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Review Article

Trade-offs between Accessibility and Practicality in Global Telemedicine: A Systematic Review

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Abstract

Background: Telemedicine is increasingly vital in healthcare, offering remote consultations via message-based and video call-based platforms. These methods improve healthcare accessibility, particularly when in-person visits are limited. Telemedicine is increasingly vital in healthcare, offering remote consultations via message-based and video call-based platforms. These methods improve healthcare accessibility, particularly when in-person visits are limited.

Methods: A systematic search was conducted in ScienceDirect, PubMed, and up to August 2024. Studies evaluating the accessibility and practicality of global telemedicine were evaluated. From initial 439 records, 19 studies were finally in this systematic review. Studies were reviewed thoroughly with quality appraisal using the Newcastle Ottawa Scale, in which those rated for high quality studies were included.

Results: Most studies (74%) were from high-income countries, notably the United States (26%) and Denmark (11%). Observational studies dominated (95%), focusing on follow-up consultations (47%) and diagnostic services (32%), particularly in general care (32%), neurology (11%), and surgery (5%). Research peaked in 2022 (32%) during the COVID-19 pandemic. Common platforms included WhatsApp, AnyDesk, and QliqSOFT. Accessibility was the primary focus in 53% of studies, while 47% addressed feasibility. Challenges like technological barriers and privacy concerns were particularly noted in lower-income regions.

Conclusion: Telemedicine has enhanced healthcare accessibility and demonstrated feasibility. However, technological limitations and remote consultation challenges persist, particularly in lower-income regions. Continued research is needed to optimize telemedicine and equitable access.

Keywords: Telemedicine; Accessibility; Message; Video call

Introduction

Improving communication is crucial in the dynamic healthcare industry to enhance patient outcomes and operational efficiency. Technological advancements have increased the demand for healthcare services that are both highly effective and easily accessible. Telemedicine facilitates the delivery of healthcare treatments remotely, providing convenience and

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straightforward accessibility. Initially developed for specific applications, telemedicine has evolved into a standard healthcare service that can be accessed through secure communication channels and mobile devices, such as video calls, phone calls, text messaging, and mobile applications (1).

Telemedicine allows individuals to access clinicians, receive mental health therapies, and manage chronic diseases (2). Recent polls indicate that 76% of hospitals in the United States use telemedicine to facilitate communication between physicians and patients, and at least 42% of Americans have used telemedicine for consultations (3). Telemedicine eliminates the need for physical visits to healthcare institutions, thereby optimizing daily schedules, improving operational efficiency, and saving time (4).

Telemedicine offers significant benefits to rural and remote regions that are difficult to access. However, these services face challenges such as inadequate internet connectivity, state-specific regulations that hinder service provision, and patient concerns about the security of health data during consultations (5). Additionally, the cost and convenience of patient access are influenced by reimbursement issues and variations in insurance coverage.Telemedicine presents both advantages and drawbacks. Among the limitations are the inability to perform physical examinations, infrastructure costs, privacy and data security concerns, and the challenge of ensuring patient compliance. Despite these challenges, telemedicine provides notable benefits, such as reducing healthcare access disparities for remote populations by up to 30% (3). Furthermore, telemedicine is 15% less expensive than in-person visits and supports continuity of care (6). In mental health care, 80% of patients report feeling improved after receiving telemedicine care (7). Additionally, telemedicine has reduced hospitalizations for chronic diseases by 20% due to more frequent and regular remote monitoring and consultations (8).

To overcome its obstacles, telemedicine must be made accessible fairly. This includes enhancing telecommunications infrastructure in rural and underdeveloped areas and providing comprehensive education and technical guidance for both patients and healthcare professionals. Protecting patient data through improved cybersecurity measures is essential. Additionally, effective reimbursement systems are needed to ensure telemedicine accessibility, affordability, and comprehensive insurance coverage (9).

Telemedicine significantly improves access to high-quality healthcare. To maximize its benefits, it is crucial to address existing constraints and expand available options. However, currently, there is no updated review to summarize the trade offs between accesibility and practicality of global medicine in the past few years. Hence, this systematic review aimed to evaluate the efficacy, accessibility, and user satisfaction of global telemedicine.

Methods

The protocol of this systematic review is available in PRISMA Checklist in Supplementary Material. The objective of this systematic review was to assess the utilization of telemedicine in patient care and health centers according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The review focused on the use of messaging and video call technologies and examined accessibility. We conducted an exhaustive search of four electronic databases: Scopus, PubMed, and ScienceDirect. The search strategy employed the keywords "telemedicine," "accessibility," "message," and "video call," and applied an open-access filter to ensure that all articles under review were readily accessible.

The inclusion criteria for the articles were: [1] open access, [2] published between 2018 and 2023, and [3] focused on telemedicine. Two categories of articles were excluded: [1] review articles and [2] expert opinion articles. The Scopus and PubMed databases were searched on June 8, 2024, with filters applied for publication years from 2019 to 2024, language (English), and open

access. Scopus returned 98 results, while PubMed returned 374 results. The quality of the studies were evaluated using Newcastle Ottawa Scale. The scale rated studies from selection, comparison, and outcome. Studies were regarded high quality when given at least six out of eight stars.

Three authors (MT, WFR, JBS) independently extracted and organized the data into a structured spreadsheet. The extracted data included study features such as author, year of publication, and country, as well as population statistics like sample size and demographic information. Additionally, it included details about the telemedicine technology used, such as the type of technology and its application in patient care. The results were summarized descriptively using frequencies and percentages to provide a clear overview of the technologies employed, accessibility, and telemedicine use.

We included 19 papers published between 2019 and 2024. Our initial search across multiple databases, including ScienceDirect, PubMed, and Scopus, yielded 439 items. After removing duplicate entries, we screened the titles and abstracts of 414 records. From these, we excluded 376 studies that did not meet the inclusion criteria. We then assessed the full texts of 38 papers for suitability. However, we could not obtain one report, resulting in a final selection of 19 studies that met all inclusion criteria (Fig. 1). These selected papers provide a comprehensive assessment of the accessibility and feasibility of telemedicine, examining global trends and challenges across various healthcare settings.

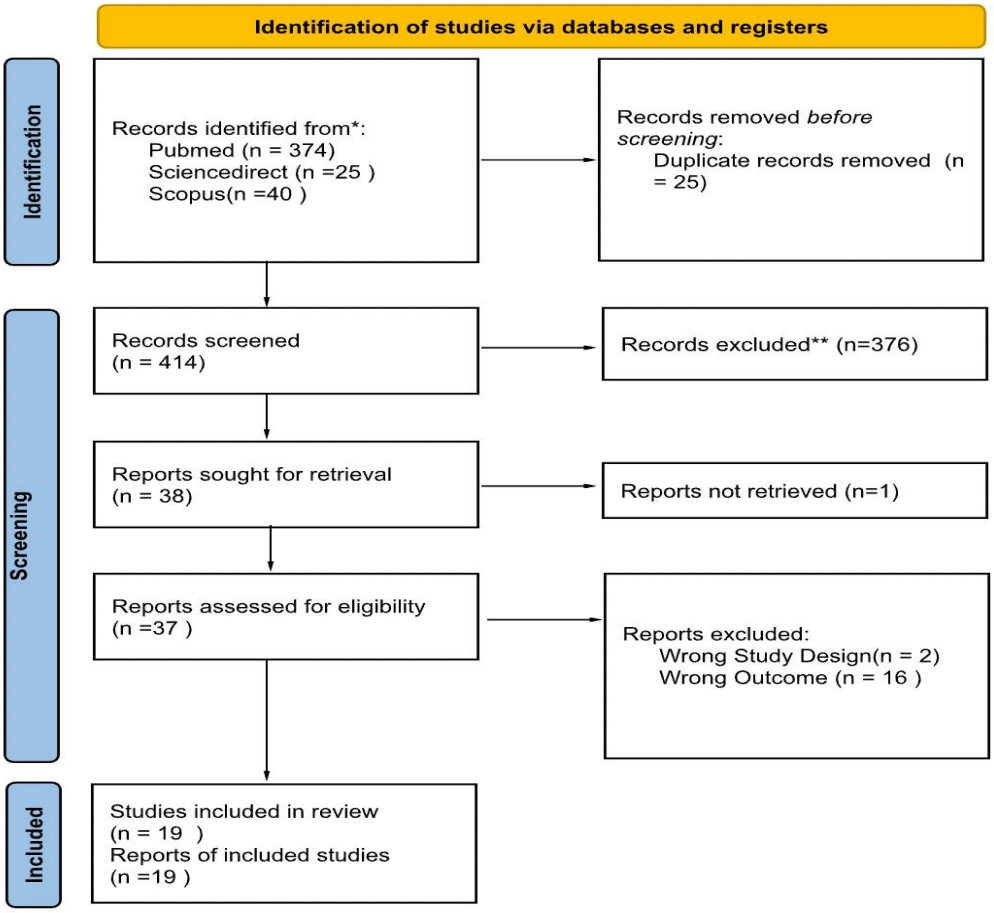

Fig. 1: PRISMA flow diagram of the study selection process

Results

The studies included in this review were predominantly observational (95%), consisting of cross-sectional surveys, qualitative research, and retrospective analyses. Only a small fraction (5%) employed experimental designs. The sample sizes varied widely, ranging from small-scale studies with as few as 20 participants (10) to large-scale studies involving millions of patients (11). The studies represented a broad age range from infants to elderly adults, reflecting telemedicine's broad applicability across different life stages. Gender distribution also varied, with some studies reporting a higher proportion of female participants, such as Lawford et al., which had 65% female participants (12). Geographically, majority of the studies (74%) were conducted in high-income countries, including the United States, Denmark, and Australia. Upper-middle-income countries contributed 16% of the studies, while lower-middle and low-income countries accounted for just 5% each. Table 1 summarizes the characteristics of the included studies and Table 2 shows the quality assessment of the included studies using the Newcastle Ottawa Scale.

Table 1: Characteristics of the included study

Author	Country	Income Level	Study Design	Total Patients	Median Age (years)	Female (n/%)	Male (n/%)
Checchter, M.(31)	Brazil	Upper Middle Income	Non-randomized clinical trial	187	37.6	-	-
Kim, E.(32)	United States	High Income	Inductive thematic qualitative study	20	44	15 (75)	5 (25)
Asukile, M.(33)	Zambia	Low Income	Retrospective single-center observational study and cross-sectional survey.	323	46.4 (group 1) / 50.3 (group 2)	121 (37.5)	202 (62.5)
Lawford, B.J.(34)	Australia	High Income	Cross-sectional national survey	581	-	378 (65)	192 (33)
Gren, C.(35)	Denmark	High Income	Mixed-methods study	1.371	-	576 (42)	799 (58)
Fonner, V.A.(36)	United States	High Income	Formative acceptability and feasibility study	26	-	-	-
Gren, C.(37)	Denmark	High Income	Prospective quality improvement study	312	1.4	168 (54)	144 (46)
Barca, I.(38)	Italy	High Income	Retrospective observational study.	90	62.15	36 (40)	54 (60)
Bell, S.(39)	United Kingdom	High Income	Cross-sectional survey study	50	-	-	-
O'Neill, L.(40)	Ireland	High Income	Mixed methods study	48	58.9	27 (56)	21 (44)
Weiss Lucas, C.(41)	Germany	High Income	Cross-sectional study with surveys	56	59	27 (48)	29 (52)
Peralta, E.A.(42)	Dominican Republic	Upper Middle Income	Observational study	6.800	-	-	-

Table 1: Continued…

Tuot, D.S.(43)	United States	High Income	Qualitative improvement study	776	-	-	-
Pinyopornpanish, K.(44)	Thailand	Upper Middle Income	Qualitative study	213	32.26	125 (58.69)	88 (41.31)
Gummidi, B.(45)	India	Lower Middle Income	Mixed methods study	1.250	-	-	-
Saywell, N.L.(46)	New Zealand	High Income	A qualitative descriptive study	33	-	-	-
Chu, J.N.(47)	United States	High Income	Quality Improvement (QI) intervention	1.427	75.6	595 (58)	433 (42)
Bhadola, S.(48)	United States	High Income	Quality Improvement (QI) project	153	-	-	-
Solans, O.(49)	Spain	High Income	Retrospective descriptive cross-sectional study	5.844.804	44.96	-	-

Table 2: Quality assessment of the included study

Author, year	Selection (max. 4)	Comparability (max.1)	Outcome (max. 3)	Total
Chechter, M.(31)	3	1	3	7
Kim, E.(32)	3	1	3	7
Asukile, M.(33)	3	1	2	6
Lawford, B.J.(34)	4	1	2	7
Gren, C.(35)	4	1	3	8
Fonner, V.A.(36)	3	1	2	6
Gren, C.(37)	4	1	2	7
Barca, I.(38)	3	1	3	7
Bell, S.(39)	4	1	2	7
O'Neill, L.(40)	3	1	3	7
Weiss Lucas, C.(41)	3	1	3	7
Peralta, E.A.(42)	3	1	2	6
Tuot, D.S.(43)	2	3	2	7
Pinyopornpanish, K.(44)	4	1	3	8
Gummidi, B.(45)	3	1	3	7
Saywell, N.L.(46)	4	1	3	8
Chu, J.N.(47)	3	1	2	6
Bhadola, S.(48)	4	1	2	7
Solans, O.(49)	4	1	3	8

Fig. 2 summarizes the distribution of telemedicine studies by country. The United States leads with five studies, followed by Denmark with two. Other countries each contribute one study.

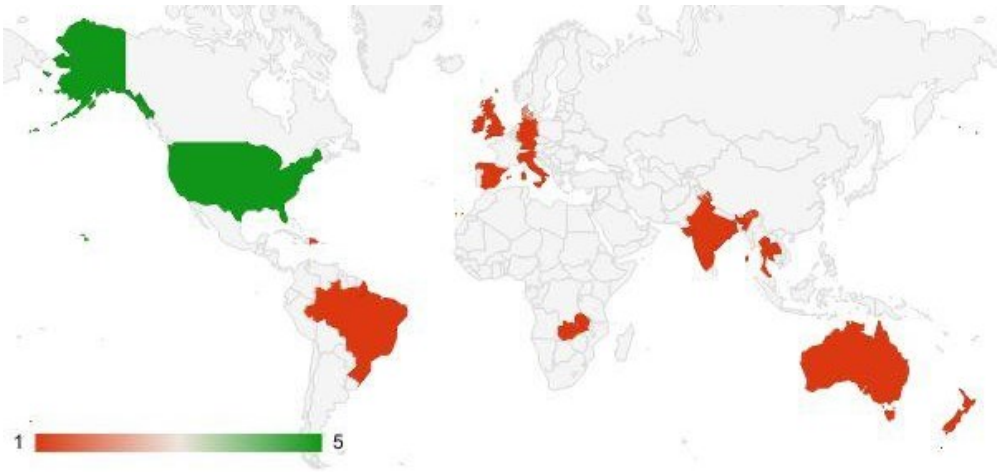

Fig. 2: Global Distribution of Telemedicine Studies by Country

Fig. 3 visualizes the distribution of telemedicine studies across different income levels according to World Bank classifications. Most studies come from high-income countries (74%), while lower-middle-income and upper-middle-income countries contribute 5% and 16%, respectively. Low-income countries contribute the least, highlighting a potential gap in telemedicine research in lower-income settings.

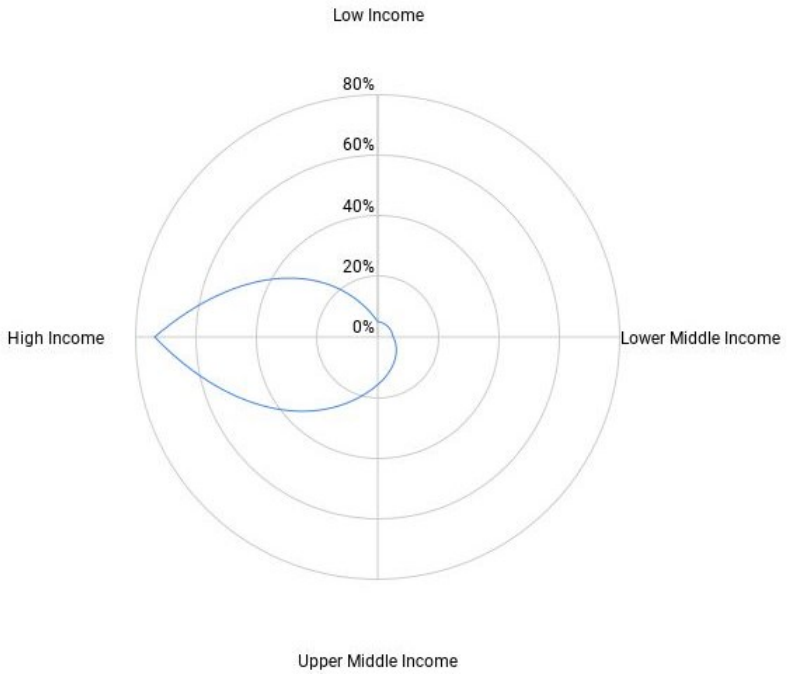

Fig. 3: Telemedicine Studies Distribution by Income Level

Fig. 4 presents the number of telemedicine studies published annually from 2019 to 2024. The data shows a peak in 2022 with six studies, reflecting increased interest and research in telemedicine during the COVID-19 pandemic. The trend indicates a continued focus on telemedicine, with a slight decrease in the number of studies in 2024.

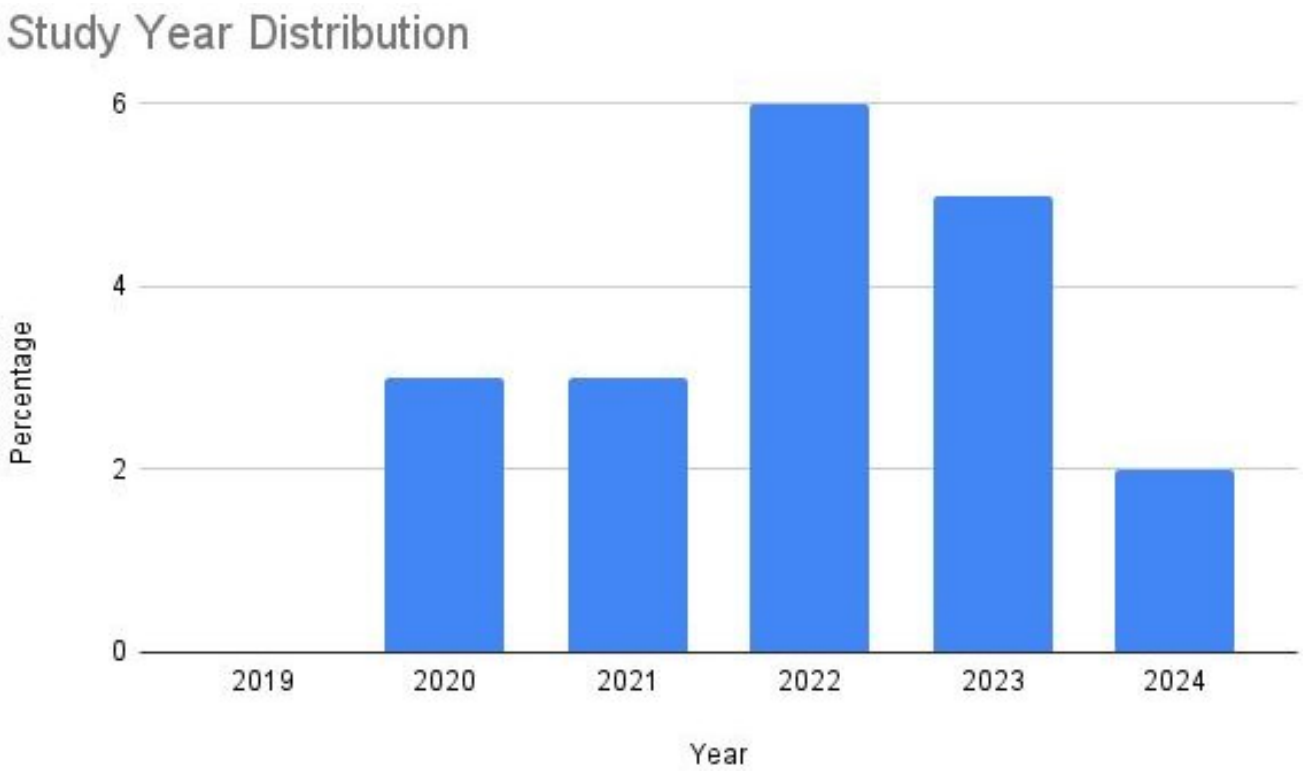

Fig. 4: Telemedicine Studies by Year (2019-2024)

Table 3 shows that telemedicine has been effectively implemented for follow-up consultations in 47% of cases, and for diagnostic and treatment services in 32%, demonstrating its adaptability across various departments such as general medicine, surgery, neurology, oncology, and pediatrics (11)(13). The research utilized a range of platforms, from basic video calls via WhatsApp and AnyDesk to advanced systems like QliqSOFT for secure messaging and psychotherapy (14). The program durations, spanning from a few months to two years, highlighted telemedicine's flexibility in meeting diverse healthcare needs (12)(15). Positive outcomes included increased healthcare accessibility, reduced logistical burdens, and high patient satisfaction. However, challenges such as privacy concerns and technological barriers underscore the need for further development (16).

Fig. 5 displays the distribution of telemedicine studies across various medical departments. The "General" category is the largest, accounting for 32% of the studies, followed by "Rehabilitation" and "Neurology," each representing 11%. Other departments, such as Surgery, Psychiatry, and Primary Care, each contribute 5%, highlighting telemedicine's versatility across diverse healthcare specialties.

Table 3: Function, department of usage, and platform for each study

Author	Purpose	Function	Department of Usage	Program Description	Platform	Duration (months)
Chechter, M. (31)	To evaluate the clinical outcomes of patients treated by telemedicine during the early stages of the COVID-19 pandemic, with a focus on reducing the severity of the disease, hospitalization rates, and disease transmission.	Diagnostic and treatment	General	Telemedicine consultations for COVID-19 management	WhatsApp video calls, AnyDesk	1
Kim, E.(32)	To deeply understand donor experiences and preferences using hybrid telemedicine video/in-person visits to ease access to donor evaluation or counseling.	Interview for Surgery	Surgery	Hybrid telemedicine/in-person model for living kidney donor evaluation	Video visits and in-person visits	15
Asukile, M.(33)	To assess the feasibility, acceptability, and benefits of a teleneurology clinic serving adults who usually attend the UTH neurology outpatient clinic during the COVID-19 pandemic.	Diagnostic and treatment	Neurology	Teleneurology visits for neurology outpatient appointments	Telephone, WhatsApp video calls, Zoom	2
Lawford, B.J.(34)	To investigate and compare perceptions about the efficacy and acceptability of allied health care delivered via telephone and video call for adults with disabilities during the COVID-19 pandemic.	Diagnostic and treatment	General	Allied health care services delivered via telehealth	Telephone and video calls	4
Gren, C.(35)	To investigate how video triage compared to telephone triage was experienced by parents and call-handlers and to evaluate call-handlers' participation in the video triage project.	Primary survey	Emergency	Video triage of children at a medical helpline	GoodSAM video streaming technology	18
Fonner, V.A. (36)	To understand patient and provider perspectives on the acceptability and feasibility of using text messaging and video calling for communication within an HIV clinic setting.	Follow-up consultation	Infectious disease	Bidirectional text messaging and video calling for patient-provider communication	QliqSOFT secure messaging app, standard SMS	None
Gren, C.(37)	To investigate the safety and feasibility of introducing video triage for young children with respiratory symptoms at a medical helpline and its impact on patient outcomes.	Primary survey	Pediatric emergency	Video triage for children with respiratory symptoms at a medical helpline	GoodSAM Instant-on-Scene browser-based streaming technology	13
Barca, I.(38)	To demonstrate the advantages of using telemedicine in managing outpatients with maxillofacial surgical pathologies during the COVID-19 pandemic.	Follow-up consultation	Plastic surgery	Telemedicine consultations for maxillofacial surgery patients	WhatsApp, Telegram	2
Bell, S.(39)	To evaluate the acceptability of telegenetics (remote genetic consultations) among families with genetic eye diseases and	Follow-up consultation	Genetics	Remote genetic consultations	Telephone and video calls	5

Table 3: Continued…

	assess patient satisfaction.					
O'Neill, L.(40)	To explore patient experiences and preferences regarding telehealth for cancer rehabilitation and to inform service development.	Follow-up consultation	Oncology	Telehealth for cancer rehabilitation	Telephone and video calls	13
Weiss Lucas, C.(41)	To investigate the openness to telemedicine among HGG patients compared to healthy controls and to explore the extent of telemedicine use among speech and language therapists.	Follow-up consultation	Rehabilitation	Digital assessment and therapy for communication disorders	General digital tools and platforms (not specified)	21
Peralta, E.A.(42)	To determine the effectiveness of teleconsultation in increasing access to mental health services during the COVID-19 pandemic.	Diagnostic and Treatment	Psychiatry	Mental health teleconsultations	Telephone service with calls, video calls, and text messages	2
Tuot, D.S.(43)	To increase the use of video visits in an urban safety-net delivery system by providing technical support to patients.	Diagnostic and Treatment	Primary care	Telehealth ambassador program to support video visits	Not specified	2
Pinyoporn panish, K.(44)	To explore the concerns of COVID-19 patients receiving care via telemedicine during home isolation.	Diagnostic and Treatment	General	Home isolation care with telemedicine support	Online text messaging platform	2
Gummidi, B.(45)	To assess the perceptions about COVID-19, the impact of the lockdown on access to health services, and continuity of care for NCDs.	Follow up consultation	General	Teleconsultations for non-communicable disease management	Mobile phone-based consultations	9
Saywell, N.L.(46)	To investigate participants' experiences with the ACTIV telerehabilitation program and their perceptions of its acceptability and utility.	Follow up consultation	Rehabilitation	ACTIV telerehabilitation program	Readily accessible technology (not specified)	6
Chu, J.N.(47)	To promote equitable access to telemedicine for vulnerable older patients during the COVID-19 pandemic by helping them access video visits.	Follow up consultation	General	Video Visits for Elders Project (VVEP)	Zoom	2
Bhadola, S.(48)	To evaluate the feasibility of hybrid consultations that combined televisits and abbreviated in-person visits for neuromuscular referrals, aiming to improve healthcare access among underserved populations.	Follow up consultation	Neurology	Hybrid consultations for neuromuscular referrals	Video-enhanced televisions, audio-only televisions	6
Solans, O.(49)	To analyze the profile of citizens using the eConsulta tool and understand their usage patterns before and during the COVID-19 pandemic.	Primary survey	General	eConsulta teleconsultation tool	Asynchronous, two-way teleconsultation tool	24

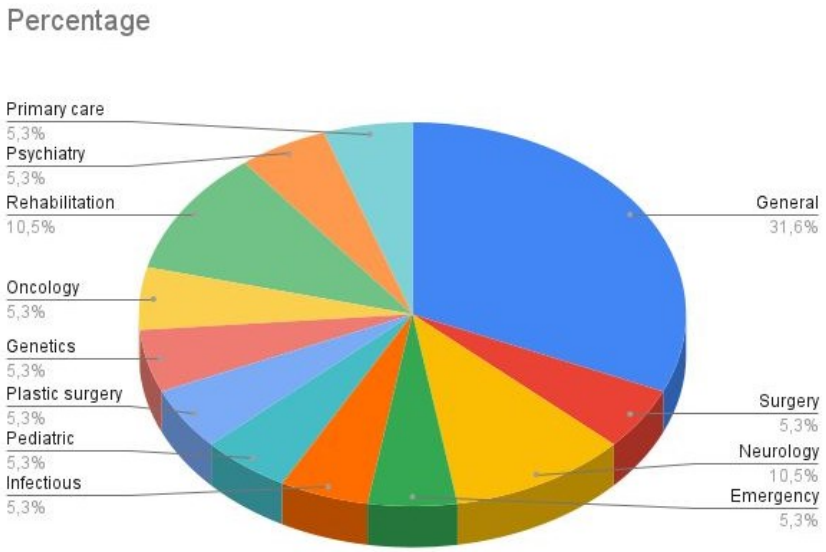

Fig. 5: Distribution of telemedicine studies by medical department

Fig. 6 categorizes telemedicine studies based on their primary function. Most of the studies (47%) focus on follow-up consultations, followed by diagnostic and treatment services at 32%. Primary surveys account for 16% of the studies, while interviews for surgery represent the smallest portion at 5%. This distribution highlights the pivotal role of telemedicine in ongoing patient care and diagnostics.

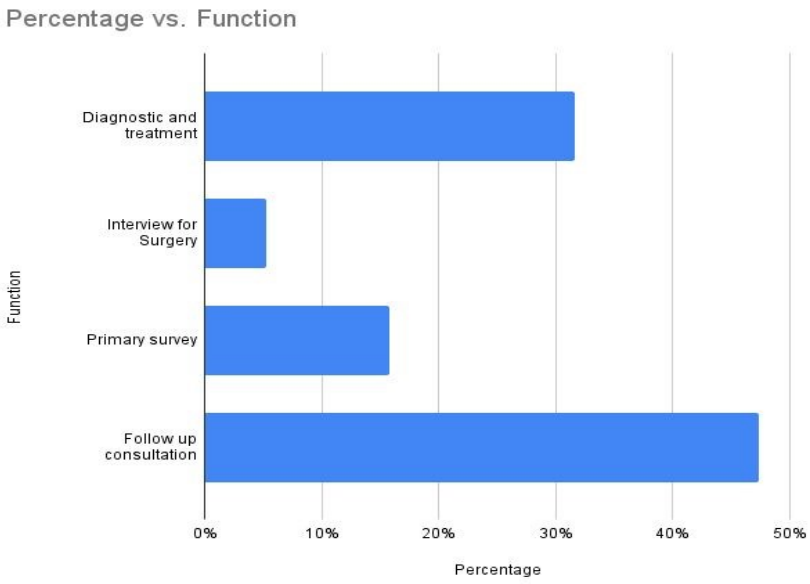

Fig. 6: Functional distribution of telemedicine studies

Studies focusing on accessibility (53%) highlighted reduced logistical constraints and greater scheduling flexibility, despite challenges such as privacy concerns and the need for occasional in-

person visits (11)(17). Research oriented toward feasibility (47%), particularly during the COVID-19 pandemic, found telemedicine beneficial in managing healthcare services and reported high satisfaction ratings, despite issues with technology such as platform usability (12)(13)(18). Common obstacles identified in the research, especially in lower-income areas or among older adults (16)(19), included limitations in remote physical assessments and technological issues. High-income countries have generally experienced smoother integration and higher patient satisfaction (18)(20), indicating that the success of telemedicine largely depends on the quality of technology infrastructure and its capacity to address specific challenges. Table 4 summarizes the main outcomes and limitations of the included studies.

Table 4: Main outcomes and limitations for each study

Author	Positive aspect of the program	Problems during the program	Conclusion	Outcome Type
Kim, E.(32)	Reduced logistical burdens, enhanced scheduling flexibility for kidney donors.	Privacy and security concerns, need for in-person visits.	Improved access and convenience for donor evaluation.	Accessibility
Barca, I. (38)	High satisfaction with telemedicine in maxillofacial surgery, reduced travel burden.	Limited ability to perform physical examinations.	Effective for follow-up and urgent consultations, reduces risk of transmission.	Accessibility
Bell, S. (39)	High satisfaction with telegenetics, but preference for face-to-face consultations.	Preference for in-person consultations over remote ones.	Effective for genetic eye disease consultations, improves access.	Accessibility
O'Neill, L. (40)	High willingness to use telehealth for cancer rehabilitation, noting benefits.	Issues with internet connectivity and IT skills.	Accepted and effective for cancer rehabilitation, needs complementary in-person care.	Accessibility
Weiss Lucas, C. (41)	High acceptance of digital participation by HGG patients.	Limited use by therapists despite benefits.	Potential to improve access for brain tumor patients.	Accessibility
Peralta, E.A. (42)	Increased access and high engagement in mental health services via teleconsultation.	Technological challenges in reaching individuals without access.	Effective for timely mental health care, suggesting continued use post-pandemic.	Accessibility
Pinyopornpanish, K. (44)	Increased access and patient engagement in home-isolated COVID-19 care.	Technological barriers and patient uncertainty.	Effective support for home-isolating patients, need for improved systems.	Accessibility
Gummidi, B. (45)	Increased access and high patient satisfaction with teleconsultations for NCD management.	Technological barriers, limited physical examinations.	Effective alternative for NCD management, need for addressing technological barriers.	Accessibility

Table 4: Continued…

Chu, J.N. (47)	Promoted equitable access to care via technology for older patients.	High cancellation and decline rates for video visits.	Effective for promoting access, need to address access to devices and digital literacy.	Accessibility
Solans, O. (49)	Tripled usage of the eConsulta service during the COVID-19 pandemic.	Decrease in conversations initiated by higher-income urban users.	Effective for maintaining healthcare access, need for equitable access improvements.	Accessibility
Chechter, M. (31)	Effective early-stage COVID-19 treatment via telemedicine.	Worsening symptoms in patients not following the protocol.	Reduced hospitalizations and face-to-face consultations.	Feasibility
Asukile, M. (33)	High satisfaction with teleneurology visits.	Refusal of televisits due to new symptoms or technology limitations.	Feasible and acceptable in resource-limited settings.	Feasibility
Lawford, B.J. (34)	High satisfaction with allied health telehealth but barriers to future use remain.	Some participants faced difficulties using the technology.	Positive experiences, need to address barriers for wider adoption.	Feasibility
Gren, C. (35)	High satisfaction with video triage and reduced unnecessary hospital visits.	Technical issues and increased call duration.	Effective for reducing hospital visits and improving satisfaction.	Feasibility
Fonner, V.A. (36)	High acceptability of text messaging and video calling in HIV care.	Concerns about increased workload and potential impersonal communication.	Convenient and acceptable for communication, need to address barriers.	Feasibility
Gren, C. (37)	High feasibility and acceptability of video triage, reduced hospital assessments.	Longer call duration for video triage compared to telephone triage.	Safe and feasible, potential for optimizing hospital referrals.	Feasibility
Tuot, D.S. (43)	High completion rate of video visits with technical support, positive feedback.	Challenges in engagement, technological barriers.	Feasible and effective for increasing video visit usage among low-income patients.	Feasibility
Saywell, N.L. (46)	High acceptance and increased autonomy with telerehabilitation.	Technological barriers and initial resistance to remote physiotherapy.	Feasible and accepted for stroke recovery, promotes independence.	Feasibility
Bhadola, S. (48)	Lower no-show rates and increased video-enhanced televisits.	Lower completion rates for lab and imaging studies in hybrid consultations.	Feasible for neuromuscular referrals, equity focus needed for future telehealth.	Feasibility

Discussion

Impact of Message-Based and Video Call-Based Telemedicine on Healthcare Accessibility and Feasibility Across Socioeconomic Contexts

The growing adoption of telemedicine modalities, particularly message-based and video call-based systems, has been crucial in expanding healthcare accessibility across various socioeconomic contexts. Studies reviewed, including those by Gren et al., and Kim et al., indicate that video call-based telemedicine offers more interactive consultations, which are beneficial for comprehensive care delivery, especially in high-income regions with robust digital infrastructure. In these areas, the availability of high-speed internet and advanced digital literacy contribute to the success of video telemedicine, leading to higher patient satisfaction and improved health outcomes (11)(21).

Conversely, in lower-income regions where digital infrastructure is often underdeveloped, message-based telemedicine, as explored by Asukile et al., and Peralta et al., emerges as a more feasible solution (18,22). These regions benefit from the lower bandwidth requirements of message-based systems, which facilitate essential healthcare communication. Another study further highlight that in areas with limited internet connectivity, video call-based telemedicine often fails, making message-based systems critical for maintaining healthcare access (23). However, prior study suggest that targeted interventions, such as subsidized internet services, could enhance the feasibility of telemedicine even in resource-limited settings (24).

Thus, the effectiveness of telemedicine modalities is closely tied to the socioeconomic context. In high-income regions where infrastructure supports advanced technologies, video telemedicine is more feasible and effective. In contrast, message-based telemedicine serves as a vital, albeit sometimes limited, alternative in lower-income areas.

Primary Barriers to Telemedicine Implementation in Lower Income Regions and Their Effects on Accessibility and Feasibility

Studies indicate that primary barriers in lower-income regions include inadequate digital infrastructure and limited digital literacy, which severely restricts the feasibility of implementing advanced telemedicine solutions like video calls (18). These barriers result in a greater reliance on simpler, message-based telemedicine systems. Another study supports this, noting that poor digital infrastructure and high technology costs in rural India make advanced telemedicine solutions less viable, leading healthcare providers to rely on basic communication methods (24).

Additional challenges, such as high costs for devices and internet services, along with concerns over data security, further exacerbate the problem, making widespread telemedicine accessibility difficult in these regions (9,19). This results in a fragmented healthcare delivery system, where only basic consultations can be effectively managed, leaving significant gaps in care, especially for complex health needs.

However, some studies suggest that these barriers can be mitigated. Previous study by El-Mouelhy et al., discuss how community-based initiatives in certain lower-income regions have successfully improved telemedicine feasibility through subsidized internet services and digital literacy programs. This indicates that while barriers exist, they can be overcome with targeted interventions (25).

Patient Satisfaction and Outcomes Between Message-Based and Video Call-Based Telemedicine

Patient satisfaction and healthcare outcomes vary significantly between message-based and video call-based telemedicine, as noted by previous studies (8, 26). Video call-based telemedicine generally results in higher patient satisfaction because it closely mimics in-person consultations, allowing for real-time interaction and more nuanced communication. This modality is particularly effective in specialties requiring detailed dis-

cussions, such as mental health care and chronic disease management.

However, in settings where infrastructure limits video calls, message-based telemedicine, while less interactive, still provides essential access to healthcare. Studies by Peralta et al., and Pinyopornpanish et al., indicate that message-based telemedicine is well-received for follow-up consultations and routine care, although it may not deliver the comprehensive care achievable with video calls (27)(28). Osei et al. found that patients in these settings often prefer message-based systems for routine care or follow-up consultations, where the simplicity and lower resource demands outweigh the benefits of video calls (29). This challenges the notion that video telemedicine is always superior, suggesting that patient preferences can vary depending on the context.

Telemedicine's Role in Reducing Logistical Burdens and Improving Healthcare Access During Public Health Emergencies including COVID-19

During the COVID-19 pandemic, telemedicine significantly reduced logistical burdens by enabling healthcare delivery without physical presence, thus minimizing infection risks. Previous studies illustrate how telemedicine, particularly video calls, facilitated the continuation of critical healthcare services, including diagnostic and treatment consultations (13, 17). Message-based telemedicine offered an alternative means of maintaining healthcare communication, especially in regions where video call infrastructure was lacking (7,30).

However, the effectiveness of telemedicine during emergencies is not universal. Study by Rahman and Zaman highlight challenges in Bangladesh, where inconsistent digital infrastructure and cultural barriers limited the effectiveness of video call-based telemedicine, leading to additional logistical issues (26). This suggests that while telemedicine was crucial in maintaining healthcare access during the pandemic, its effectiveness varied depending on regional infrastructure and the specific telemedicine modality used.

This systematic review has several limitations that may affect the generalizability and depth of the findings. First, the majority of included studies are from high-income countries, potentially overlooking the unique challenges faced in lower-income regions. The heavy reliance on observational studies, which comprised 95% of the included research, limits the ability to draw definitive causal conclusions about the effectiveness of telemedicine across different settings. Additionally, the diversity in telemedicine platforms, healthcare settings, and study designs introduces variability that complicates the comparison and synthesis of results. Future research should aim for a more inclusive representation of studies from low- and middle-income countries, employ more robust experimental methodologies, and consider the long-term implications of telemedicine to provide a more comprehensive understanding of its impact.

Conclusion

Telemedicine has significantly improved healthcare accessibility, especially in high-income countries where robust digital infrastructure supports effective video consultations, leading to better patient outcomes. However, in lower-income regions, technological limitations and lower digital literacy necessitate reliance on message-based systems. While these systems are essential, they lack the interactivity of video calls. These challenges highlight the need for continued research and targeted interventions to optimize telemedicine and ensure equitable access to healthcare across all socioeconomic contexts.

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Conflicts of Interest

The Authors declare that there is no conflict of interest.

Ethics and Consent

Not applicable.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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