



ICT in Health: Lesson 04

Exploring digital innovations
transforming healthcare delivery



ICT in Health Applications

Learning Objectives

- Understand layered architectures in telemedicine systems
- Analyze standards for interoperability and data exchange
- Evaluate ethical, regulatory, and sustainability dimensions

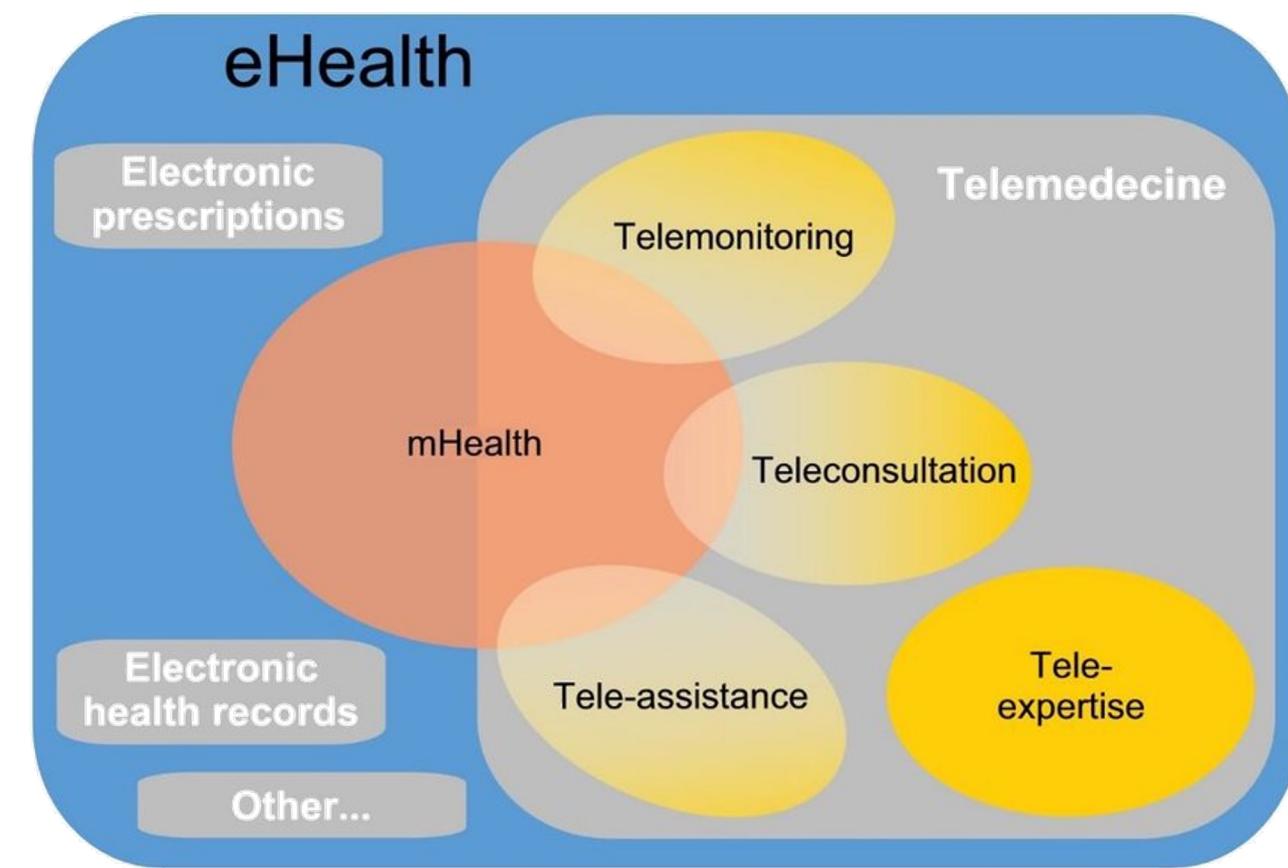


Modern Definitions: Telemedicine & eHealth

- **Telemedicine:**

Remote delivery of healthcare via telecom tech (WHO)

- **eHealth:** ICT use for health systems and services (WHO)



eHealth is the broad use of information and communication technologies (ICTs) in healthcare.

Telemedicine is a specific application of eHealth, focusing on the remote delivery of clinical medical services.

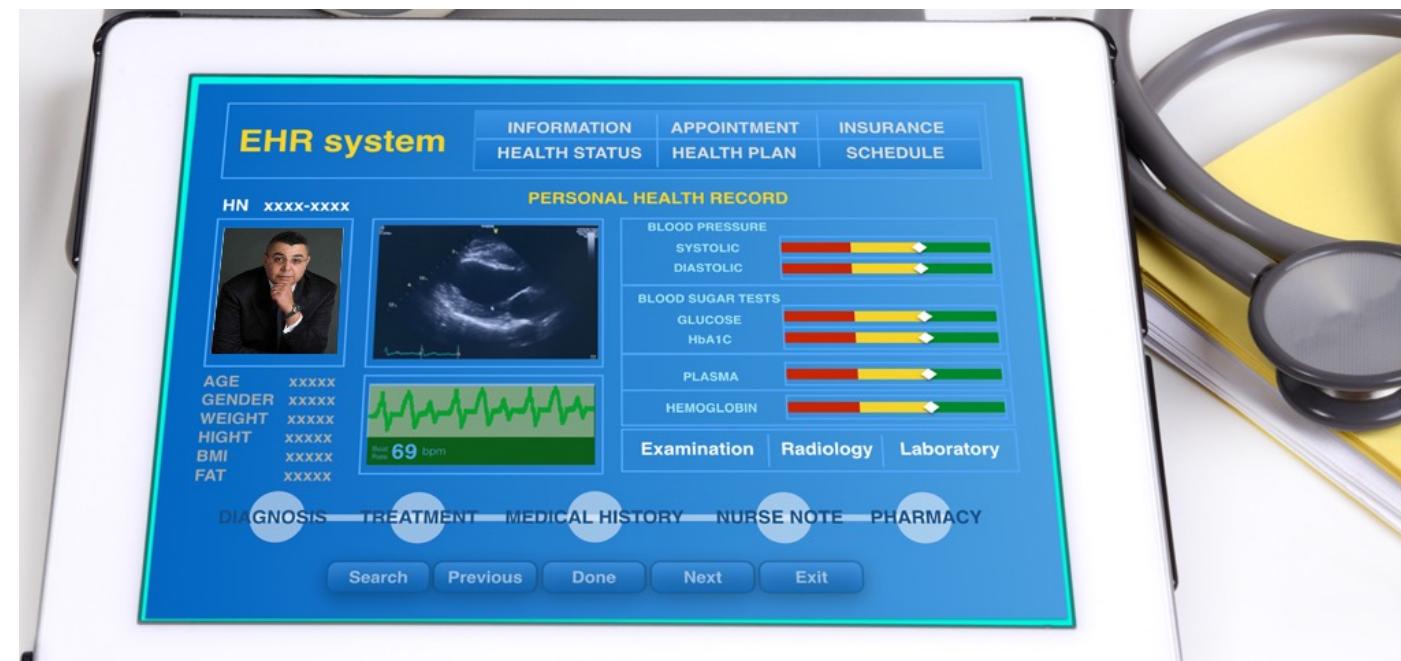
Healthcare ICT Ecosystem Overview

Stakeholders:

- patients, providers, technologists, regulators

Systems:

Electronic Health Records (EHRs), telemedicine, mHealth, AI support



Telemedicine Systems Architecture

Device layer:

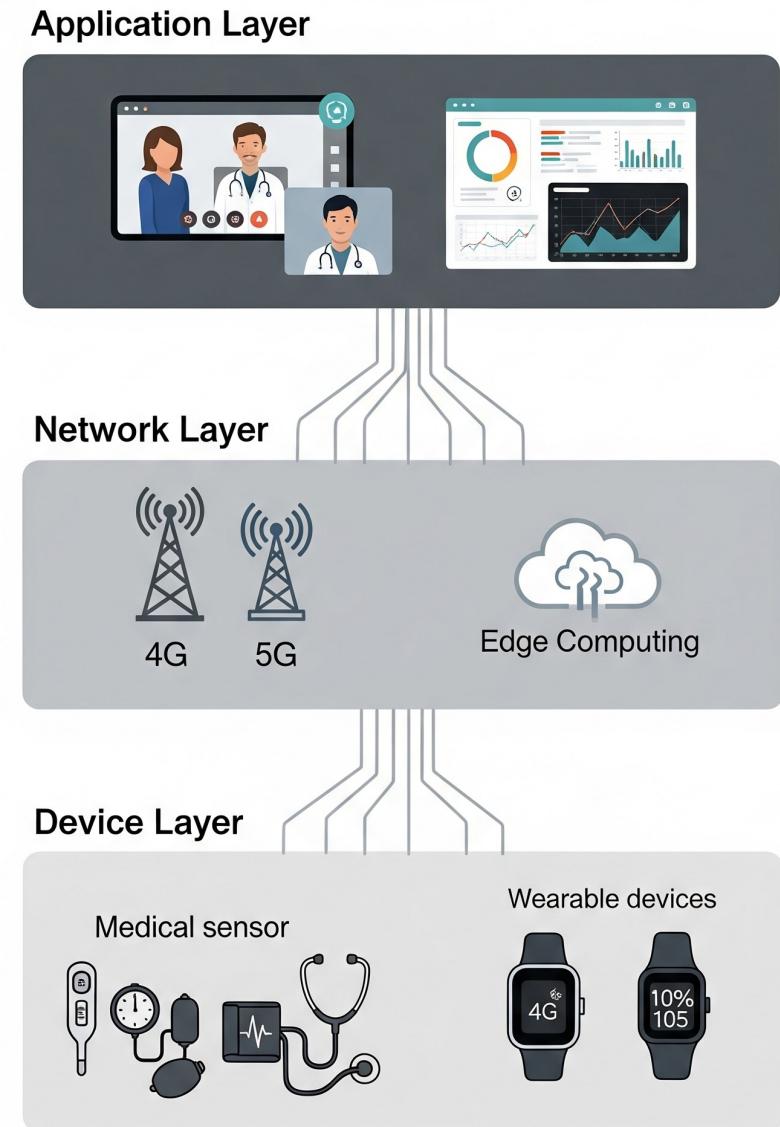
sensors, wearables

Network layer:

4G/5G, edge computing

Application layer:

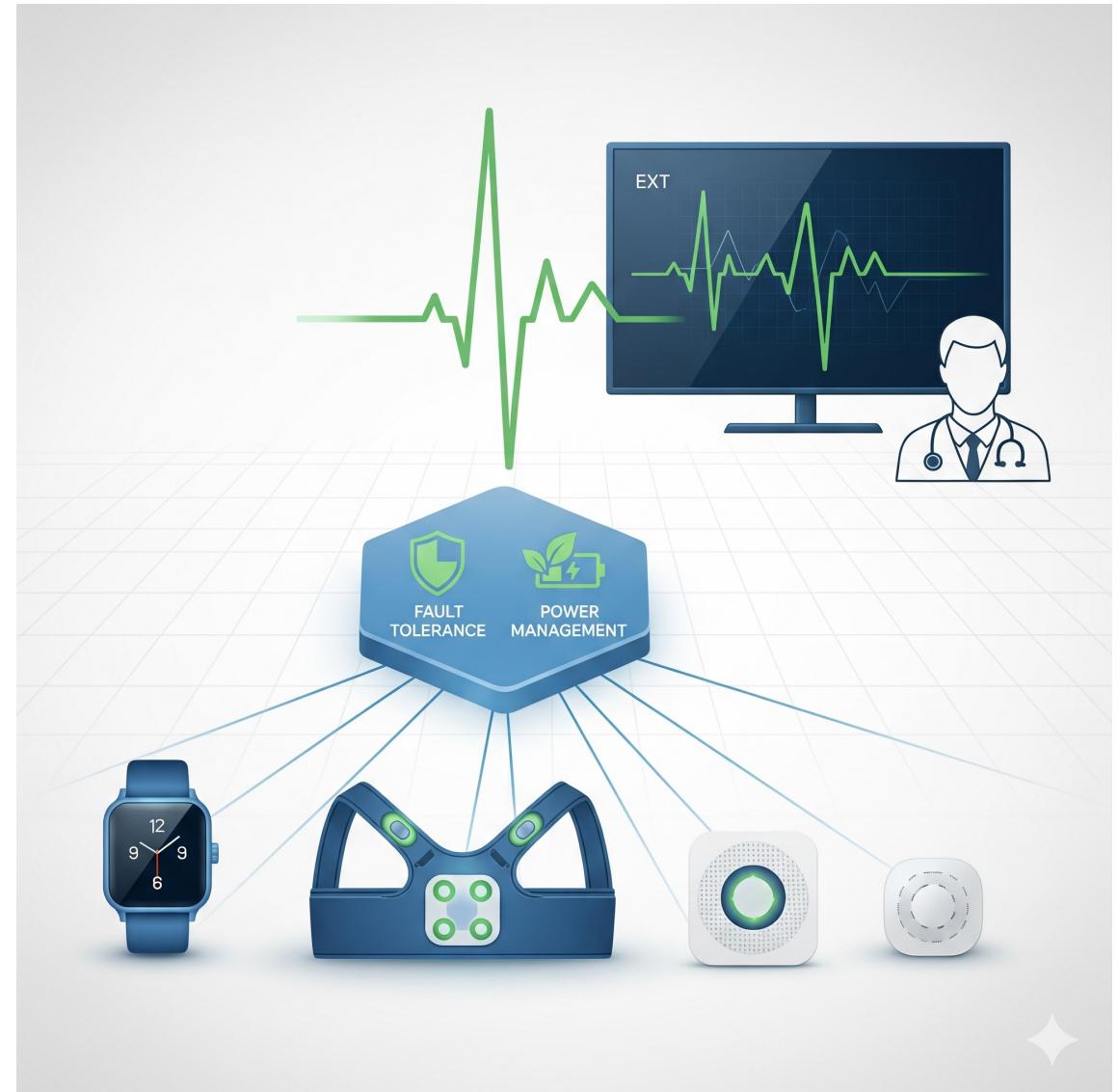
diagnostics, video consults



IoT and Sensor Networks

Highlight distributed sensing and resilience in **health telemetry systems.**

- Wearable health devices and sensor nodes
- Fault tolerance and power management
- Remote ECG monitoring



Signal Processing and Compression

Contribute data reduction techniques for constrained diagnostic environments.

- Codecs: H.264, HEVC for medical video
- Bandwidth optimization
- Ultrasound transmission

Bandwidth optimization ensures reliable, high-quality audio and video for consultations, enabling a seamless patient-provider experience.

It is critical for the transmission of large medical files.

Medical File Type	Typical File Size (Approximate)
X-ray (DICOM) 	1-10 MB (per image)
CT Scan (DICOM)	10-300 MB (per study)
MRI (DICOM)	100-700 MB (per study)
Ultrasound (DICOM)	50-200 MB (per study)

Security and Risk Management

Frames cybersecurity as a core requirement for health ICT deployment.

Encryption: TLS, AES

Role-based access control

ISO/IEC 80001 compliance



AI and Machine Learning in Health

Introduces algorithmic decision support and ethical AI considerations.

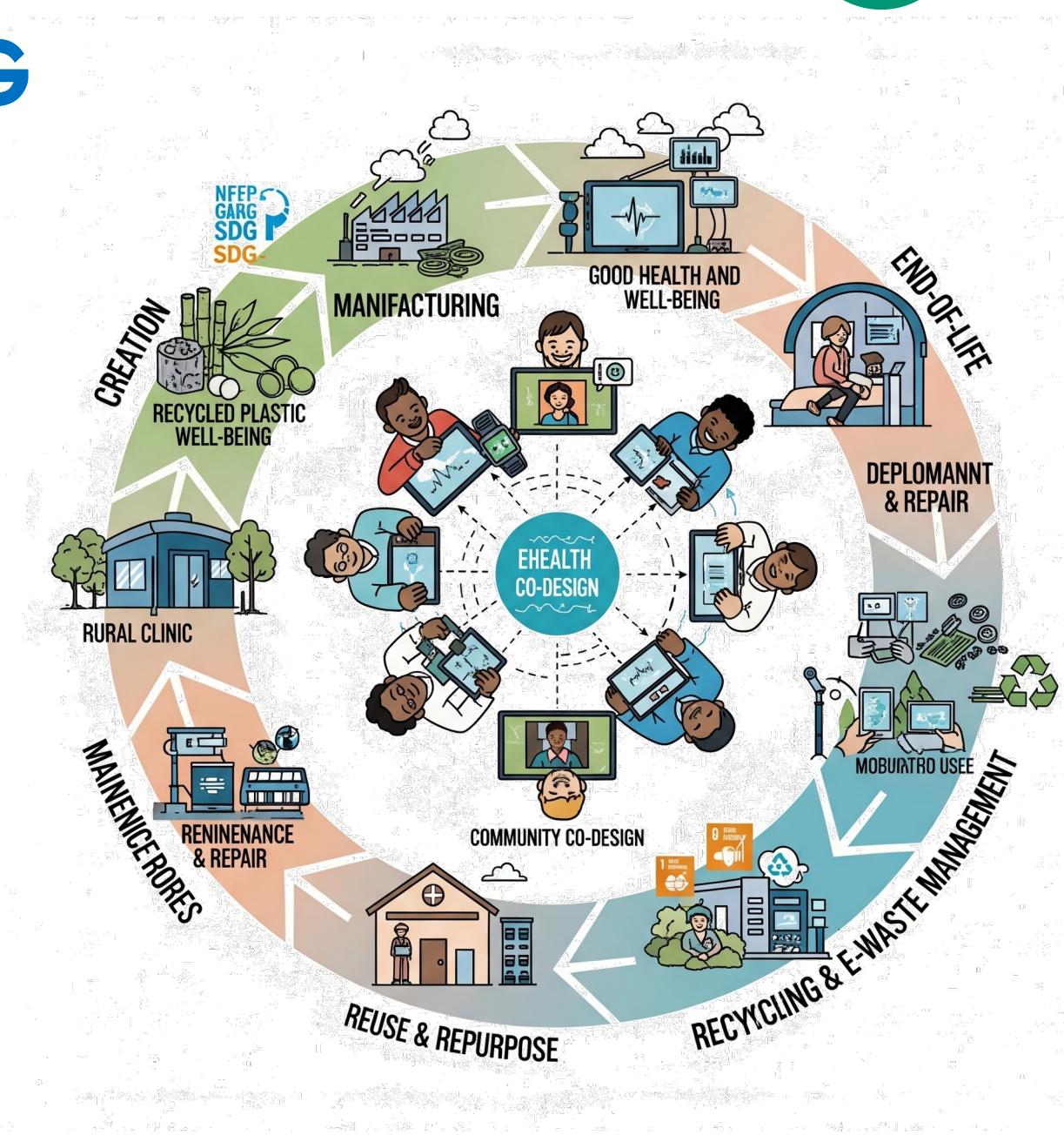
- Predictive analytics and triage
- NLP for documentation
- Bias mitigation and explainability



Sustainability and SDG Alignment

Connects ICT to environmental and participatory development goals in the context of eHealth and Telemedicine.

- Lifecycle analysis of ICT infrastructure
- E-waste management
- Community co-design



References and Standards

Anchors content in recognized standards and scholarly frameworks.

- HL7, FHIR
- ISO/IEC 80001
- IEEE 11073

Academic and institutional sources

HL7: A set of standards for exchanging, integrating, sharing, and retrieving electronic health information.

FHIR: A modern standard for healthcare data exchange using web-based resources for easy, fast interoperability.

ISO/IEC 80001: A standard for risk management of IT networks that incorporate medical devices.

IEEE 11073: A family of standards that ensures interoperability between personal health and medical devices.

ICT as enabler of SDG 3 and SDG 9

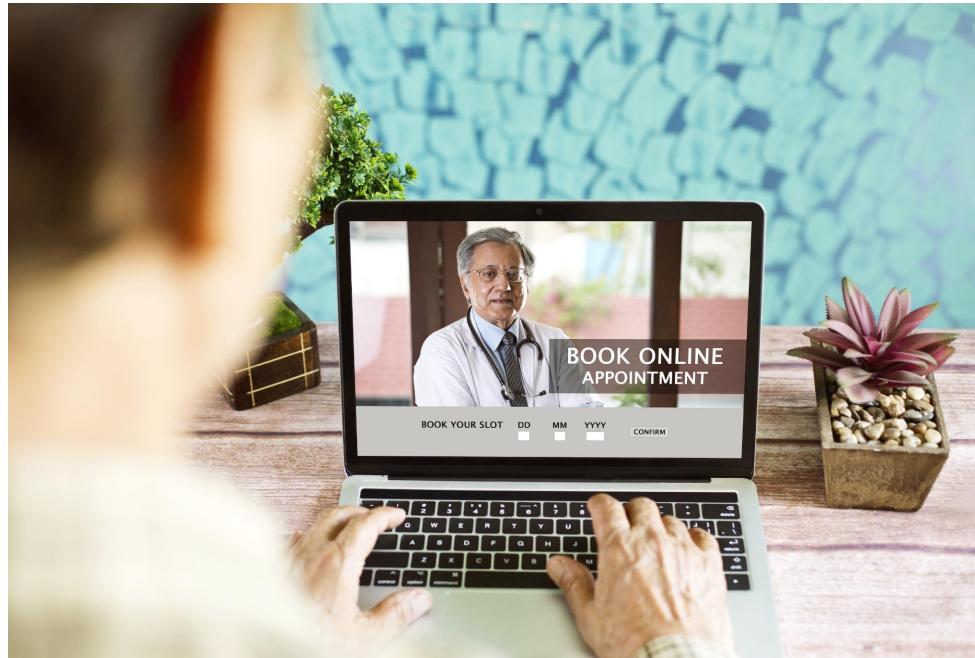
Barriers in rural regions

Challenges include :

- poor internet connectivity and lack of infrastructure,
- limited access to technology, and a
- shortage of digitally literate healthcare professionals and patients.
- The fragmented health system also presents barriers.
- because it lacks **coordination and interoperability**, with separate institutions and data systems, hindering seamless patient care and information sharing.



Telemedicine in Rural Areas



Definition and Types

Telemedicine uses digital technology for remote healthcare, including video calls, data sharing, and monitoring.

Benefits of Telemedicine

Improves healthcare access, reduces travel costs, and supports continuous treatment in rural areas.

Challenges Faced

Infrastructure gaps, insufficient trained staff, and cultural barriers hinder telemedicine adoption.

Successful Implementations

Latin American programs show telemedicine's potential when combined with community health support.



Mobile Health Applications

Core Functions of mHealth Apps

mHealth apps support diagnosis, patient monitoring, health education, and communication between providers and patients.

Rural mHealth Solutions

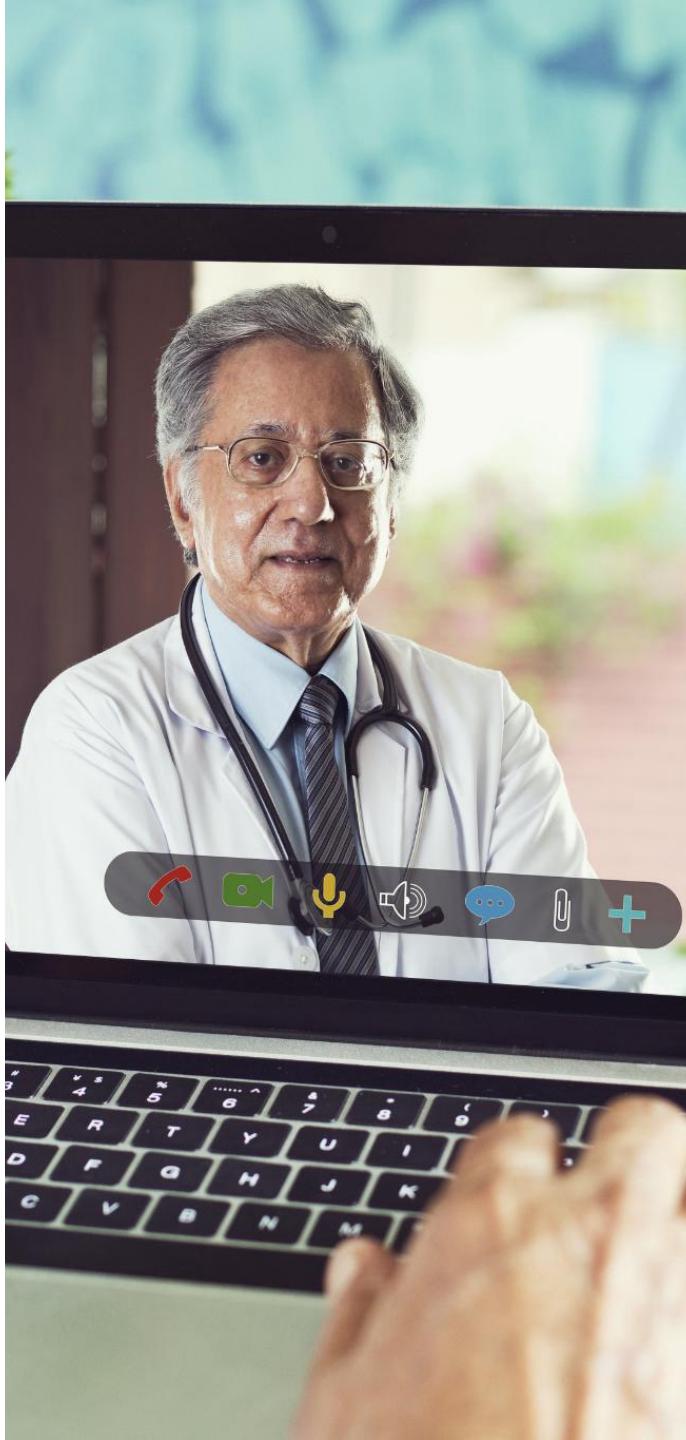
In rural areas, mHealth uses SMS, voice calls, and smartphones to reach users with limited digital skills effectively.

Impact on Health Outcomes

Case studies from Latin America show mHealth improves maternal health, chronic disease management, and preventive care.

Success Factors

User-centered design, cultural relevance, and health system integration are key for effective mHealth application success.



Health Data and Ethical Considerations

Data Management in Telemedicine

Effective collection and analysis of patient data support clinical decisions and public health in rural telemedicine.

Ethical Priorities

Privacy, informed consent, data security, and equitable access are fundamental ethical concerns in health data management.

Interoperability and Continuity

Seamless interoperability between systems ensures accurate records and continuity of care in telemedicine.

Cultural Sensitivity and Trust

Respecting cultural diversity and ethical frameworks builds trust and supports sustainable telemedicine programs.

Networks and Telecommunications for Rural Telemedicine



Essential Telemedicine Network Needs

Stable internet and sufficient bandwidth enable smooth video consultations in rural telemedicine applications.

Challenges in Rural Connectivity

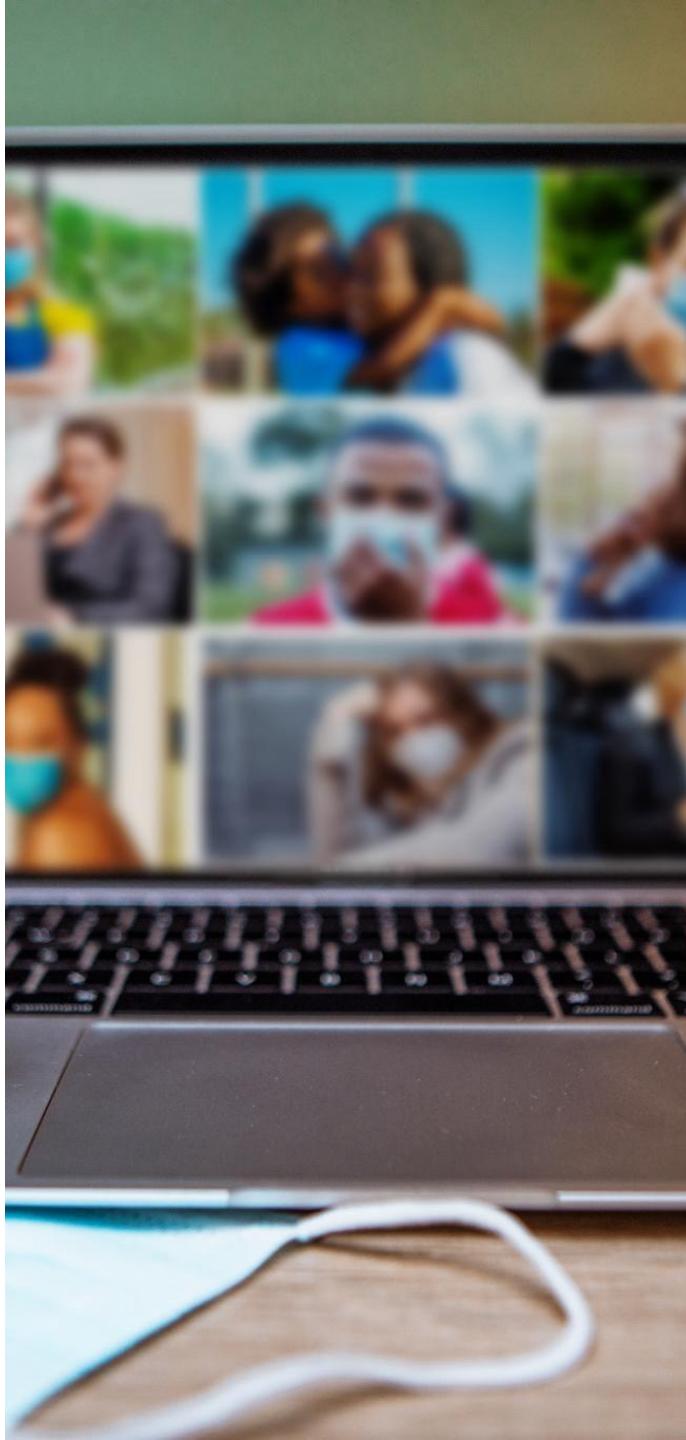
Limited infrastructure, high latency, and deployment costs create obstacles for telemedicine in rural regions.

Innovative Network Solutions

Mobile networks, satellite communication, and mesh networks can extend coverage in underserved areas.

Sustainable System Design

Low-cost, scalable, and locally adaptable systems ensure sustainability and community ownership.



Government Role in Rural Telemedicine

Policy and Regulation

Governments develop policies and regulatory frameworks to ensure quality, safety, and equity in rural telemedicine services.

Infrastructure Investment

Investment in ICT infrastructure and subsidies help expand telemedicine access in rural and low-income areas.

Partnerships and Collaboration

Governments facilitate partnerships with private sector and NGOs to enhance telemedicine service delivery and reach.

Monitoring and Community Engagement

Monitoring programs and grassroots engagement help tailor telemedicine to local needs and build community trust.

Civil Society and Academia in Rural Telemedicine



Role of Civil Society

NGOs advocate for rural communities, provide health education, and execute pilot telemedicine projects demonstrating impact.

Academic Contributions

Universities conduct research, innovate technologies, and train professionals to address rural health challenges effectively.

Collaborative Models

Partnerships between academia, civil society, and local stakeholders enhance telemedicine sustainability and relevance.

Capacity Building and Knowledge Exchange

Collaborations foster inclusive development through capacity building and knowledge sharing tailored to community needs.



Summary and Reflection

ICT Transforming Healthcare

ICT enables scalable solutions like telemedicine and mobile apps to improve rural healthcare access and quality.

Implementation Considerations

Ethical issues, infrastructure needs, and stakeholder involvement are crucial for successful ICT healthcare projects.

Collaborative Roles for Change

Government, civil society, and academia play key roles in fostering supportive environments and sustainable healthcare change.