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Opportunities for Hospital-Based Telemedicine Development: A Systematic Review

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Abstract

Purpose: This study aims to examine the adoption, hospital integration, and revenue implications of telemedicine, with specific emphasis on Indonesia where hospital-based telemedicine services remain less developed than commercial platforms. The review focuses on identifying key drivers of user acceptance, organizational readiness, and financial outcomes to support strategic telemedicine development in hospitals.
Methodology: A systematic review was conducted using a comprehensive search of open-access empirical studies published from 2020 to 2025. Twenty-six eligible articles were identified and analyzed. Data were synthesized thematically across three domains: factors influencing user adoption, hospital-level implementation processes, and the economic impact of telemedicine services. The review integrates both global and Indonesian evidence to provide a comparative perspective.
Results: Findings show that perceived usefulness, trust, and digital readiness consistently shape patient and provider adoption of telemedicine. Successful hospital integration is supported by adequate infrastructure, clear governance, and alignment with clinical workflows. Several studies report cost-effectiveness and increased service utilization, indicating potential for enhanced hospital revenue, although economic evidence from Indonesian hospitals is still emerging.
Applications/Originality/Value: This review offers practical insights for policymakers and hospital administrators planning long-term institutionalization of telemedicine. It is original in combining global and Indonesian contexts while emphasizing the financial sustainability of hospital-based telemedicine services.

Introduction

Telemedicine is a health-related service through communication and information technologies. It has wide range of uses, including online patient consultations, remote control, telehealth nursing, and remote physical and psychiatry rehabilitation.(Haleem et al., 2021)

The COVID-19 pandemic fundamentally transformed the way healthcare systems deliver services worldwide, accelerating the adoption of telemedicine as a core modality for patient care. Initially introduced as a temporary measure to maintain continuity during lockdowns, telemedicine has since evolved into a critical component of modern health systems, enabling remote consultations, chronic disease management, and post-discharge monitoring. In high-income countries, hospital-based telemedicine programs have rapidly scaled, supported by policy reforms, reimbursement incentives, and digital infrastructure development (Gayot et al., 2022; Tilhou et al., 2024). These initiatives have demonstrated measurable benefits in clinical efficiency, patient satisfaction, and cost-effectiveness(Nguyen et al., 2024).

Telemedicine is not a novel concept in Indonesia, having first been introduced in 1985, although most early activities were poorly documented. With the rapid increase in smartphone use, interest and utilization of telemedicine services have significantly increased and The COVID-19 pandemic further accelerated this growth, as the need for remote communication technologies surged to maintain healthcare delivery while adhering to physical distancing measures(Indrayathi et al., 2023). In Indonesia, the telemedicine landscape is largely dominated by private commercial platforms such as Halodoc and Alodokter, while hospital-based telemedicine initiatives are comparatively limited(Sari et al., 2024)

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Hospitals face multiple structural challenges including limited interoperability between hospital information systems, unclear reimbursement policies, and insufficient clinician digital readiness which constrain large-scale institutional adoption(Nugroho et al., 2024). Nonetheless, the potential benefits are substantial. Telemedicine offers hospitals the opportunity to extend access to care beyond physical boundaries, reduce congestion in outpatient clinics, enhance patient satisfaction, and create new revenue streams through digitally mediated services(Liu et al., 2024; Susanti et al., n.d.)

Empirical research increasingly supports these prospects. Experimental and economic evaluations demonstrate that well-structured telemedicine programs can reduce unplanned hospitalizations and be cost-effective compared with standard care(Gayot et al., 2022). Similarly, another study developed a comprehensive cost-benefit framework for digital hospitals, showing that telemedicine integration contributes to financial sustainability when supported by appropriate investment and governance(Nguyen et al., 2024). However, studies from Indonesia highlight a gap between potential and practice while user adoption is high, institutional uptake remains fragmented, and financial evidence for hospital-based telemedicine is still emerging(Alexandra et al., 2021; Sari et al., 2024; Soelasih et al., 2025).

Despite growing global literature on telemedicine, few systematic reviews have examined its adoption, institutional integration, and revenue implications specifically within hospital contexts, particularly in LMICs. Addressing this gap is essential for guiding hospital administrators and policymakers toward evidence-based telemedicine strategies.

Therefore, this systematic review aims to synthesize empirical studies published between 2020 and 2025 that investigate determinants of telemedicine adoption, hospital integration, and financial or revenue impacts of telemedicine implementation. By integrating international and Indonesian perspectives, this review provides a comprehensive understanding of how telemedicine can evolve from a pandemic necessity into a sustainable hospital innovation strategy.

Methods

This systematic review was conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines.(Liberati et al., 2009) A systematic approach was employed to identify, screen, and synthesize recent empirical studies examining hospital-based telemedicine adoption and its financial or operational implications.

Study design and search strategy

The search strategy employed a combination of controlled vocabulary terms (e.g., MeSH) and free-text keywords, including "telemedicine," "telehealth," and "virtual care," in conjunction with "hospital" or "healthcare institution," as well as "adoption," "acceptance," "revenue," "financial impact," or "business model." Boolean operators and truncation were applied as appropriate to enhance search sensitivity and ensure comprehensive coverage of relevant studies. The search covered the period from January 2020 to March 2025, reflecting the surge of telemedicine research during and after the COVID-19 pandemic.

Data sources

A systematic search was conducted in the following databases: PubMed, Scopus, Web of Science, and Google Scholar. We also carried out hand searches from reference lists of retrieved studies.

Study Selection

All records retrieved from the database search were imported into a reference management tool, and duplicates were removed prior to screening. The review process was conducted in two stages. In the first stage, titles and abstracts were independently screened by two reviewers against predefined inclusion and exclusion criteria, which are described in **Table 1.** Articles were retained if they examined hospital-based telemedicine adoption, acceptance, or financial implications, with any discrepancies resolved through discussion to achieve consensus. In the second stage, full-text articles deemed potentially eligible were assessed in detail. Studies were excluded if they did not present empirical data, focused solely on commercial telemedicine platforms without hospital involvement, or failed to report outcomes related to hospital operations, patient or provider adoption, or financial considerations.

Table 1. Inclusion and Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Study Type	Empirical primary research (quantitative, qualitative, or mixed methods)	reviews, meta-analyses, commentaries, conceptual papers, or protocols
Publication Period	2020-2025	Studies published before 2020
Language	English or English-translated open-access articles	Non-English articles without translation
Focus of Study	Telemedicine adoption, hospital integration, or economic/revenue implications	Studies on unrelated e-health, m-health, or general digital health tools without hospital context
Setting/Population	Healthcare institutions (hospitals, clinics, or integrated health systems)	Non-healthcare or consumer-only settings
Geographical Scope	Global studies and at least several from Indonesia	Studies without relevance to healthcare system or hospital-level implementation

Data Extraction

A standardized data extraction form was employed to maintain consistency across studies. Two reviewers independently extracted information from each included article, with discrepancies resolved through consensus, and verification conducted by a third reviewer. Extracted data encompassed bibliographic details (authors, year, country/region), study characteristics (design, theoretical framework, objectives), population and setting (patients, healthcare providers, administrators, and hospital context), sample size and demographics, methodology (data collection instruments and analytical techniques), key findings (adoption factors, perceptions, financial outcomes, and barriers), as well as reported limitations and future directions. The extracted data were synthesized narratively and further summarized in tabular and thematic formats to highlight common patterns and research gaps.

Quality and Risk of Bias Assessment

The methodological quality of included studies was appraised using established tools tailored to study design: the Joanna Briggs Institute (JBI) Checklists for quantitative studies, the CASP Qualitative Checklist for qualitative research, and the Mixed Methods Appraisal Tool (MMAT, 2018) for mixed methods designs. Two reviewers independently assessed each study across domains such as clarity of objectives, sampling adequacy, validity and reliability of instruments, transparency of analysis, outcome reporting, and potential sources of bias, with disagreements resolved by a third reviewer. Studies were categorized as having low, moderate, or high risk of bias. Overall, most studies demonstrated low to moderate risk, though common limitations included small sample sizes, reliance on self-reported data, and restricted generalizability.

Result

Study Selection

The study selection process and the results of literature search are depicted in **Figure 1.** Our search strategy yielded 1,247 records published between January 2020 and March 2025 from 4 databases. After removing 312 duplicates, 935 unique titles and abstracts were screened, and 809 studies were excluded. The remaining 126 studies were read full text; 100 studies were excluded and finally 26 studies were selected for this study.

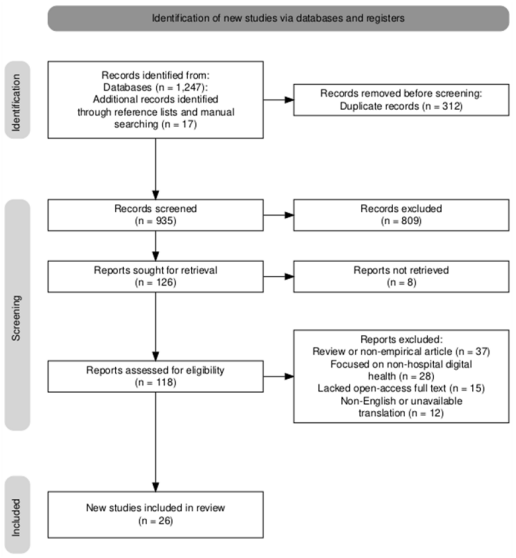


Figure 1. Selection process of literature

Study Characteristics

The study characteristics of 26 studies were summarized in **Table 2.** The included studies varied in geographic origin. The largest share originated from the United States (n=13), reflecting the country's broad implementation and evaluation of telemedicine services followed by Indonesia (n=7) offering important perspectives from a middle-income setting where hospital-based telemedicine is still emerging. The remaining studies came from China (n=2), and one each from India, Malaysia, Australia, and France.

Methodologically, the studies employed a variety of empirical designs, including quantitative approaches (n = 17) such as cohort analyses, retrospective claims evaluations, electronic health record (EHR) analyses, and cross-sectional surveys. Qualitative methods (n = 6) were used in studies employing interviews, focus group discussions (FGDs), and stakeholder consultations to explore implementation experiences. A further three studies utilized mixed methods designs, combining quantitative surveys with qualitative interviews to capture multi-dimensional insights. Several Indonesian studies(Huda et al., 2025; Nugroho et al., 2024; Sari et al., 2024; Susanti et al., n.d.) explored hospital readiness, stakeholder perceptions, and user experience, highlighting regulatory, infrastructural, and socio-cultural challenges unique to Low-Middle Income Countries. In contrast, U.S.-based studies primarily utilized claims data, electronic health records (EHRs), or national survey datasets to investigate utilization patterns, disparities, and clinical outcomes in telemedicine, particularly for chronic and behavioral health services(Patel et al., 2024; Pusnik et al., 2024; Xu et al., 2022).

Two studies from China and one from India and Malaysia added insight into physician experience and organizational adoption in the Asian context. High-income countries like France and Australia contributed structured frameworks for cost evaluation and clinical integration.

Table 2. Study characteristics

Author, Year	Country	Study Design	Sample/Setting	Focus / Key Findings
Gayot et al., 2022	France	Cluster-Randomized Trial	Nursing home residents	Structured telemedicine reduced unplanned hospitalizations and costs
Nguyen et al., 2024	Australia	Conceptual; Stakeholder consultation	Digital hospital stakeholders	Proposed CBA model evaluating economic and intangible value
Adepoju et al., 2022	USA	Cross- Sectional	Hospital administrators	Explored financial impact and hybrid model challenges in telemedicine
Liu et al., 2024	China	Quasi-Experimental (DID)	Chronic outpatient population	Teleconsultation raised outpatient visits and revenue

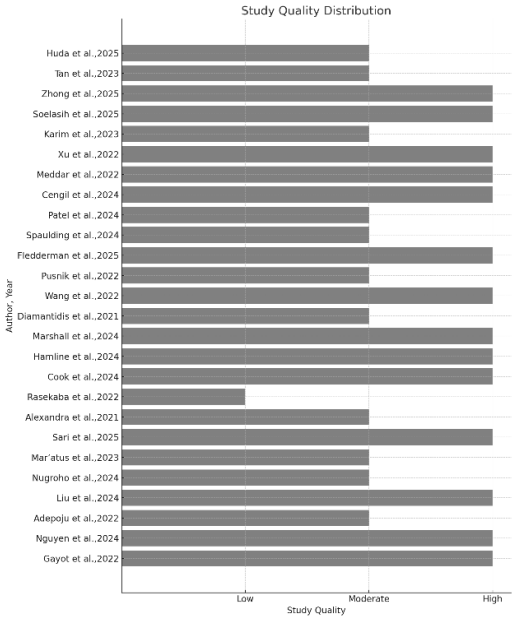
Nugroho et al., 2024	Indonesia	Cross-Sectional	Hospitals and CHCs	Organizational readiness disparities influenced adoption
Mar'atus et al., 2023	Indonesia	Quantitative Survey	Halodoc users	User loyalty driven by trust and service quality
Sari et al., 2025	Indonesia	Qualitative	Geriatric patients	Adoption driven by socio-technical factors; demand exists
Alexandra et al., 2021	Indonesia	Quantitative (CB-SEM)	Telemedicine users	Adoption intention linked to usefulness and trust
Rasekaba et al., 2022	India	Mixed-Methods	Elderly patients	Digital literacy key to rural telehealth readiness
Cook et al., 2024	USA	Retrospective Analysis	CHC patients	Telehealth sustained for behavioral health but dropped for primary care
Hamline et al., 2024	USA	Cross-Sectional (Claims Analysis)	Adult telehealth users	High use in younger, female, mental health patients
Marshall et al., 2024	USA	National Physician Survey	Frontline clinicians	Adoption influenced by specialty and prior experience
Diamantidis et al., 2021	USA	Mixed-Methods	Nephrology clinicians	Telehealth transition feasible for CKD but with workflow issues
Wang et al., 2022	USA	Large-Scale EHR Analysis	55 health systems	Social vulnerability and broadband access affect access
Pusnik et al., 2022	USA	Medicare Claims	SUD patients	Behavioral health telemedicine persisted but varied by geography
Fleddermann et al., 2025	USA	National Survey	Behavioral health providers	High post-pandemic use: barriers include infrastructure
Spaulding et al., 2024	USA	Cross-Sectional (HINTS)	General adults	Use higher among women, married, and insured
Patel et al., 2024	USA	Cohort Study	Diabetes patients	Telehealth improved follow-up and A1c goal attainment
Cengil et al., 2024	USA	Statistical Analysis	1.5M outpatient encounters	Behavioral health and Medicaid had high telehealth share
Meddar et al., 2023	USA	Survey (HINTS 5)	General population	Lower use in Latino and Asian groups; trust matters
Xu et al., 2022	USA	Claims Data	Alabama Medicaid enrollers	Sustained telehealth uses in underserved areas
Karim et al., 2023	USA	Retrospective Cohort	Rural hospitals	Telehealth adopters had better operating margins
Soelasih et al., 2025	Indonesia	Quantitative (SEM-PLS)	Java online users	Behavioral intention shaped by trust and performance
Zhong et al., 2023	China	Qualitative Interviews	Physicians in 10 internet hospitals	Provider perceptions on equity, workload
Tan et al., 2023	Malaysia	Quantitative Survey	200 physicians	Adoption influenced by infrastructure and organizational support
Huda et al., 2025	Indonesia	Qualitative FGDs + Interviews	Patients and HCWs in rural Sulawesi	Trust, infrastructure gaps impact adoption

The Outcome of Quality Assessment

We appraised methodological quality and risk of bias for the 26 included empirical studies using established, design-specific tools: the Newcastle–Ottawa Scale (NOS) for retrospective cohort and database studies; the AXIS tool or Joanna Briggs Institute (JBI) critical appraisal checklists for cross-sectional surveys; and the JBI qualitative checklist or CASP qualitative checklist for qualitative studies. Mixed-methods studies were appraised using the relevant quantitative and qualitative instruments and by assessing the integration of methods. The details of study quality are shown in **Figure 2**.

Overall, 10 studies were rated as high quality, 14 as moderate, and 2 as low, based on completeness of reporting, methodological transparency, and efforts to minimize selection, reporting, or analytic bias. High-quality studies typically had robust sampling strategies, clearly defined outcomes, and appropriate data analysis procedures. These studies (Gayot et al., 2022; Liu et al., 2024; Patel et al., 2024) demonstrated a clear alignment between study objectives, methods, and interpretations, and several were peer-reviewed in high-impact journals with open access.

Studies rated as moderate frequently lacked detail in sampling rationale or did not account for confounding factors, particularly in observational and cross-sectional designs (Meddar et al., 2025; Tan et al., 2024). While most of these still offered valuable insights, they showed moderate risk of bias due to potential measurement inconsistencies or incomplete adjustment for covariates.



Qualitative and mixe h CASP and JBI standards in terms of reflexivity, data credibility, and contextual coherence (Huda et al., 2025; Rasekaba et al., 2022; Susanti et al., n.d.). However, some studies did not clearly articulate the relationship between researchers and participants or lacked depth in their data triangulation process.

Two studies were assessed as lower quality due to insufficient methodological detail, limited sample representation, or unclear analytic strategies. These studies, while relevant to the review's objectives, should be interpreted with caution due to their elevated risk of bias.

Synthesis of Results

Telemedicine Effectiveness and Clinical Outcomes

Across multiple studies included in this review, telemedicine demonstrated a consistent positive impact on clinical outcomes, particularly in chronic disease management, geriatric care, and behavioral health settings. Gayot et al.(Gayot et al., 2022) demonstrated in a French cluster-randomized trial that structured telemedicine with regular geriatric assessments significantly reduced unplanned hospitalizations among nursing home residents and led to meaningful cost savings. Patel et al. (Patel et al., 2024) showed similar benefits observed in chronic disease management in a large retrospective cohort study of more than 242,000 diabetic patients showed that those who engaged in telemedicine services exhibited higher rates of HbA1c testing and goal attainment compared to those who did not receive virtual follow-up, particularly when telemedicine was embedded within a fully integrated healthcare system. Likewise, Diamantidis et al. (Diamantidis et al., 2022) reported that CKD care delivery successfully transitioned to telehealth for stable patients, although physical examination limitations and workflow disruptions remained. Behavioral health was consistently identified as one of the most telemedicine-responsive clinical domains. Longitudinal evidence from over 1.58 million patients across 218 U.S. community health centers showed that telemedicine became the dominant modality for behavioral health services during and after the pandemic, maintaining higher retention and continuity rates compared to primary care (Cook et al., 2024). Sustained virtual utilization suggests that telemedicine may be particularly beneficial in addressing mental health access barriers, especially among patients with anxiety, depression, and substance use disorders.

These studies collectively suggest that when integrated into routine care workflows, telemedicine can maintain or improve clinical outcomes, particularly in chronic disease management, geriatrics and behavioral health settings, where longitudinal monitoring and frequent touchpoints are clinically beneficial. Effectiveness appears contingent on system readiness, provider training, and the ability to maintain continuity of care virtually.

Economic Value and Revenue Generation in Hospital-Based Telemedicine

A significant body of evidence within the reviewed studies confirms that telemedicine contributes not only to cost-efficiency but also to the expansion of hospital revenue streams and improved financial performance when strategically integrated into health service delivery models. Economic benefits were demonstrated through increased service utilization, reduced revenue leakage, improved patient retention, and enhanced billing recovery from averted missed appointments. In a cost-impact analysis conducted within a large Federally Qualified Health Center (FQHC) in Texas, telemedicine implementation led to a substantial reduction in missed appointment rates, decreasing no-shows from 21% in in-person visits to 19% in standalone telemedicine consultations and further to 15% when telemedicine was supported by pre-visit digital readiness checks(Adepoju et al., 2022).

The financial implications of telemedicine adoption extend beyond immediate cost recovery. A longitudinal retrospective cohort study of U.S. rural hospitals revealed that those adopting telehealth services consistently demonstrated higher operating and total financial margins compared to non-adopters over an 11-year period (2009–2019)(Karim et al., 2023). This study suggests that hospitals capable of integrating telemedicine more comprehensively not only improve payer mix and service utilization but also protect long-term financial sustainability. In parallel, cost–benefit frameworks such as those proposed in digital hospital economic models emphasize the need to evaluate telemedicine through multi-dimensional value metrics, including workforce efficiency, reduced bed turnover pressure, and population-level health gains(Nguyen et al., 2024). These models reinforce the notion that return on investment (ROI) must incorporate both tangible (revenue, reimbursement, billing efficiency) and intangible (patient loyalty, reduced provider burnout) outcomes.

In addition, demand stimulation through telemedicine was evident in evidence from Chinese Internet Hospital models. A quasi-experimental study analysing more than 56,000 chronic patients demonstrated that integrating online consultations within hospital service structures led to a 2.4% increase in outpatient visit volume and a 15.5% increase in outpatient spending after implementation(Liu et al., 2024). Contrary to concerns that teleconsultations may replace in-person visits and dilute hospital revenue, findings indicate that digital access improved continuity of care and increased total service engagement, thereby expanding the hospital's revenue-generating reach.

Furthermore, administrative data from Alabama Medicaid claims showed that telehealth became a sustained mode of service delivery post-pandemic in underserved areas, leading to continuous reimbursement flow where services might have otherwise been forgone(Xu et al., 2022). Such reimbursement stabilization in vulnerable populations is especially critical for hospital systems operating under Medicaid-heavy payer mixes, where service disruptions directly impact financial viability.

From a financial sustainability perspective, emerging studies emphasize the importance of reimbursement policies, payment parity, and incentivization models in supporting hospital-level telehealth expansion. Hospitals operating in environments with reimbursement parity and bundled care models have demonstrated stronger financial incentives for digital integration, as telemedicine serves as an efficient throughput enhancer without significantly increasing staffing expenditure(Hamline et al., 2024).

Together, these findings affirm that hospitals adopting telemedicine can experience enhanced financial performance, provided integration is supported by reimbursement mechanisms and aligned with broader digital strategies.

Determinants of Telemedicine Adoption: Patient and Provider Perspectives

Telemedicine adoption was significantly influenced by factors related to perceived usefulness, ease of use, trust, and prior digital familiarity among both patients and healthcare providers. Several hospital-based acceptance models confirmed that users are more likely to adopt and sustain telemedicine when it is perceived as efficient, trustworthy, and aligned with their service expectations. From the patient perspective, trust and digital satisfaction emerged as central drivers of telemedicine loyalty. Studies conducted in Indonesia demonstrated that perceived usefulness, performance expectancy, brand image, and trust significantly influenced behavioral intention and repeat usage(Sholihah et al., 2024; Soelasih et al., 2025). These findings highlight the importance of building credibility through professional presentation, data privacy assurance, and seamless user experience to support recurring telehealth engagement, which is essential for stable hospital revenue.

Provider readiness and confidence were also critical. Survey-based studies among hospital physicians in Malaysia and Indonesia showed that willingness to adopt telemedicine increased when infrastructure, training, technical support, and organizational endorsement were present(Alexandra et al., 2021; Tan et al., 2024). Conversely, perceived risk, lack of digital literacy, and uncertainty regarding regulatory protections reduced clinician enthusiasm toward hospital-based teleconsultation models. Furthermore, qualitative research from China and India underscored that provider acceptance is also shaped by work burden perception, communication challenges, role clarity, and suitability of clinical contexts(Huda et al., 2025; Zhong et al., 2024).

These studies confirm telemedicine adoption is driven not only by technological accessibility but also by psychological trust, professional alignment, and perceived clinical appropriateness. Hospitals aiming to scale telemedicine must therefore combine digital infrastructure with stakeholder confidence-building strategies and workflow integration.

Institutional Enablement and Organizational Readiness

Successful telemedicine integration at the hospital level is closely tied to organizational preparedness, digital maturity, and alignment of clinical workflows. Evidence across multiple studies shows that institutions with stronger technological infrastructure, established governance structures, and dedicated support systems demonstrated higher and more sustainable telemedicine uptake. Readiness disparities were particularly evident in low- and middle-income countries. For example, Indonesian studies revealed that private hospitals exhibited significantly greater readiness for teleconsultation compared to public hospitals and community health centers due to better policy clarity, resource allocation, and IT infrastructure(Nugroho et al., 2024; Sari et al., 2024). Similarly, rural healthcare systems in India cited unstable connectivity, limited technical workforce, and poorly aligned reimbursement structures as major constraints to institutional adoption(Rasekaba et al., 2022). In high-income settings, effective workflow redesign, reimbursement certainty, and administrative support were central enablers of sustainable adoption. Large-scale behavioral health studies in the United States showed that organizations with structured scheduling systems, telehealth training programs, and continuous IT support were able to maintain high telehealth utilization post-pandemic(Cook et al., 2024; Fleddermann et al., 2025). Additionally, integrated systems with EHR-linked telemedicine platforms demonstrated greater efficiency, provider adherence, and billing continuity.

These studies evidence hospital readiness for telemedicine is not determined by technology availability alone but by sociotechnical alignment requiring governance, training, reimbursement mechanisms, digital literacy, and workflow standardization. This underscores the importance of organizational capability-building in ensuring long-term telemedicine viability.

Equity, Access, and Sociodemographic Disparities

Despite demonstrated benefits, telemedicine adoption remains uneven, with significant disparities linked to digital infrastructure, socioeconomic status, geographic context, and population vulnerability. Studies consistently show that underserved populations, particularly those in rural, low-income, and socially marginalized communities face greater barriers to telemedicine access.

Large-scale U.S. datasets indicate that telehealth uptake is lower among patients in areas with limited broadband coverage, lower income, and higher social vulnerability, particularly for video-based services(Meddar et al., 2025; Wang et al., n.d.-a). Medicaid-dependent populations in Alabama displayed sustained telehealth utilization during pandemic phases, but disparities persisted by race, age, and service type, with behavioral health services showing highest adoption(Xu et al., 2022). Similarly, older adults in India and Indonesia expressed willingness to use telehealth but struggled due to low digital literacy and dependence on caregivers for navigation(Rasekaba et al., 2022; Sari et al., 2024).

Provider-related inequities were also observed. Physicians in better-resourced urban hospitals and integrated systems were more likely to adopt and sustain telemedicine compared to those in low-resource or rural facilities(Karim et al., 2023; Tan et al., 2024). This reflects structural inequity at the institutional level, where financially stronger hospitals can invest in telemedicine capabilities, further widening the digital care gap.

Equity concerns also intersected with cultural trust and perceived inclusiveness of telemedicine models. Qualitative studies in China indicated that patient hesitation was often driven by perceived impersonality, fear of misdiagnosis, and doubts about whether telemedicine adequately replicated face-to-face clinical interactions(Zhong et al., 2024). Thus, while telemedicine can expand access, it may inadvertently reinforce existing care disparities unless paired with strategies such as digital literacy training, subsidized access, culturally adapted communication approaches, and equitable reimbursement mechanisms.

Discussion

This systematic review explored empirical studies on telemedicine adoption, hospital integration, and financial implications from 2020 to 2025. Overall, the findings suggest that when strategically embedded into hospital service delivery, telemedicine can enhance clinical outcomes, improve operational efficiency, increase financial sustainability, and expand access to underserved populations. However, successful integration is dependent on institutional readiness, alignment with care pathways, and mitigation of digital inequality.

Clinically, telemedicine demonstrated substantial benefits in chronic disease management, geriatric care, mental health services, and other conditions requiring continuous engagement. Both randomized and observational studies showed improved hospitalization rates, adherence to monitoring protocols, and sustained disease control when virtual care was linked to structured clinical workflows.(Gayot et al., 2022; Patel et al., 2024). Behavioral health services demonstrated high telemedicine persistence beyond pandemic peaks(Cook et al., 2024), reinforcing its appropriateness in domains reliant on conversational care. However, many included clinical studies were observational and pandemic-specific, which may overestimate the effectiveness of telemedicine under conditions of necessity. Future studies should employ longitudinal or post-pandemic-controlled designs that differentiate between temporary substitution effects and long-term outcome improvements attributable to telemedicine integration.

Financially, telemedicine proved to be not just a cost-saving mechanism but a hospital revenue enhancer. Health systems captured income from averted missed appointments(Adepoju et al., 2022), improved financial margins through strategic telehealth expansion(Karim et al., 2023), and saw increased outpatient volume and spending through Internet hospital models(Liu et al., 2024). Yet, most financial evaluations were U.S.-based and conducted within temporarily favorable reimbursement environments driven by emergency policy waivers. Sustainability under evolving telehealth payment schemes, particularly in low-to-middle income countries (LMICs), remains insufficiently explored. Future research should assess telemedicine's financial viability under standard reimbursement conditions, bundled payment models, and public insurance schemes such as BPJS in Indonesia.

Adoption trends were shaped by trust, digital ease-of-use, perceived professional benefit, and alignment with workflow expectations. Patient adoption increased when telemedicine systems conveyed institutional credibility and trust(Soelasih et al., 2025), while physician engagement required adequate technological support and diagnostic confidence(Tan et al., 2024; Zhong et al., 2024). However, many included studies used cross-

sectional surveys reliant on self-reported intention rather than actual usage, which may not reflect long-term adoption behavior. Future research should incorporate behavioral analytics, longitudinal adoption modeling, and real-world implementation trials to better understand sustained usage trajectories.

Institutional readiness played a central role in determining telemedicine viability. Well-resourced hospitals demonstrated higher digital maturity and smoother integration efforts, while facilities in resource-limited settings cited infrastructure and workforce constraints as major barriers(Nugroho et al., 2024; Sari et al., 2024). However, a limitation of existing literature is its focus on hospital-level readiness without examining system-wide governance support or leadership-driven transformation strategies. Future research should investigate how organizational culture, leadership engagement, and cross-departmental digital workflows mediate telemedicine success.

Digital inequity emerged as a recurring theme, highlighting that telemedicine risks reinforcing existing access disparities among rural, elderly, minority, or low-income populations(Meddar et al., 2025; Rasekaba et al., 2022; Wang et al., n.d.-b). However, current research often treats digital inequity descriptively rather than testing intervention-based models to enhance inclusivity. Future studies should explore equity-oriented strategies such as community digital navigators, telehealth-supported caregivers, multilingual teleconsultation interfaces, and subsidized internet initiatives.

Methodologically, the review is limited by variability in study designs, with a predominance of cross-sectional studies and pandemic-driven analyses, which may limit causal inferences and post-pandemic generalizability. Additionally, most included studies originated from high-income countries, leading to limited comparative insights into telemedicine implementation under fragmented funding models or weaker digital infrastructures. Future research should prioritize experimental, longitudinal, and implementation science-driven studies, particularly in LMIC hospital systems. Collectively, the reviewed evidence supports that telemedicine can improve hospital-based clinical and financial outcomes when implemented as part of a coordinated, institutionally supported digital strategy. However, sustainability depends on moving beyond temporary crisis-driven adoption toward intentional integration that incorporates digital equity, clinician empowerment, economic resilience, and regulatory support. Future research must therefore extend beyond effectiveness evaluations toward understanding organizational transformation processes and designing equitable digital ecosystems that reinforce telemedicine as a core driver of hospital modernization.

Conclusions

This systematic review provides comprehensive insights into the adoption, integration, and financial implications of telemedicine in hospital settings from 2020 to 2025. The evidence confirms that telemedicine is not merely a reactive tool for crisis management but a transformative modality capable of sustaining care delivery, improving patient outcomes, and supporting hospital revenues particularly in chronic and behavioral health services.

Crucially, this review offers practical guidance for hospitals aiming to develop and institutionalize hospital-based telemedicine systems. It identifies organizational readiness, clinician engagement, and user trust as consistent determinants of successful implementation. Hospital administrators can leverage these insights to inform investment decisions, guide change management processes, and design telemedicine services that align with existing care pathways. Studies from both high-income and low-middle income countries contexts underscore that sustainable adoption depends not only on infrastructure, but also on aligning services with clinical priorities and patient needs.

The review also supports strategic planning efforts by highlighting the revenue-generating potential of telemedicine. Findings from Indonesia, China, and the U.S. suggest that hospitals can strengthen their financial performance by integrating virtual services into outpatient workflows, provided reimbursement mechanisms and regulatory support are in place. This is especially relevant for hospitals in resource-constrained settings, where telemedicine can extend service reach without proportionate increases in fixed costs.

However, successful implementation depends on more than just technological readiness. Organizational leadership, institutional trust, workforce preparedness, and reimbursement mechanisms are pivotal for embedding telemedicine within routine hospital workflows. In low- and middle-income countries such as Indonesia, telemedicine holds promise in overcoming geographic barriers, but it requires alignment with regulatory frameworks and patient needs.

Persistent disparities in access and use driven by sociodemographic, technological, and systemic factors underscore the need for hospitals to adopt equity-centered strategies. Tailored solutions that account for local infrastructure, cultural contexts, and clinical workflows are essential to scaling telemedicine without widening the digital divide.

As hospital systems transition into a post-pandemic era, telemedicine should be treated as a core component of service design. Future research should focus on long-term cost-effectiveness, equity-oriented implementation strategies, and policy environments that enable hospitals to leverage telemedicine for health system resilience.

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