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A Decade of Telerehabilitation Using Virtual Reality from a Bioethics Perspective

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ABSTRACT

Aims This study analyzed the development of virtual reality-based telerehabilitation over the past decade (2015-2024) through a bibliometric approach based on 323 scientific publications.
Information & Methods This qualitative systematic review focuses on bibliometric studies analyzing data from reputable international journals indexed in Scopus. The collected data were then thoroughly analyzed and visualized using the VOSviewer program.
Findings A predominance of technical and clinical studies, with minimal attention to ethical aspects, was revealed, indicating a disparity between technological advances and bioethical considerations. Keyword network analysis identified three main clusters, including clinical effectiveness, immersive technology, and patient quality of life, while ethical issues, such as informed consent, data privacy, and equitable access, emerged as separate nodes. Key findings were the dominance of research by developed countries (the US and Italy account for 44% of publications), reflecting global disparities in access to technology, the risk of dehumanization in rehabilitation practices due to reduced therapeutic interaction, and the lack of an ethical framework in the development of virtual reality systems.
Conclusion Virtual reality-based telerehabilitation advances mainly through technical and clinical research, while ethical issues, such as patient consent, equitable access, and data privacy, remain insufficiently addressed.

Keywords Bioethics; Telemedicine; Telerehabilitation; Virtual Reality

CITATION LINKS

[1] Digital ... [2] Technological ... [3] “We ... [4] The ... [5] Immersive ... [6] Exploring ... [7] Digital ... [8] Emerging ... [9] Virtual ... [10] Differential ... [11] Digital ... [12] Scoping ... [13] Telerehabilitation ... [14] What ... [15] Virtual ... [16] Bibliometric ... [17] Bioethics ... [18] Tracking ... [19] Understanding ... [20] Ethics ... [21] Ethical ... [22] Rethinking ... [23] Using ... [24] Effects ... [25] Can ... [26] Physiotherapy ... [27] Applications ... [28] Topical ... [29] Semantic ... [30] Construction ... [31] Climate ... [32] Artificial ... [33] Sourcing ... [34] Transit ... [35] How ... [36] Trust ... [37] Artificial ... [38] Bibliometrix ... [39] Application ... [40] A ... [41] Feasibility ... [42] Using ... [43] The ... [44] Rehabilitation ... [45] The ... [46] Virtual ... [47] “Fibromyalgia ... [48] Immersive ... [49] Dance ... [50] Advancing ... [51] Role ... [52] Strengthening ... [53] Challenges ... [54] Comparative ... [55] RehabGesture ... [56] How ... [57] Rewriting ... [58] Assessing ... [59] Real ... [60] Exploring ... [61] Tele ... [62] A ... [63] Exploring ... [64] The ... [65] Telerehabilitation ... [66] Home ... [67] Data ... [68] Virtual ... [69] The ... [70] Exploring ... [71] Effect ... [72] DiEvD ... [73] Research ... [74] Virtual ... [75] Beyond ... [76] Recent ... [77] The ... [78] A ... [79] An ... [80] A ... [81] The ... [82] An ... [83] Breaking ... [84] Effectiveness ... [85] Nursing ... [86] Rehabilitation ... [87] Development ... [88] Utilizing ... [89] Telerehabilitation ... [90] Barriers ... [91] Reprogramming ... [92] Integration ... [93] Updated ... [94] Unveiling ... [95] Efficacy ... [96] Qualitative ... [97] Research ... [98] A ... [99] Frailty ... [100] A ... [101] Supportive ... [102] Modelling ... [103] Online ... [104] Use ... [105] How ... [106] Predicting ... [107] Effects ... [108] The ... [109] Telemedicine ... [110] News ... [111] Data ... [112] Efficacy ... [113] Telerehabilitation ... [114] Exploring ... [115] Tourists’ ... [116] Participatory ... [117] Smart ... [118] Opioid ... [119] Framing ... [120] Combining ... [121] Advancing ... [122] The ... [123] User ... [124] Technology ... [125] Information ... [126] Artificial ... [127] Home ... [128] Virtual ... [129] Leveraging ... [130] Effectiveness ... [131] What ... [132] Recommendations ... [133] Tele ... [134] #Drugsforsale ... [135] Clinical ... [136] A ... [137] Effects ... [138] Effects ... [139] The ... [140] A ... [141] Clinical ... [142] The ... [143] Evaluation ... [144] Effectiveness ... [145] Wearable ... [146] Transparency ... [147] A ... [148] A ... [149] The ... [150] Techno ... [151] Autonomous ... [152] Telerehabilitation ... [153] New ... [154] Statistical ... [155] Virtual ... [156] A ... [157] Virtual ... [158] Digital ... [159] Exploring ... [160] Integrated ... [161] Steering ... [162] Virtual ... [163] Advance ... [164] Mapping ... [165] A ... [166] Virtual ... [167] Towards ... [168] Effects ... ... [373] Enhancing ...

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Introduction

Advances in information and communication technology have brought about significant transformations in various sectors, including healthcare [1]. One of the most notable innovations in the last decade is the use of virtual reality (VR) technology in telerehabilitation services [2]. Telerehabilitation, as part of telemedicine, provides rehabilitation services that patients can access remotely, addressing the limitations of conventional healthcare, particularly in remote areas or for those with mobility constraints [3]. With the advent of VR, telerehabilitation approaches have become more interactive, immersive, and adaptive to the complex needs of patients, especially those with neurological disorders such as stroke, hemiplegia, fatigue, and upper limb disorders [4]. VR enables the simulation of therapeutic environments that resemble real-world conditions [5]. The combination of VR and telerehabilitation has been proven to enhance patient engagement in the therapeutic process, accelerate recovery, and reduce the burden on hospitals and rehabilitation clinics [6]. However, amid the excitement surrounding these advancements, important questions have emerged regarding the ethical dimensions of applying technology in clinical practice, which have not received sufficient attention in the scientific literature [7].

Bioethical issues are highly relevant, as health technology addresses not only technical and clinical aspects but also patient rights, equitable access, data privacy, and the quality of therapeutic relationships [8]. In the context of VR-based telerehabilitation, several ethical challenges require serious consideration [9]. First, how can we ensure that all patients, regardless of their socioeconomic or geographic background, have equitable access to this technology? Second, how can we guarantee that health data collected through VR devices is secure and used ethically? Third, do patients truly understand and consent to this technology-based therapy (informed consent), given its technical complexity?

Additionally, the use of VR in telerehabilitation raises questions about patient dependence on technology, the potential loss of humanistic aspects in the patient-therapist relationship, and the validity and reliability of therapy outcomes when care is not conducted face-to-face [10]. In many cases, technology design is developed with greater emphasis on functional and market aspects, while ethical dimensions are marginalized [11]. This reflects a gap in the literature, where studies on ethics, although important, have not yet become mainstream in VR-based telerehabilitation research [12].

Most articles from the last decade discussing telerehabilitation and VR focused on clinical, technical, and therapeutic effectiveness aspects [13]. Publications that explicitly address ethical issues remain very limited in both quantity and depth of discussion. However, to ensure that technological innovations in the health sector develop responsibly and sustainably, bioethical issues must be integral to scientific discourse and professional practice [14, 15]. In response to this situation, this article aimed to conduct a bibliometric analysis of scientific literature discussing VR-based telerehabilitation over the past ten years. The bibliometric method was chosen because it provides a quantitative overview of trends, collaboration patterns, and dominant keywords in academic literature [16]. This approach can indicate the extent to which bioethical issues have received attention in academic discourse on this topic can be identified [17]. This analysis will not only reveal the dynamics of research from geographical, institutional, and thematic perspectives but also provide a critical reflection on the role of ethical issues within the landscape of VR-based telerehabilitation research [18-22]. Thus, we did not merely present a research map but also offered conceptual and normative contributions regarding the importance of integrating ethical perspectives into the development and implementation of health technology.

The main objectives of this study were to identify trends in publications related to telerehabilitation and VR over the past decade, reveal the relevance of bioethics themes in the analyzed literature corpus, and encourage further discussion on the need for an interdisciplinary approach that combines technology, health, and ethics in the development of telerehabilitation services. The study is intended to serve as an initial reference for researchers, policymakers, technology developers, and healthcare practitioners to become more sensitive to the ethical implications of the innovations they develop or use. Overall, this study emphasized that technological innovations in healthcare cannot be separated from ethical considerations. Good technology is not only technically advanced or clinically effective but also fair, transparent, and respectful of human dignity. By incorporating bioethics into bibliometric analysis, this study sought to bridge the gap between technological sophistication and moral integrity in modern healthcare practice.

Information and Methods

This systematic review used a bibliometric approach to map the development of the scientific literature on “telerehabilitation” and “virtual reality” over the period 2015-2024.

Data were sourced from the Scopus database using the (TITLE-ABS-KEY (telerehabilitation) AND TITLE-ABS-KEY (“virtual reality”)) AND PUBYEAR>2015 AND PUBYEAR<2024 AND (LIMIT-TO (SUBJAREA, “MEDI”) OR LIMIT-TO (SUBJAREA, “HEAL”) OR LIMIT-TO (SUBJAREA, “SOCI”)) AND (LIMIT-TO (DOCTYPE, “ar”) OR LIMIT-TO (DOCTYPE, “re”)) AND

(LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (LANGUAGE, "English")) search syntax, resulting in 387 initial documents.

The documents were then filtered based on publication type, language, topic relevance, and subject area. From the initial 387 documents, filtering was conducted based on relevance to the research topic. This process included reviewing titles and abstracts to ensure relevance to telerehabilitation and VR use, followed by excluding articles that only marginally mentioned either term without a health rehabilitation context.

The articles then focused on three main areas aligned with the needs of interdisciplinary analysis: medicine (MEDI), health professions (HEAL), and social sciences (SOCI), thereby broadening the scope to encompass clinical, health-professional, and social/ethical perspectives.

From an initial 503 records identified in databases, 87 were removed as duplicates, 20 were marked ineligible by automated tools, and 9 were removed for other reasons. After screening 387 records, 20 were excluded, and 10 reports were sought for retrieval. Of these, 8 reports were not retrieved. Subsequently, 349 reports were assessed for eligibility, resulting in the exclusion of 14 reports for not being in English, 7 for being off-topic, and 5 for lacking an abstract. This rigorous selection process ultimately resulted in 323 new studies being included in the review and used as the basis for bibliometric analysis.

All documents were exported in CSV format, including metadata such as author names, affiliations, keywords, abstracts, citation counts, and the journals in which they were published, followed by analysis using VOSviewer to visualize collaboration networks and map keywords.

The analysis was conducted in two main stages: descriptive analysis to identify annual trends and geographic distribution, and visual analysis using VOSviewer to map keyword co-occurrence relationships and identify thematic clusters. Additionally, to explore the bioethics dimension specifically, a manual search was conducted for terms such as "ethics," "bioethics," "consent," "privacy," and "justice" that appeared in keywords or abstracts. To capture the representation of ethical values in VR-based telerehabilitation literature, while acknowledging that bibliometric methods have limitations in measuring the depth of ethical substance in each article, a qualitative exploration was conducted of documents that explicitly mentioned ethical or normative dimensions. Additionally, the use of the keywords "telerehabilitation" and "virtual reality" in TITLE-ABS-KEY excluded articles that used synonyms or more technical terms. However, this decision was made to maintain the specificity and focus of the search [23-26].

Findings

This systematic review analyzed the literature on the use of VR in telerehabilitation through a bibliometric approach. As an initial step, the distribution of scientific publications per year from 2014 to 2025 was obtained, providing an overview of the dynamics of research productivity and the critical phases in the adoption of VR technology for remote rehabilitation (Figure 1).

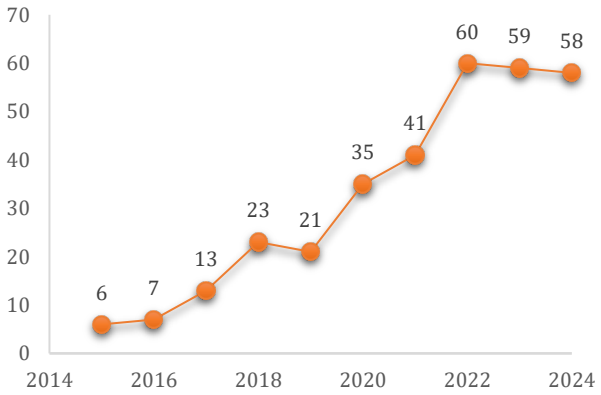

Figure 1. Publication by year (2015-2024)

The field of VR-based telerehabilitation has shown dynamic research development over the past decade. In 2015, research in this field was just beginning to take shape, with only 6 publications. The following year (2016) saw a slight increase to 7 publications, followed by a significant surge in 2017 to 21 publications—an increase of over 200%, indicating a sudden rise in research interest. The period from 2018 to 2023 represented a phase of stable and consistent growth, with the number of publications increasing from 23 (2018) to 60 (2023). Annual growth ranged from 1.7% to 52.2%, with the greatest acceleration occurring between 2019 and 2021. The peak of research productivity was reached in 2023 with 60 publications, indicating the maturity of this research field.

However, 2024 saw a drastic 78.3% decline, with only 13 publications. This sharp decline requires further investigation [27-30], with several possible causes, including research saturation in the field of VR for telerehabilitation, a shift in focus toward new technologies, such as augmented reality or the metaverse, changes in research funding priorities, or delays in indexing the latest publication data [31-34]. This development pattern provides important insights into the dynamics of research in digital health, particularly the application of immersive technology for remote rehabilitation. These findings also raise new questions about the factors influencing the lifecycle of a research field in health technology.

The analysis of 323 articles showed a clear imbalance in VR-based telerehabilitation research, with strong dominance of clinical effectiveness (34%) and technological innovation (23%).

Table 1. Categorization of research focus (n=323)

Main theme	Focus	Finding(s)	Frequency (%)	Keywords	Reference
Clinical Effectiveness	Stroke rehabilitation, motor function, physiotherapy	The majority of studies report that VR-based telerehabilitation effectively improves motor function and clinical outcomes	110 (34)	Stroke rehab, motor recovery, physiotherapy	[23-132]
Virtual reality (VR) technology and innovation	Immersive VR, exergaming, and AI integration	Focus on the development of VR systems, user interfaces, and the integration of emerging technologies	75 (23)	Virtual reality, immersive tech, serious games	[133-207]
Quality of life and patient experience	QoL, patient satisfaction, engagement	VR enhances patient motivation, adherence, and overall experience	48 (15)	Quality of life, patient satisfaction, engagement	[186-233]
Digital health and telemedicine	Telehealth, remote monitoring, IoT	Integration of VR into digital health systems and home-based care	32 (10)	Telemedicine, remote care, digital health	[234-265]
Implementation barriers and challenges	Cost, usability, and technology access	Key challenges include high costs, digital literacy, and infrastructure limitations	26 (8)	Barriers, cost, usability, and access	[266-291]
Adherence and motivation	Treatment compliance, behavioral factors	Technology improves adherence but does not replace human interaction	12 (4)	Adherence, motivation, compliance	[292-303]
Bioethics and regulation	Data privacy, informed consent, equity of access	A minor theme, not yet well integrated into mainstream research	10 (3)	Ethics, privacy, consent, justice	[302-311]
Medical education and training	VR for healthcare training	Use of VR in simulation and clinical education	5 (2)	Medical education, simulation	[312-321]
Pandemic and COVID-19 context	Healthcare access during pandemic	VR as a solution to limitations in physical healthcare services	5 (2)	Pandemic, COVID-19, remote therapy	[322-331]

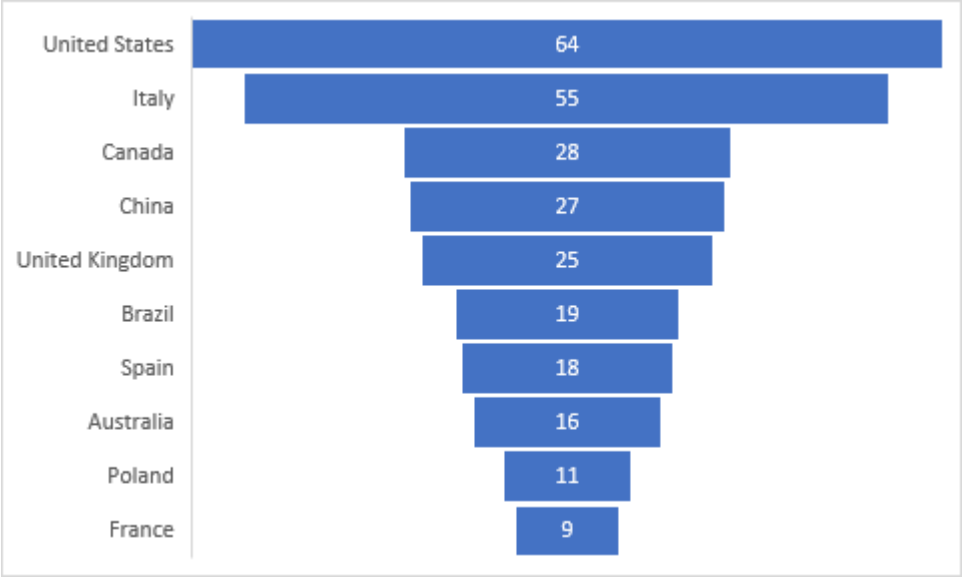

Figure 2. Publication by country from 2015 to 2024

While evidence confirms that VR improves motor function and rehabilitation outcomes, the focus remained largely technocentric and outcome-driven, with limited attention to real-world implementation and patient context. Emerging themes, such as quality of life (15%) and digital health integration (10%) indicated a gradual shift toward patient-centered and remote care models, yet these remained secondary and fragmented.

A critical gap was evident in implementation barriers (8%), highlighting disparities between evidence and practice due to cost, infrastructure, and digital literacy limitations. Most notably, bioethical considerations (3%) were significantly underrepresented, revealing an ethical blind spot in the literature (Table 1).

Among the top 10 countries with the most research on telerehabilitation and VR, the United States contributed 23.5% (64 publications), making it the leading contributor to VR -based telerehabilitation research. Italy followed with 20.2% (55 publications), indicating that these two countries collectively account for nearly 44% of global publications. Contributions from other countries varied significantly, with Canada and China each contributing 28 (10.3%) and 27 (9.9%), respectively. The United Kingdom contributed 9.2% (25 publications).

Interestingly, contributions from non-Western countries were also beginning to emerge, such as Brazil (19 publications), Spain (18), and Australia (16), each contributing around 6-7%. Although

smaller, their presence indicated promising market potential and technological development in the Global South [158-161]. On the other hand, countries like Poland and France contributed 11 and 9 publications, respectively, accounting for less than 4% of the total (Figure 2).

Using the VOSviewer tool, keyword co-occurrence patterns were visualized from the literature on VR-based telerehabilitation published between 2015 and 2024. In the resulting network map, colors indicate interrelated thematic clusters that reflect the main research foci in this field. Keywords with larger label sizes appear more frequently in the analyzed publications, highlighting the most prominent terms in the literature.

The red cluster focused on patient aspects, quality of life, technology, and pandemic conditions, including terms such as "patient satisfaction", "quality of life", "digital health", and "pandemic". This reflects how VR in telerehabilitation responds to patients' personal needs, especially during the COVID-19 pandemic. The dominance of this color also indicated that service personalization and patient perception were the focus of current literature. Meanwhile, the green cluster grouped keywords, such as "stroke", "upper limb", "clinical article", "procedures", and "recovery of function", highlighting a major focus on post-stroke recovery, particularly functional rehabilitation of the upper limbs.

The blue and purple clusters indicated a more clinical and physiological approach, with the emergence of words such as "daily life activity", "therapy effect", "Parkinson's disease", "motor performance", and "neurorehabilitation". The blue color on the outer part indicated that this theme was studied earlier (around 2014-2017). The yellow cluster represented a new direction that has gained popularity in recent years, with terms like "video games", "pilot project", and "user interface". This indicated a shift toward using interactive, game-based VR technology to enhance patient participation and to support the development of prototypes and feasibility studies.

Interestingly, a few keywords, such as "AI", "convalescence", and "technology", were strategically positioned to connect several clusters, indicating that interdisciplinarity—including the integration of artificial intelligence and digital innovation—is beginning to play an important role in this literature (Figure 3) [228-232].

Based on the keyword visualization, topics such as "VR procedures physiology", "neurorehabilitation treatment outcome", and "stroke rehabilitation" appeared as the densest (marked in dark yellow). Meanwhile, keywords, such as "quality of life", "patient satisfaction", and "self-care", which are also quite prominent, highlighted the importance of the principles of beneficence and non-maleficence in ensuring that telerehabilitation interventions genuinely improve patient well-being without causing psychological or physical harm. On the other hand, keywords, such as "digital health", "telehealth", and "home rehabilitation", which are less prominent (light yellow), opened up new research opportunities in bioethical reviews, particularly regarding patient data privacy, digital system security, and the challenges of implementing technology in home environments that may be less supervised (Figure 4) [233-363].

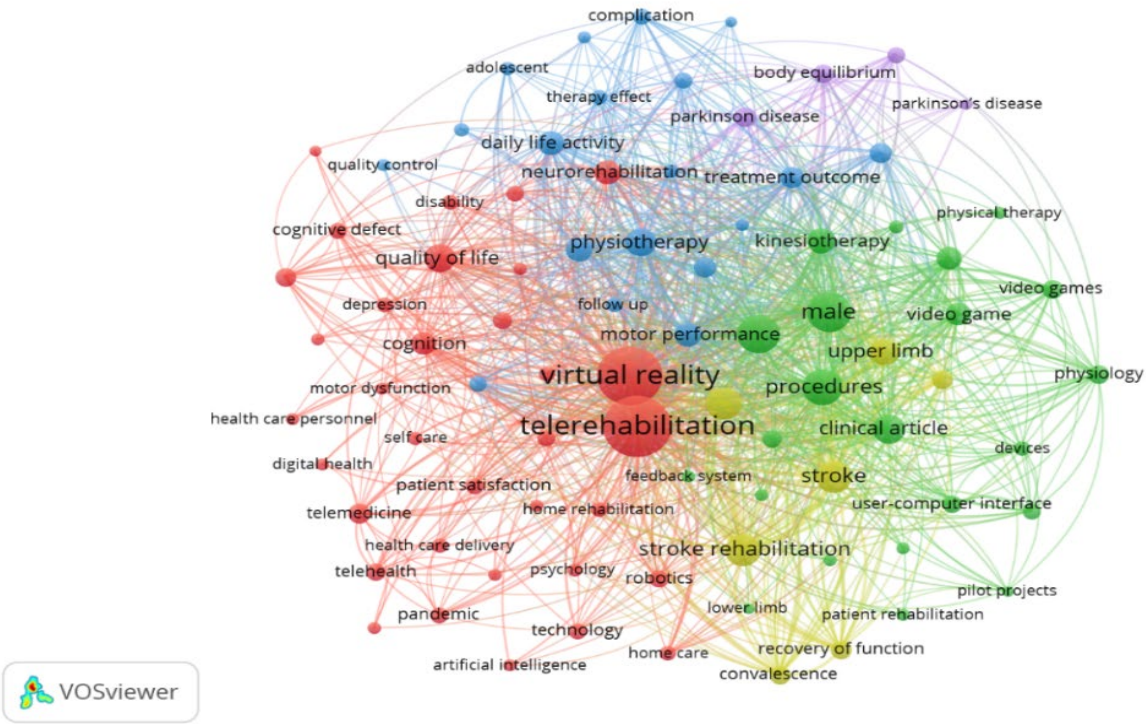

Figure 3. Telerehabilitation and virtual reality research trends (2015-2024)

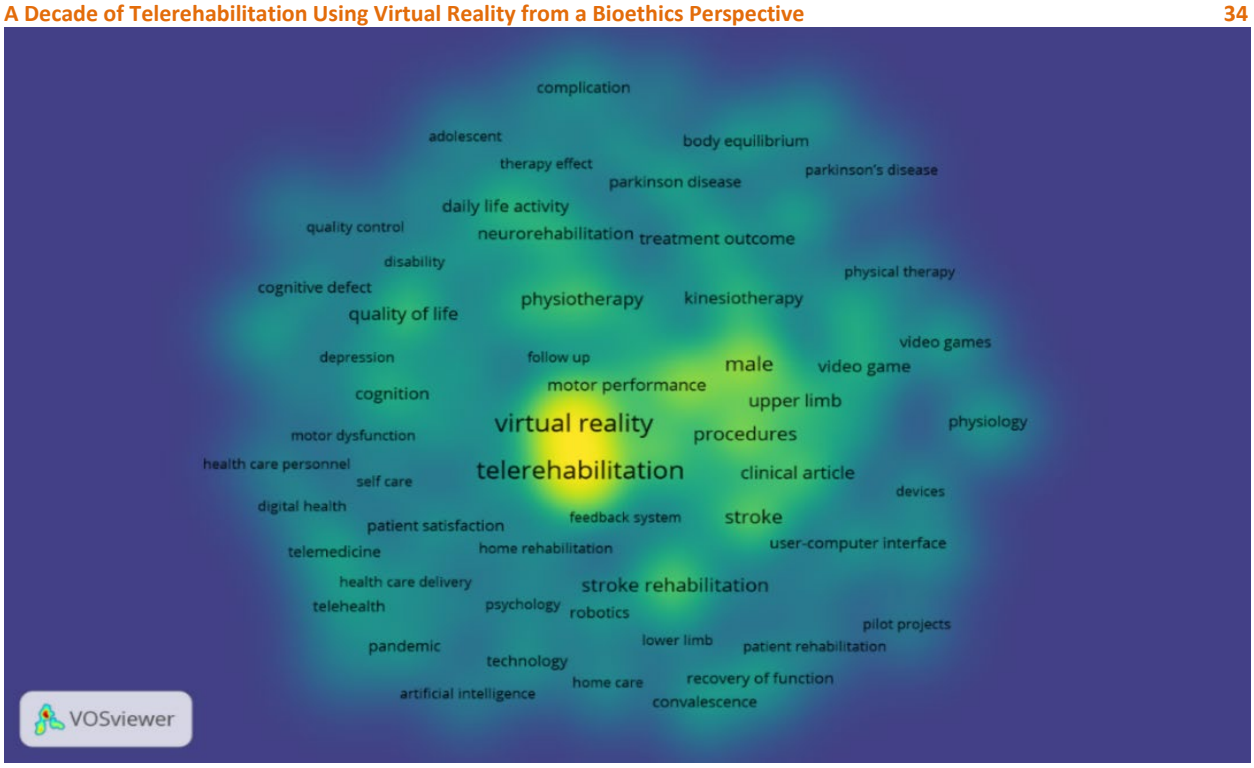

Figure 4. Conceptual map of bibliometric analysis, indicating focus and research opportunities in virtual reality-based telerehabilitation

Discussion

This study analyzed the development of VR-based telerehabilitation over the past decade through a bibliometric approach based on 323 studies. The integration of VR into telerehabilitation practices has brought about a significant revolution in digital health over the past decade [345]. Based on a bibliometric analysis of 323 scientific publications from 2015 to 2024, research in this field remains heavily dominated by studies on clinical effectiveness and technical implementation [346]. Terms, such as "neuro-rehabilitation outcomes", "therapeutic effectiveness", and "cost efficiency" emerged as the most prominent keywords, while bioethical concepts, such as "informed consent", "data privacy", and "equitable access" were scarcely discussed. This reflects a serious imbalance between technological advancements and ethical considerations in the development of VR-based telerehabilitation [347]. This study can fill a gap in the literature by comprehensively examining the ethical aspects of VR-based telerehabilitation, from patient rights to healthcare providers' responsibilities in the digital age [237-240].

Keyword network mapping using VOSviewer revealed a rather concerning pattern. The dense and interconnected research clusters were almost entirely focused on technical and clinical aspects, such as "upper extremity rehabilitation," "motor performance," and "post-stroke recovery." Meanwhile, ethical issues emerged as isolated nodes that were not well integrated into the main research network. As highlighted by Gopal *et al.* [1] in their discussion of bioethical principles, the four main pillars of medical ethics (autonomy, justice, beneficence, and non-maleficence) should serve as the foundation for developing health technology [348]. An analysis of the most frequently cited studies further reinforced this finding. For example, Dobkin's [136] study, the most influential with 234 citations, although it successfully demonstrated the equivalence of VR effectiveness to conventional therapy, completely overlooked patients' understanding of the technology used [349]. However, according to the theory of informed consent developed by Lindberg *et al.*, a comprehensive understanding of the risks and benefits of a medical intervention is an absolute requirement for patient autonomy [350]. A similar phenomenon is observed in the study by Pot-Kolder *et al.*, which focuses on cost savings but overlooks the psychological impact of long-term VR use [351]. This is in line with the sharp criticism by Rubeis *et al.* in their book "Deep Medicine" of the tendency toward "solutionism" in digital health, where technical solutions are often considered the answer to all problems, without regard for the ethical complexities that accompany them [352]. For example, VR systems that use machine learning algorithms to automatically customize therapies could contain hidden biases against certain patient groups, as cautioned by Gianfrancesco et al. in their study on algorithmic bias in health prediction tools [353].

The geographical distribution of research output showed a pronounced dominance by developed countries, with the United States and Italy alone

accounting for 44% of all publications. This reflects greater inequality in actual access to VR-based telerehabilitation technologies [343, 344]. Around 74% of rehabilitation facilities in low- and middle-income countries lack access to basic VR devices, let alone advanced systems used in key studies [356, 357]. This problem is exacerbated by supporting infrastructure factors. As Bhuiyan revealed in their systematic review, even "low-cost" VR solutions still require stable internet connectivity and adequate supporting devices—requirements that are often difficult to meet in rural or remote areas [358]. This creates what Shaban calls a "second-order digital divide," where inequality exists not only in access to technology but also in the ability to utilize it optimally [359]. The cultural aspect is also a serious challenge that is often overlooked. Most VR systems are designed with the cultural assumptions and digital literacy of Western society in mind, as seen in the interface design of existing Rehabilitation Internet of Things (RIoT) systems [360]. As reminded by Moor [285] in the cultural dimension theory, the effectiveness of a health intervention is strongly influenced by its compatibility with local cultural values [361]. Brazil's experience with the Telehealth SUS program, as shown by Naderbagi *et al.*, indicates that cultural adaptation to digital health technologies can significantly improve patient acceptance and adherence [362].

Recent trends in VR telerehabilitation research, as seen from the emergence of the keyword clusters "patient satisfaction" and "video games", point to efforts to make therapy more engaging and interactive. However, this approach risks reducing the supposedly holistic rehabilitation process to mere fragmented "technical solutions" [363]. According to Lewkowicz *et al.*, the importance of the human connection between patient and therapist in chronic back pain rehabilitation underscores that technology should not replace essential therapeutic interactions altogether [364]. Regarding VR telerehabilitation, as Manseau notes, there is a significant risk of dehumanizing healthcare when digital interfaces completely replace human interaction [365]. As shown by Drossman & Ruddy, the quality of communication between healthcare providers and patients contributes significantly to clinical outcomes [366].

Accordingly, we offer several strategic recommendations to address the gap between technological innovation and ethical considerations [367]. First, it is necessary to develop an "ethics-by-design" framework in the development of VR systems for telerehabilitation. This concept, adapted from the privacy-by-design principle by Spindler *et al.*, emphasizes the need to integrate ethical considerations from the early stages of technology design [368]. For example, VR systems should include specialized modules that ensure patient understanding before obtaining consent, using adaptive methods based on the user's digital literacy level [369]. Second, a more inclusive financing model is needed to address the global gap. Cross-subsidization and differential pricing schemes based on the country's economic capabilities can be a solution [370]. India's experience in developing a low-cost telemedicine system can serve as a reference for developing more affordable VR [371]. Third, it is important to develop a hybrid model that blends technological advantages with a humanistic touch; the optimal ratio might be 70% VR sessions and 30% face-to-face interaction (in person or via teleconference) to maintain the therapeutic relationship [372, 373].

The development of VR-based telerehabilitation in the past decade has been dominated by technical and clinical studies. At the same time, ethical aspects, such as patient consent, fairness of access, and data privacy protection, have not received adequate attention. This imbalance is evident in the dominance of research by developed countries, reflecting a global gap in the use of cutting-edge rehabilitation technologies. The main findings point to three critical challenges, including the dominance of technocratic approaches that ignore ethical dimensions, the digital divide between developed and developing countries, and the risk of reducing humanism in rehabilitation practices. Overcoming these challenges requires an integrated approach that combines technological excellence with in-depth ethical considerations.

Conclusion

VR-based telerehabilitation advances mainly through technical and clinical research, while ethical issues, such as patient consent, equitable access, and data privacy, remain insufficiently addressed.

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Ethical Permissions: This section is not applicable, as the researcher used anonymized secondary data that was publicly available. There was no direct interaction with research participants, thus negating the need for additional ethical clearance.

Conflicts of Interest: The authors declared no conflicts of interest.

Authors' Contribution: Lestari RD (First Author), Introduction Writer/Methodologist/Main Researcher/Discussion Writer/Statistical Analyst (50%); Lazuardi L (Second Author), Methodologist/Assistant Researcher/Discussion Writer (25%); Darwito D (Third Author), Methodologist/Assistant Researcher/Discussion Writer (25%)

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