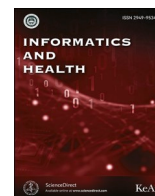




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Nursing in the Digital Age: Harnessing telemedicine for enhanced patient care

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ABSTRACT

Background: Telemedicine has emerged as a transformative force in contemporary healthcare, reshaping nursing practice across various specialties. This narrative review explored the role, challenges, and ethical considerations associated with telemedicine in nursing practice. Also, it emphasizes telemedicine's impact on patient care, the evolution of nursing workflows, and future directions for implementation.

Method: A comprehensive narrative review was conducted, drawing upon primary research articles, systematic reviews, and policy documents published between 2010 and 2023. The search was carried out using electronic databases, including PubMed, ScienceDirect, CINAHL, and Google Scholar, employing keywords such as "telemedicine," "nursing practice," "patient care," and "ethical considerations." Eligible studies were critically appraised for relevance and rigor. Data synthesis included the identification of key themes, trends, and exemplary instances of telemedicine utilization in nursing practice.

Results: The review revealed a multifaceted role of telemedicine in nursing practice. Teletriage and remote patient monitoring were instrumental in reducing emergency department overcrowding and improving patient triage accuracy. Teleconsultations and virtual visits facilitated patient-provider interactions, while telepsychiatry addressed the growing demand for mental health support. Tele-education emerged as a vital tool for ongoing professional development among nurses. Moreover, telemedicine effectively reached rural and underserved populations, addressing healthcare disparities. Ethical considerations, such as patient privacy, informed consent, and data security, emerged as significant challenges in telemedicine.

Conclusions: As telemedicine continues to evolve, nurses should remain adaptable, actively engaging with emerging technologies and interdisciplinary teams. Furthermore, healthcare organizations, policymakers, and nursing associations/regulatory bodies should collaborate to establish clear ethical and legal guidelines. These efforts will ensure the continued growth of telemedicine in nursing practice, ultimately enhancing patient outcomes and expanding access to quality healthcare services.

1. Introduction

Telemedicine, a technology-driven approach to delivering healthcare services remotely, has emerged as a transformative force in modern healthcare.¹²⁵ With advancements in digital technology and the

increasing demand for accessible and cost-effective healthcare, telemedicine has witnessed significant adoption across various medical disciplines. Among these, nursing practice stands at the forefront of embracing telemedicine's potential to enhance patient care, improve health outcomes, and optimize healthcare delivery.¹⁰⁴

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The concept of telemedicine dates back to the early 20th century when radio and telephone technologies were initially used for medical consultations. However, it was not until the late 20th and early 21st centuries that significant advancements in telecommunications and digital technology propelled telemedicine to the forefront of healthcare innovation.⁷³ The advent of high-speed internet, mobile devices, wearable sensors, and secure data transmission enabled real-time communication between healthcare providers and patients regardless of geographical barriers.^{6,14,29}

Telemedicine has been reported to be a game-changer in healthcare delivery, especially in regions with limited access to medical facilities.¹¹⁶ By leveraging telecommunication technologies, healthcare providers can remotely assess, diagnose, and treat patients, overcoming geographical challenges and reducing the burden on physical healthcare infrastructure.¹¹⁶ Additionally, telemedicine has been instrumental in improving care coordination, empowering patients to manage their health proactively, and reducing the strain on emergency departments through teletriage services.^{135,54}

Nursing, as a core component of the healthcare system, has embraced telemedicine to augment its roles and responsibilities.¹²⁸ Telemedicine applications in nursing practice are diverse and span various specialties. Teletriage services enable nurses to remotely assess patients' conditions and direct them to appropriate levels of care.⁶⁹ Teleconsultations facilitate virtual visits, allowing nurses to interact with patients in real time, address concerns, and provide expert advice without requiring physical presence.⁹³ Telepsychiatry has also gained traction, extending mental health support to individuals in remote areas or facing mobility constraints.

Furthermore, teleeducation and professional development have enabled nurses to access continuous training, ensuring their skills remain up-to-date with rapidly evolving medical practices.⁹⁵ Telemedicine initiatives tailored to rural and underserved populations have brought healthcare services to regions where access to medical facilities is limited^{34,116}, thus reducing health disparities and improving overall healthcare equity.¹¹⁹

The global COVID-19 pandemic served as a catalyst for the widespread adoption of telemedicine across all healthcare sectors, including nursing practice.¹¹ With social distancing measures in place, telemedicine emerged as a vital means of maintaining healthcare services while minimizing the risk of viral transmission.¹²⁰ Virtual consultations, remote patient monitoring, and telehealth interventions became essential components of nursing practice, ensuring continuity of care amidst unprecedented challenges.¹¹⁹

Despite the growing recognition of telemedicine's potential in nursing practice, several questions remain unanswered.¹²⁴ This comprehensive review aims to address these gaps in knowledge and provide a deeper understanding of the current state of telemedicine in nursing. By exploring the roles, impacts, and challenges of telemedicine, we aim to identify opportunities to optimize its implementation, promote evidence-based practices, and overcome potential barriers hindering its widespread adoption. The primary aim of this review is to critically analyze the evolving landscape of telemedicine in nursing practice, providing valuable insights for healthcare stakeholders, policymakers, and nursing professionals. By consolidating evidence from current research, expert opinions, and best practices, we endeavor to present a comprehensive overview of telemedicine's impact on nursing care and patient outcomes.

2. Method

2.1. Literature search strategy

A comprehensive literature review was conducted to collect relevant articles and documents related to telemedicine in nursing practice. The search covered publications across multiple databases, including PubMed, CINAHL, Google Scholar, and ScienceDirect, spanning the

period from 2010 to 2023. This yielded a total of 198 articles, with PubMed contributing 71 articles, CINAHL contributing 27 articles, Google Scholar contributing 38 articles, and ScienceDirect contributing 62 articles (see Fig. 1 for the PRISMA flowchart). To ensure the integrity of our review process, duplicates were meticulously sorted and removed using reference management software. Following this initial identification phase, we screened the articles based on their titles and abstracts, resulting in 96 articles deemed potentially relevant for full-text review. Subsequently, a thorough assessment of the full-text articles was conducted, applying predetermined inclusion and exclusion criteria. Through this meticulous screening process, 35 articles were identified as meeting the eligibility criteria for inclusion in our review. This multi-database approach ensured a comprehensive coverage of the available literature and enabled selection of a diverse range of articles for our review.

Table 1 below provides a clear overview of the number of articles identified, selected for full-text review, and ultimately eligible for review across different databases.

The following keywords and Boolean operators were used for the search:

"Telemedicine" OR "Telehealth", "Nursing practice" OR "Nursing care", "Patient care" OR "Healthcare delivery".

"Ethical considerations" OR "Ethical challenges".

"Teletriage" OR "Remote patient monitoring".

"Teleconsultations" OR "Virtual visits".

"Telepsychiatry" OR "Mental health support".

"Teleeducation" OR "Professional development".

"Telehealth in rural areas" OR "Underserved populations".

2.2. Inclusion and exclusion criteria

Articles and documents were included if they met the following criteria: being published in peer-reviewed journals, written in English, focused on the role, impacts, and challenges of telemedicine in nursing practice, including relevant data on telemedicine technologies, ethical considerations, patient outcomes, or future directions, and being published between 2010 and 2023. Conversely, articles were excluded if they were published in non-peer-reviewed sources, not written in English, lacked focus on telemedicine in nursing practice, did not include relevant data on telemedicine technologies, ethical considerations, patient outcomes, or future directions, or were published outside the specified timeframe of 2010 to 2023.

2.3. Study selection process

Two independent reviewers conducted the initial screening of titles and abstracts to identify potentially relevant articles. Full-text articles were then assessed for eligibility based on the inclusion and exclusion criteria. Any disagreements between reviewers were resolved through discussion, and a third reviewer was consulted if necessary.

2.4. Data extraction and synthesis

Data were extracted from the selected articles using a standardized data extraction form. Information extracted included study objectives, methodology, key findings, and relevant statistics. Thematic analysis was employed to identify common themes related to the role, impact, and challenges of telemedicine in nursing practice.

Data synthesis involved categorizing and organizing findings according to the predefined themes, including the role of telemedicine in nursing practice, ethical considerations, impacts on patient care, challenges, and future directions. Key insights and trends were summarized, and data were presented in a structured and coherent manner.

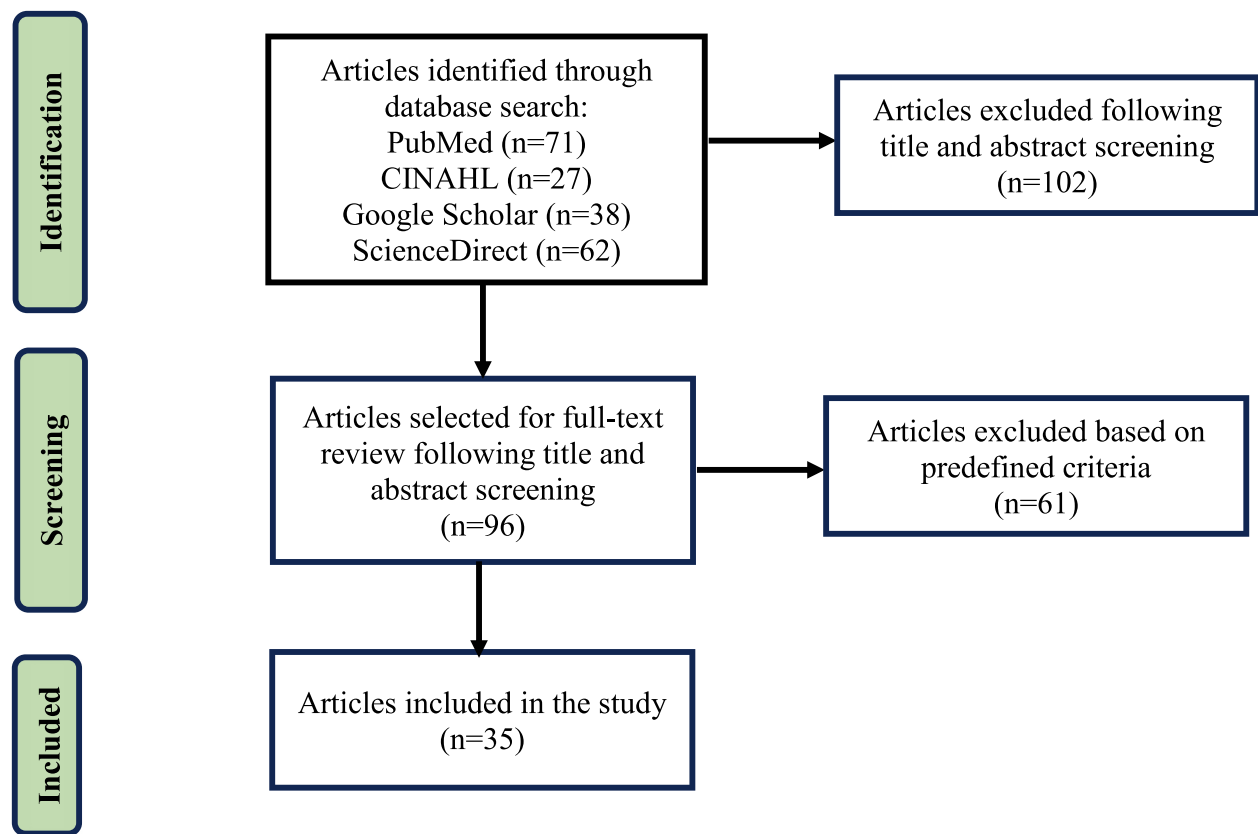


Fig. 1. PRISMA flowchart for selection of included studies.

Table 1
Summary of Articles Identified, Selected for Full-Text Review, and Eligible for Review across Databases.

Database	Total Articles Identified	Articles Selected for Full-Text Review	Articles Eligible for Review
PubMed	71	37	11
CINAHL	27	14	6
Google Scholar	38	19	8
ScienceDirect	62	26	10
Total	198	96	35

2.5. Ethical considerations

This study is a narrative review and did not involve human subjects or the collection of personal data; thus, ethical approval was not required.

3. The role of telemedicine in nursing practice

The integration of telemedicine in nursing practice has brought about transformative changes, enhancing patient care, improving health outcomes, and overcoming geographical barriers in healthcare delivery.^{55,127} Teletriage, remote patient monitoring, teleconsultations, telepsychiatry, teleeducation, and telehealth for rural and underserved populations have revolutionized the roles of nurses, fostering patient-centered care and interdisciplinary collaboration.^{24,31} As telemedicine continues to evolve, nurses are poised to play a critical role in leveraging these technologies to advance healthcare and create a more accessible and efficient healthcare system for all.¹²⁹

a. Teletriage and remote patient monitoring

Teletriage and remote patient monitoring have emerged as invaluable tools in nursing practice, revolutionizing the way nurses assess, monitor, and prioritize patient care.¹²⁹ Teletriage allows nurses to remotely evaluate patients' health concerns, symptoms, and medical history to determine the appropriate level of care needed.¹⁰⁵ This is particularly crucial in emergency situations and can significantly reduce unnecessary visits to emergency departments, easing the burden on healthcare facilities.³²

Remote patient monitoring (RPM) involves the use of wearable devices and home-based monitoring systems to collect and transmit patients' vital signs, health data, and symptoms to healthcare providers in real-time.⁵ RPM empowers nurses to closely monitor patients with chronic conditions, post-operative recovery, or other complex health needs without requiring them to visit the healthcare facility frequently. Early detection of potential health issues through RPM enables timely interventions, such as targeting high-risk individuals, accurate detection of health decline, responsive and timely care, personalized and supportive care, and collaborative and integrated care leading to better disease management and improved patient outcomes.^{139,142}

b. Teleconsultations and virtual visits

Teleconsultations and virtual visits have revolutionized the nurse-patient relationship, enabling nurses to provide timely and personalized care regardless of geographical distances.^{80,150} This enhances patient engagement and satisfaction, as patients can access healthcare services from the comfort of their homes^{1,98}. Furthermore, teleconsultations foster interdisciplinary collaboration, enabling nurses to consult with physicians, specialists, and other healthcare professionals remotely.^{18,106} This multidisciplinary approach enhances care coordination, leading to more comprehensive and patient-centered treatment strategies.¹⁴⁰

c. Telepsychiatry and Mental Health Support

Telepsychiatry has emerged as a critical component of nursing practice, facilitating the delivery of mental health services to individuals in remote or underserved areas.^{110,145} The shortage of mental health providers in certain regions can create significant barriers to accessing care.⁷ Telepsychiatry addresses this challenge by allowing nurses and nurse practitioners (NPs) to connect with mental health patients through virtual platforms, such as real-time video conferencing and audio messaging.⁸² Nurses in telepsychiatry play a vital role in providing mental health care. While registered nurses usually do not have prescribing authority for psychiatric medication, they can conduct mental health assessments, provide counseling, and offer support to patients with various mental health conditions, such as depression, anxiety, and post-traumatic stress disorder (PTSD).¹⁵¹ In contrast, NPs, who have prescriptive authority, can diagnose, treat, and prescribe medications for mental health conditions, thus playing a significant role in telepsychiatry. Additionally, telepsychiatry has proven effective in crisis interventions and suicide prevention, as it allows for immediate assistance and remote monitoring of at-risk individuals.³⁰

d. Teleeducation and professional development for nurses

Teleeducation and professional development opportunities have transformed the way nurses access training, continuing education, and skill enhancement.¹⁰⁰ Online platforms and virtual classrooms have made educational resources readily available, allowing nurses to pursue advanced certifications and specialized training from reputable institutions worldwide.⁵³ Teleeducation not only supports nurses' academic growth but also helps in staying abreast of the latest medical advancements, evidence-based practices, and technological innovations. This continuous professional development ensures that nurses remain competent and well-equipped to provide high-quality care to their patients.¹²⁸

e. Telehealth for Rural and Underserved Populations

Telehealth has emerged as a lifeline for individuals residing in rural and underserved areas with limited access to healthcare facilities.⁶³ Telemedicine initiatives extend medical services, including primary care, specialty consultations, and preventive health measures, to remote communities.⁵⁶ Nurses play a pivotal role in telehealth programs targeted at rural and underserved populations, providing health assessments, patient education, and health promotion activities through virtual platforms.³⁹ These telemedicine interventions help bridge healthcare gaps, reduce health disparities, and improve health outcomes in vulnerable populations.⁶⁶ Table 2 provides a detailed overview of how telemedicine is utilized across various nursing specialties. It includes information on the nursing specialty, common telemedicine applications, potential benefits, and any notable challenges.

4. Impacts on patient care and outcomes

Telemedicine has emerged as a game-changing force in healthcare, with profound impacts on patient care and outcomes.^{37,40} Improved access to healthcare services, enhanced chronic disease management, reduced hospital readmissions, patient engagement, and interdisciplinary collaboration are among the key trends shaping the telemedicine landscape.¹⁰¹ As technology continues to evolve and healthcare systems adapt to meet the challenges of the future, nurses will play a central role in leveraging telemedicine to optimize patient care, drive positive health outcomes, and create a patient-centric healthcare experience for all healthcare delivery, patient outcomes, and the overall patient experience.³⁶ With the advent of advanced telecommunication technologies and the widespread adoption of telemedicine, healthcare is easier to access.²⁰ This has revolutionized medical service delivery by allowing patients to consult with professionals from home, reducing travel and wait time, improving patient participation, continuity of care, and prompt interventions through remote monitoring and virtual

Table 2
Telemedicine Utilization Across Nursing Specialties.

Nursing Specialty	Telemedicine Applications	Potential Benefits	Notable Challenges
Teledermatology	- Skin condition assessments	- Timely diagnosis ⁴⁹ - Involvement of healthcare and care partner teams ¹⁰⁷	- Limited physical examination capability ¹⁰³
Telecardiology	- ECG monitoring - Remote cardiac consultations	- Early detection ⁹⁹ - Reduced hospitalizations ⁷⁵ - Involvement of teams ¹⁵⁹	- Limited physical assessments ⁷⁵ - Need for specialized equipment ¹⁵⁹
Telepsychiatry	- Mental health counseling - Psychiatric assessments	- Improved access ¹⁵⁵ - Reduced travel ⁶²	- Privacy and stigma concerns ¹⁰⁹ - Limited non-verbal cues ³⁸
Teleoncology	- Cancer care consultations - Chemotherapy follow-ups	- Access to specialized care ¹³³ - Reduced travel ¹¹⁷	- Complex treatment discussions ⁷⁸ - Emotional support ¹³¹
Telesurgery Nursing	- Surgical consultations - Preoperative assessments	- Expert opinions ¹³⁴ - Reduced surgical risks ⁶⁷	- Limited hands-on assessments ¹³⁴ - Technical challenges during surgery ¹²¹
Tele-ICU Nursing	- Intensive care monitoring - Vital sign monitoring	- Early intervention ⁸⁵ - Reduced mortality ⁸⁵ - Involvement of teams ⁴³	- Data overload ⁶⁵
Teletriage Nursing	- Remote patient assessments - Symptom assessment	- Prioritized care ⁸⁶ - Reduced ED overcrowding ⁵⁴ - Involvement of teams ¹⁵⁸	- Limited physical assessments ²²
Telepharmacy Nursing	- Medication management - Medication therapy management	- Medication adherence ¹⁵² - Enhanced safety ³⁵ - Involvement of teams ¹⁵⁸	- Limited hands-on medication administration ¹⁵² - Lack of in-person medication review ¹³⁸
Tele-Home Health Nursing	- Home-based patient care - Chronic disease management	- Patient comfort ⁹³ - Reduced hospitalizations ¹¹⁵	- Limited physical assessments ¹¹⁵ - Technical challenges during visits ¹²³

consultations. The integration of telemedicine into patient care has resulted in significant impacts on platforms, nurses and healthcare providers have been able to deliver care more efficiently and effectively.^{20,79}

4.1. Improved access to healthcare services

One of the most prominent benefits of telemedicine is improved access to healthcare services, particularly for patients residing in remote or underserved areas.⁶³ Telemedicine allows patients to connect with healthcare providers without the need for physical travel, eliminating geographical barriers.³ This improved accessibility translates to timely interventions, early diagnosis, and better management of chronic conditions, ultimately leading to enhanced patient outcomes. In telestroke programs, neurologists use specialized telemedicine platforms such as REACH Health and InTouch Health to remotely assess and diagnose stroke patients in emergency departments.⁹⁴ These platforms enable real-time video consultations, allowing neurologists to evaluate symptoms, review medical imaging, and recommend time-critical treatments like thrombolytic therapy. This approach significantly reduces the time to treatment, improving outcomes for stroke patients and minimizing disability.^{64,111}

4.2. Enhanced chronic disease management

Telemedicine has revolutionized the management of chronic diseases, such as diabetes, hypertension, and heart failure.¹⁶ Through remote patient monitoring and teleconsultations, nurses can closely monitor patients' health metrics, medication adherence, and symptoms.¹⁴⁶ This continuous monitoring empowers nurses to detect changes in patients' conditions promptly, intervene as needed, and provide personalized care plans, leading to better disease management and reduced hospital readmissions.¹⁴⁴ For example, patients with cardiac conditions use mobile apps and connected devices (e.g., AliveCor's KardiaMobile, Eko) to record and transmit their ECG readings to healthcare providers. Nurses and cardiologists can remotely monitor these readings for irregularities or arrhythmias.^{23,88} Early detection of cardiac issues allows for timely interventions, potentially preventing heart-related complications and hospitalizations.⁸⁸

4.3. Reduced hospital readmissions

Telemedicine has shown promise in reducing hospital readmissions, a critical factor in healthcare costs and patient well-being.¹³ By monitoring patients remotely, nurses can detect early signs of complications, ensuring timely interventions and preventing hospitalizations.¹⁴⁸ Teleconsultations also facilitate post-discharge follow-ups, enabling nurses to address patients' concerns and ensure a smooth transition from hospital to home care.⁷¹ For instance, patients undergoing cancer treatment can consult with oncology nurses and oncologists through teleoncology platforms such as American Well's Onco360, Navigating Cancer. These consultations can cover treatment plans, side-effect management, and psychosocial support. Teleoncology services enhance patient access to specialized care, reduce the need for travel to cancer centers, and ensure that patients receive timely guidance, potentially improving treatment adherence and quality of life.⁴⁵

4.4. Patient engagement and empowerment

Telemedicine platforms promote patient engagement and empowerment by providing patients with access to their health data, educational resources, and interactive tools.²⁷ Patients actively involved in their care tend to have better health outcomes as they become more aware of their conditions, adhere to treatment plans, and make informed decisions regarding their health.⁸⁹ Teledermatology such as DermEngine, and VisualDx allows nurses and dermatologists to assess skin conditions remotely. Patients can capture images of their skin issues using a smartphone app and share them securely with healthcare providers. Nurses can triage cases, and dermatologists can provide diagnoses and treatment recommendations.¹¹⁸ Teledermatology improves access to dermatological care, reduces wait times, and ensures that skin conditions are addressed promptly.^{96,160} However, it is important to acknowledge the limitations and potential for errors that may arise from the quality of images, such as poor lighting, blurry images, or poor picture angles that can impede the dermatologist's ability to establish a precise diagnosis.

4.5. Enhanced care coordination and interdisciplinary collaboration

Telemedicine promotes seamless care coordination and interdisciplinary collaboration among healthcare teams.⁴¹ Nurses can easily communicate with physicians, specialists, and other healthcare professionals through virtual platforms, leading to more comprehensive and coordinated care plans.^{74,137} This collaborative approach ensures that patients receive holistic and patient-centered care, resulting in improved health outcomes. Patients with diabetes can use CGM devices (e.g., Dexcom, Freestyle Libre) that continuously monitor their glucose levels.⁵⁸ These devices transmit data to mobile apps, which nurses and endocrinologists can remotely access.^{46,59} Nurses can review glucose

trends, adjust insulin regimens, and provide education to patients about managing their diabetes effectively.¹⁰⁸ Remote diabetes management using CGM improves glycemic control and reduces the risk of complications.⁵⁷

4.6. Timely emergency and critical care interventions

In emergency and critical care settings, telemedicine plays a crucial role in delivering timely interventions.⁸⁵ Telerriage allows nurses to assess patients remotely and direct them to appropriate levels of care, enabling rapid response and optimal utilization of healthcare resources.¹²⁸ In time-sensitive situations, teleconsultations enable nurses to consult with specialists quickly, facilitating expert advice and informed decision-making.²¹ For instance, in tele-ICU programs, critical care nurses and intensivists use telemedicine technology (e.g., eICU by Philips, Mercy Virtual) to monitor patients in ICUs from remote locations. High-definition cameras and real-time data streams allow healthcare providers to continuously assess patients, detect early signs of deterioration, and intervene promptly. Tele-ICU programs have been associated with reduced mortality rates and shorter ICU stays.⁸⁵

4.7. Positive patient experience and satisfaction

The convenience and flexibility offered by telemedicine contribute to a positive patient experience and increased patient satisfaction.¹¹² Patients appreciate the ability to access healthcare services from the comfort of their homes, reducing wait times, and avoiding unnecessary travel.⁶³ Additionally, the personalized care provided through telemedicine fosters a sense of connection and trust between patients and healthcare providers.¹²⁶ Mental health nurses and counselors use telebehavioral health platforms such as Zoom, and Doxy.me to provide therapy and counseling sessions to patients.²⁵ These sessions address various mental health concerns, including anxiety, depression, and substance abuse. Telebehavioral health improves access to mental health services, reduces stigma, and can lead to improved mental health outcomes.⁹

Table 3 delves into the impact of telemedicine on patient outcomes in various healthcare areas. It includes details on the healthcare area, specific telemedicine interventions, observed outcomes, and supporting studies or evidence.

5. Enhancing nursing practice and workflows

Telemedicine's integration into nursing practice has had a profound impact on workflows and the way nurses deliver patient care.⁶³ Efficient communication, remote patient monitoring, telerriage services, and continuing professional development are among the current trends that enhance nursing practice and empower nurses to provide high-quality, patient-centered care.⁸⁶ As technology continues to advance, nurses will continue to play a central role in leveraging telemedicine to optimize workflows, improve patient outcomes, and shape the future of healthcare delivery.⁵⁰

5.1. Efficient communication and care coordination

Telemedicine platforms enable nurses to communicate with patients, physicians, and other members of the healthcare team in real-time.⁶³ Virtual communication channels, such as secure video conferencing and messaging applications, facilitate quick consultations, care updates, and patient handoffs. This seamless communication improves care coordination, allowing nurses to stay informed about patients' conditions, treatment plans, and progress.⁶³ For instance, during the COVID-19 pandemic, nurses used secure video conferencing platforms (e.g., Zoom for Healthcare, Microsoft Teams, Doxy.me) to conduct virtual care team meetings, discuss patient care plans, and consult with physicians and specialists. These platforms allowed for real-time communication

Table 3
Telemedicine Impact on Patient Outcomes.

Healthcare Area	Telemedicine Interventions	Observed Outcomes	Supporting Evidence
Stroke Care	Telestroke consultations, remote imaging	Reduced time to thrombolysis, improved survival	AHA/ASA guidelines, clinical trials ⁴⁸
Chronic Disease Care	Remote monitoring, teleconsultations	Better disease management, fewer hospitalizations	Systematic reviews, randomized controlled trials ¹⁵⁴
Mental Health	Telepsychiatry, counseling sessions	Improved access to care, reduced psychiatric symptoms	Clinical studies, patient surveys ⁵¹
Diabetes Management	Continuous glucose monitoring	Improved glycemic control, fewer complications	Clinical trials, diabetes management programs ²⁸
Dermatology	Teledermatology consultations	Timely diagnosis, early treatment	Dermatology journals, clinical case studies ⁹⁷

and care coordination while minimizing in-person contact.¹⁰²

5.2. Remote patient monitoring and early intervention

Remote patient monitoring (RPM) has emerged as a critical aspect of enhancing nursing practice. RPM tools, such as wearable devices and home-based monitoring systems, allow nurses to track patients’ vital signs, symptoms, and health data remotely.¹⁴⁹ By continuously monitoring patients, nurses can detect changes in health status early on, enabling timely interventions and proactive care.¹⁷ RPM is particularly beneficial for managing chronic conditions, post-operative recovery, and high-risk patients, leading to improved patient outcomes and reduced hospitalizations.⁵² Nurses employed wearable devices (e.g., Fitbit, Apple Watch) and remote monitoring software (e.g., Philips Healthcare) to track patients with chronic conditions like heart disease. These devices continuously collected data on patients’ heart rate, activity levels, and ECG readings, which nurses monitored remotely. If any concerning trends were detected, nurses could intervene promptly, preventing complications and hospital admissions.⁹⁰

5.3. Telehealth triage and decision support

Teltriage services have transformed the way nurses assess patients and prioritize care. Through teltriage, nurses can conduct remote health assessments, evaluate patients’ symptoms, and make informed decisions regarding the appropriate level of care needed.⁸⁷ This not only optimizes healthcare resources by directing patients to the most suitable care setting but also expedites access to care for patients requiring urgent attention.¹⁹ In emergency departments, nurses utilized teltriage software such as Bright.md, and Teladoc to conduct remote assessments of patients with non-life-threatening conditions. Patients could use a mobile app to provide information about their symptoms, and nurses would evaluate the data to determine the appropriate course of action. This helped prioritize care and reduce overcrowding in emergency departments.¹⁵⁷

5.4. Empowering nurses to practice at their fullest potential

Telemedicine empowers nurses to practice at the top of their license and expertise. With access to teleconsultations and virtual visits, nurses can independently assess and manage patients within their scope of practice, enhancing their autonomy and decision-making capabilities.¹⁴⁷ This increased responsibility and involvement in patient care contribute to job satisfaction and professional growth among nurses.¹⁵³ Nurse practitioners (NPs) working on telemedicine platforms such as Amwell, and Doctor On Demand provided primary care services to patients. NPs conducted virtual visits, assessed patient conditions, ordered tests, prescribed medications, and offered health education.¹²² These platforms empowered NPs to practice autonomously within their scope of practice.

5.5. Teleeducation and continuing professional development

Telemedicine offers nurses ample opportunities for teleeducation and continuous professional development.⁸¹ Virtual conferences,

webinars, and online courses allow nurses to expand their knowledge, acquire new skills, and stay up-to-date with the latest medical advancements and evidence-based practices. Teleeducation fosters a culture of lifelong learning, enabling nurses to deliver high-quality and evidence-based care to their patients. Nursing schools and healthcare organizations used virtual learning management systems (e.g., Moodle, Canvas) and webinar platforms (e.g., GoToWebinar, Zoom) to deliver continuing education courses to nurses. Topics included the latest treatment protocols, emerging healthcare technologies, and updates on best practices. Nurses could participate in these sessions from anywhere, promoting ongoing professional development.

5.6. Workflow optimization and time efficiency

Integrating telemedicine into nursing practice has led to workflow optimization and improved time efficiency.¹⁵ Telemedicine reduces the need for physical travel between healthcare facilities, enabling nurses to spend more time on direct patient care and less time on administrative tasks.⁵⁶ Virtual consultations and remote monitoring also facilitate timely patient interactions, reducing waiting times and enhancing the overall patient experience. For instance, nurses in hospital settings used EHR systems integrated with telemedicine capabilities such as Epic, and Cerner to conduct virtual rounds. They could review patient records, consult with specialists, and communicate with patients and their families through the EHR interface. This streamlined workflows and reduced the need for physical travel within the hospital.⁸¹

5.7. Supporting interprofessional collaboration

Telemedicine promotes interprofessional collaboration among healthcare teams. Nurses can easily consult with physicians, specialists, pharmacists, and other healthcare professionals through virtual platforms, fostering a multidisciplinary approach to patient care.¹⁵⁹ This collaborative environment enhances care coordination, promotes information sharing, and leads to comprehensive and patient-centered treatment strategies.¹⁴¹ Nurses collaborated with physicians, pharmacists, and other healthcare professionals using specialized collaboration platforms such as Doximity, UpToDate.⁶⁸ These platforms allowed for secure messaging, sharing of medical literature, and multidisciplinary discussions about patient care plans.

Table 4 provides a more comprehensive overview of current telemedicine technologies and platforms commonly used in nursing practice. It includes information on the platform name, features, advantages, and potential challenges.

6. Challenges in implementing telemedicine in nursing practice

Addressing these challenges requires a multifaceted approach, including investments in technology infrastructure, policy reform, ongoing education and training for nursing staff, and a commitment to ensuring equitable access to care for all patients, regardless of their digital resources or abilities.⁴⁴ Successfully navigating these challenges will be critical in harnessing the full potential of telemedicine in nursing practice. Many healthcare facilities, especially in rural or underserved areas, lack the necessary technological infrastructure and high-speed

Table 4
Current Telemedicine Technologies and Platforms.

Platform Name	Features	Advantages	Challenges	FDA-Approval Status
Zoom for Healthcare	Secure video conferencing, screen sharing, EHR integration	User-friendly, HIPAA compliant	Potential for technical glitches, cost of enterprise-level subscriptions	Not FDA-approved as a medical device
Doxy.me	Video conferencing, patient waiting rooms, e-prescribing	Simplicity, no software downloads	Limited features for advanced clinical needs	Not FDA-approved as a medical device
Philips Telehealth	Remote patient monitoring, data analytics, alerts	Customizable, supports chronic care	Initial setup and training can be resource-intensive	Not FDA-approved as a medical device
AliveCor's KardiaMobile	Mobile ECG monitoring, instant analysis	Ease of use, early detection of arrhythmias	Limited to cardiac monitoring, need for device purchase	FDA-cleared for cardiac monitoring
Amwell	Teleconsultations, EHR integration, virtual waiting rooms	Large provider network, user-friendly	May require integration with existing EHR systems	Not FDA-approved as a medical device
REACH Health	Telestroke assessments, EHR integration, data sharing	Reduces time to stroke treatment	Requires specialized training for stroke assessments	Not FDA-approved as a medical device
DermEngine	Teledermatology image analysis, AI support	Enhanced diagnostic accuracy	Limited to dermatology, reliance on image quality	Not FDA-approved as a medical device

internet connectivity for robust telemedicine adoption.⁶⁰ Insufficient bandwidth and outdated equipment can hinder the effectiveness of telemedicine consultations.⁸⁴ In remote regions, nurses may struggle with unreliable internet connections, making it challenging to conduct real-time video consultations with patients. This can lead to disruptions in care and hinder accurate assessments.⁵⁶

The legal and regulatory landscape for telemedicine can be complex and varies from one jurisdiction to another.¹¹³ Compliance with state and federal regulations, licensure requirements, and reimbursement policies can be daunting for nurses and healthcare organizations.¹⁴³ Telemedicine often involves providing care across state lines. Nurses must navigate the intricacies of licensure compacts and state-specific regulations to ensure they are practicing within legal boundaries when caring for out-of-state patients. Maintaining the privacy and security of patient health information in a telemedicine environment is paramount.¹¹⁴ The risk of data breaches, unauthorized access, and cyberattacks can be heightened in the digital realm.⁹² In 2020, there were instances of telemedicine platforms experiencing security breaches, raising concerns about the confidentiality of patient data.⁷⁶ Such incidents highlight the importance of robust cybersecurity measures in telemedicine.⁷⁷ The reimbursement landscape for telemedicine services is still evolving. While many insurers have expanded coverage for telemedicine, the reimbursement rates may not always align with the costs of providing telemedicine services.¹³² Nurses providing telemedicine services might find that reimbursement rates are lower compared to in-person visits. This can be a financial challenge for healthcare organizations, particularly if they invest in advanced telemedicine technologies. Successful telemedicine implementation requires training and education for nursing staff. Nurses need to be proficient in using telemedicine platforms, conducting virtual assessments, and ensuring the technology does not compromise the quality of care.¹²⁹

During the rapid adoption of telemedicine in response to the COVID-19 pandemic, many nurses had to quickly learn how to use telehealth tools. Inadequate training can lead to technical difficulties during consultations and decreased confidence in using telemedicine.⁴⁷ Healthcare professionals, including nurses, may resist the adoption of telemedicine due to concerns about changes in workflow, potential job displacement, or perceived limitations in the quality of care.⁹¹ Some nurses may resist telemedicine because they value in-person interactions with patients or believe that it cannot fully replace physical assessments.⁵⁶ Overcoming this resistance requires effective change management strategies.⁸³

Not all patients have equal access to digital devices or the digital literacy required for telemedicine. This can exacerbate health disparities, as those without access to technology may be excluded from telehealth services.⁶¹ Elderly patients, individuals with disabilities, or those in lower-income communities may face barriers to accessing and effectively using telemedicine services.⁶¹ This can result in unequal access to care.¹³⁰ The human connection in nursing practice is essential for building trust and rapport with patients. Telemedicine, while

convenient, can sometimes feel impersonal, leading to concerns about the loss of the "human touch" in healthcare. Some patients may express dissatisfaction with telemedicine because they miss the physical presence of a nurse or the reassurance of a bedside manner.⁷² Striking a balance between the convenience of telemedicine and the personal touch of in-person care is a challenge.⁵⁶ Table 5 provides an in-depth look at common challenges in telemedicine implementation in nursing practice and detailed mitigation strategies for each challenge.

7. Addressing ethical considerations in telemedicine in nursing practice

The integration of telemedicine into nursing practice brings with it a set of ethical considerations that nurses and healthcare organizations must carefully navigate.² These considerations revolve around issues of patient privacy, informed consent, data security, quality of care, and maintaining human connection in healthcare.¹³⁶ Addressing these ethical concerns is essential to ensure that telemedicine upholds the highest standards of patient care and professionalism.

Table 5
Challenges and Mitigation Strategies in Telemedicine Implementation.

Challenge	Challenges Description	Mitigation Strategies
Technological Infrastructure	Insufficient technology resources and infrastructure	Invest in upgraded technology and broadband access
Legal and Regulatory Concerns	Complex and evolving telehealth regulations	Regularly monitor and comply with state and federal laws
Privacy and Security Risks	Risks of data breaches and patient privacy violations	Implement robust cybersecurity measures and encryption
Reimbursement and Financial Barriers	Inadequate reimbursement rates for telehealth services	Advocate for fair reimbursement policies
Training and Education	Lack of telehealth training for nursing staff	Provide comprehensive training and ongoing support
Resistance to Change	Staff reluctance and concerns about telemedicine	Engage staff in decision-making, provide education
Digital Health Disparities	Inequitable access to telemedicine due to technology gaps	Offer alternative access options for underserved patients
Maintaining the Human Touch	Challenges in building rapport and patient-provider trust	Provide training in telehealth communication skills
Scope of Practice and Boundaries	Unclear boundaries and potential scope violations	Clearly define roles and responsibilities, consult specialists
Cultural Competency and Diversity	Insufficient cultural competency in telehealth	Offer cultural competency training, provide language support

Protecting patient privacy and confidentiality in the digital realm is paramount. Nurses must ensure that patient health information is securely transmitted and stored during telemedicine interactions.² A nurse conducting a virtual consultation with a patient must ensure that the video conferencing platform used is encrypted and compliant with health data privacy regulations like HIPAA. Patient discussions should occur in private settings to prevent unauthorized access.⁷⁰ Nurses are responsible for obtaining informed consent from patients before initiating telemedicine consultations. Patients should be fully informed about the nature of telemedicine, its limitations, and the potential risks and benefits.¹¹⁹ Prior to a telemedicine session, a nurse should explain to the patient the purpose of the consultation, the technology to be used, and any potential limitations, such as the inability to conduct a physical examination.¹¹³ Patients should have the opportunity to ask questions and provide informed consent to participate.⁷⁹

Safeguarding patient data from data breaches and cyberattacks is an ethical imperative. Nurses should be vigilant in ensuring that telemedicine platforms and devices are secure.⁴ A nurse should use secure and encrypted communication tools for telemedicine consultations. Regularly updating passwords, keeping software up-to-date, and following best practices in cybersecurity are essential to protect patient information.¹⁵⁶ Nurses have a duty to provide high-quality care to patients, regardless of the mode of delivery. Maintaining the same standards of care in telemedicine as in traditional in-person care is an ethical obligation.⁸ When conducting telemedicine consultations, nurses should ensure that assessments and interventions are thorough and evidence-based. They should adhere to clinical guidelines and best practices, striving for the same level of care excellence as in physical healthcare encounters.²⁶

Improper use of digital devices in telenursing can lead to errors in data collection, transmission, and analysis, which can affect patient safety and quality of care. Problems such as inaccurate readings, data glitches, communication breakdowns, and workflow interruptions can occur, impacting patient outcomes and efficiency of care. Ensuring that telemedicine does not exacerbate healthcare disparities is an ethical obligation. Nurses must work to provide equitable access to care for all patients, regardless of their technological resources or abilities. To address disparities, nurses and healthcare organizations may need to explore alternative communication methods (e.g., telephone consultations) for patients who lack internet access or digital devices.¹² Ensuring that telemedicine is accessible to all socioeconomic groups is essential. Maintaining the human touch in healthcare is an ethical consideration. Nurses should strive to preserve the therapeutic nurse-patient relationship, which can be challenged in virtual care settings.¹⁰ To maintain the human connection, nurses can actively engage with patients during telemedicine consultations. This includes demonstrating empathy,

active listening, and maintaining eye contact via video conferencing to create a sense of presence and connection.⁴²

Nurses must operate within the scope of their practice and maintain professional boundaries during telemedicine encounters. A nurse should not provide medical advice or treatment outside their area of expertise, even in a telemedicine context. If a patient’s condition requires the expertise of a specialist, the nurse should facilitate a referral to ensure the patient receives appropriate care. Ensuring the continuity of care when transitioning between in-person and telemedicine encounters is an ethical consideration.² Patients should experience a seamless transition in their care journey. If a patient begins a treatment plan through telemedicine and later requires in-person care or hospitalization, the nurse should ensure that relevant information from telemedicine encounters is appropriately integrated into the patient’s medical record and communicated to other healthcare providers for continuity of care.³³

Table 6 provides a comprehensive overview of key ethical considerations related to telemedicine in nursing practice. It includes ethical concerns, examples, recommended actions, and potential consequences.

8. Conclusion

The integration of telemedicine into nursing practice has already had a profound impact on healthcare delivery, but its potential is far from fully realized. As technology continues to advance and healthcare systems evolve, several future directions and recommendations can help shape the trajectory of telemedicine in nursing practice: Continued advancements in telemedicine technology are expected, including improvements in telehealth platforms, wearable devices, and remote monitoring tools. These developments will enhance the capabilities of nurses in assessing and caring for patients remotely. Risk management is an essential part of telenursing process. Healthcare organizations have an obligation to implement protocols to identify, evaluate, and minimize risks related to the utilization of digital devices, ensuring patient safety, data security, and adherence to regulatory standards. This includes training nurses, developing safety guidelines, and supervising technological functionality to minimize the occurrence of potential risks. It is, therefore, recommended that nurses stay abreast of technological innovations and be prepared to adapt to new tools and platforms as they emerge. Healthcare organizations should invest in state-of-the-art telemedicine infrastructure to support nursing practice.

CRedit authorship contribution statement

Motunrayo Famujimi: Writing – review & editing, Writing – original draft. **Temitope Olawumi:** Writing – review & editing, Writing – original draft. **Deborah Esan:** Writing – review & editing, Supervision.

Table 6
Ethical Considerations in Telemedicine.

Ethical Concern	Examples	Recommended Actions	Potential Consequences
Patient Privacy and Confidentiality	Unauthorized access to patient data	Use encrypted platforms, educate patients on data security	Breach of patient confidentiality
Informed Consent	Lack of patient understanding of telemedicine	Provide clear explanations, document informed consent	Inadequate patient participation
Data Security and Cybersecurity	Data breaches, cyberattacks	Regularly update security measures, monitor for threats	Compromised patient data
Quality of Care	Varied quality in telemedicine encounters	Adhere to clinical guidelines, maintain standards	Suboptimal patient outcomes
Equitable Access to Care	Disparities in telehealth access	Offer alternative communication for underserved patients	Exacerbation of healthcare disparities
Sustaining the Patient-Caregiver Bond	Impersonal telemedicine interactions	Focus on patient engagement, empathy, and rapport	Decreased patient satisfaction
Professional Practice Limits and Ethical Boundaries	Providing care outside of scope	Provide clear explanations, document informed consent	Legal and ethical violations
Continuity of Care	Transitioning between telemedicine and in-person	Ensure seamless information transfer, care coordination	Fragmented patient care
Cultural Sensitivity and Inclusivity	Inadequate cultural sensitivity in telemedicine	Provide cultural competency training, language support	Cultural misunderstandings

David Bamidele Olawade: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Conceptualization. **Aanuoluwapo David-Olawade:** Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Formal analysis. **Iyanuoluwa Ojo:** Writing – review & editing, Writing – original draft, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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