging and underdeveloped component of elder abuse research, with potential to support future prevention, detection, and intervention strategies for rethinking elder abuse management. Integrating technologies such as AI, VR, mobile health, and secure reporting platforms into health and social care systems can enhance transparency, accountability, and accessibility. Nonetheless, challenges surrounding privacy, data security, and user-centered design remain pressing. As the first scientometric mapping of elder abuse in relation to digital health, this study identified major shifts, uncovered structural and thematic gaps, and offered a roadmap for embedding digital innovations into prevention, education, screening, and intervention strategies aimed at safeguarding older adults. Beyond describing publication trends, this scientometric analysis provided insight into the maturity and knowledge structure of the field. The cluster analysis represented that elder abuse research remains primarily organized around traditional themes, including prevalence, risk factors, support services, and intervention approaches, while digital health-related concepts have not yet formed a dominant thematic cluster. Therefore, the contribution of this study lies in identifying the current developmental stage of digital health integration in elder abuse research and highlighting specific gaps for future interdisciplinary investigation.

Compared with more established digital health fields, such as chronic disease management⁵⁰, where digital technologies have increasingly been integrated into routine monitoring, self-management, and intervention

strategies, our findings indicated that digital health remains an emerging and underdeveloped area within elder abuse research. Similarly, related fields, such as child abuse⁴³, digital technologies, including VR-based education, digital interventions, and technology-supported reporting approaches, have received increasing research attention. However, within elder abuse studies, technology-focused approaches have not yet emerged as a distinct research domain, as reflected by the absence of technology-specific clusters in the present scientometric analysis. This highlights an important opportunity for future interdisciplinary research to explore ethically appropriate and evidence-based digital solutions for the prevention, early detection, and support of older adults experiencing abuse.

The findings of the present scientometric analysis confirmed that although elder abuse research has expanded in volume and thematic diversity, the integration of digital health technologies remains limited and has not yet formed a distinct or dominant research cluster. Across publication, citation, and co-occurrence analyses, there was no strong or separate thematic structure related specifically to AI, VR, mobile health, or other digital health innovations, suggesting that digital health applications in elder abuse research are still in an emerging stage rather than a consolidated or mature research domain. While individual studies have explored technological tools, such as VR-based training, AI-supported monitoring, and mobile reporting systems, these approaches remain fragmented and have not yet been systematically integrated into the core scientific structure of the field.

Overall, the absence of a well-defined digital health cluster reflects a research gap and highlights a crucial opportunity for future interdisciplinary studies to strengthen the integration of innovative technologies into elder abuse prevention, detection, and intervention strategies. This structural gap emphasizes the need for a paradigm shift toward technology-driven and data-informed approaches in elder abuse research.

Conclusion

This research presented the inaugural comprehensive scientometric analysis of elder abuse studies within the context of digital health rather than only quantifying publications. The findings of this study revealed the thematic evolution, research maturity, and unmet opportunities at the intersection of elder abuse and digital health. The results also indicated that, historically, investigations into elder abuse have predominantly concentrated on traditional themes, such as prevalence rates, risk factors, and the provision of support services. Although digital health technologies demonstrate potential, the absence of technology-specific clusters suggests that digital health has not yet become an established research domain in elder abuse studies. Based on the temporal evolution of keywords and thematic analysis, recent studies involving AI, VR, and telehealth represent emerging directions rather than a mature and integrated research field.

Recent studies involving AI, VR, and telehealth represent emerging directions rather than a mature and integrated research field. However, the advent of digital health technologies is beginning to influence this field, introducing novel strategies for prevention, education, screening, and intervention. Innovations like interactive applications, VR training programs, and AI-based diagnostic tools hold significant promise for empowering older adults, enhancing the skills of caregivers, and enabling timely, evidence-informed interventions. These technological advancements not only improve accessibility and user engagement but also facilitate personalized and scalable solutions that were previously challenging to implement in conventional care environments. Despite the encouraging developments in digital health, the lack of relevant topics within the primary scientometric clusters highlights a critical research void, indicating that although the potential benefits of technology are widely recognized, its incorporation into mainstream elder abuse research and practice remains insufficient. To bridge this divide, there is a pressing need for enhanced international collaboration, targeted investments in the creation of user-friendly and ethically sound technologies, and a strategic alignment with global health initiatives, such as the WHO's Decade of Healthy Ageing. Addressing these challenges is essential for fostering a more integrated approach to elder abuse research that leverages the capabilities of digital health. Ultimately, integrating digital health into the core of elder abuse research and intervention strategies has the potential to revolutionize the field. Accordingly, researchers and practitioners can develop more effective, equitable, and sustainable approaches that not only safeguard older adults but also promote their autonomy, dignity, and overall well-being. The intersection of established research knowledge with innovative digital solutions presents a promising avenue for addressing the complex challenges associated with elder abuse, thereby paving the way for a future where technology plays a pivotal role in enhancing the lives of vulnerable populations.

Limitations

The search strategy was intentionally designed to capture a broad range of studies at the intersection of elder abuse and digital health. Although the use of "digital health" as an umbrella term was informed by previous evidence synthesis in this field, some studies focusing on specific technologies without explicitly using the term "digital health" may not have been identified. Therefore, technology-focused studies using terms such as AI, VR, mobile applications, or digital interventions without reference to digital health may have been overlooked during the search.

Furthermore, the inclusion of the term "neglect" was intended to improve sensitivity; however, it may have resulted in the retrieval of some studies not exclusively focused on older adults. Likewise, this study had several methodological limitations. First, the analysis was limited to publications indexed in the Web of Science Core Collection; although this collection provides high-quality

and standardized bibliographic data for scientometric analysis, the use of a single database may have led to the omission of relevant studies indexed only in other databases, such as Scopus or PubMed. Moreover, only English-language articles were included, which may have introduced language bias and reduced representation of research from non-English-speaking regions. Additionally, as a scientometric analysis, citation-based indicators may be influenced by citation bias, as highly cited publications and established research groups may receive greater visibility than newer or emerging studies.

To provide a more comprehensive representation of the field, future studies may refine search strategies by combining broader digital health terminology with additional age-specific terms and integrating multiple bibliographic databases.

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The data supporting the findings of this study are available upon request from the corresponding author.

Ethical approval

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Consent for publication

Not applicable.

Conflict of interests

The authors declare that they have no conflict of interests.

Institutional Review Board Statement

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