RIT Croatia

DIG HEALTH

Telemedicine Foundations: Defining Key Concepts

DigHealth –
Micro-credentials in digital health for Ethiopia and Somalia

Proj. Ref. Num. 101179425

Capacity Building in the field of Higher Education

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Understanding Telemedicine, Telehealth, eHealth, and mHealth

Precise understanding of these terms is essential for professionals, practitioners, policymakers, and organizations seeking to implement effective digital health strategies. Definitions clarify scope, regulatory policy, and technical requirements.

What is Telemedicine?

Definition: The practice of delivering clinical healthcare services to patients using digital communication technologies and digital health system when providers and patients are not physically present together.
Essential Details:

- Clinical Focus: Encompasses activities such as virtual consultations, diagnosis, follow-up, prescription issuance, and telemonitoring for ongoing care.
- Modalities: Most common are video calls, secure messaging, and remote device data integration.
- Benefits: Expands access to specialist care, reduces burdens on healthcare infrastructure, facilitates continuity of care for chronic conditions, and enables rapid response in emergencies.
- Historical Usage: Initially developed to support remote or underserved areas and military medicine, but now increasingly mainstream due to digital infrastructure advancements.

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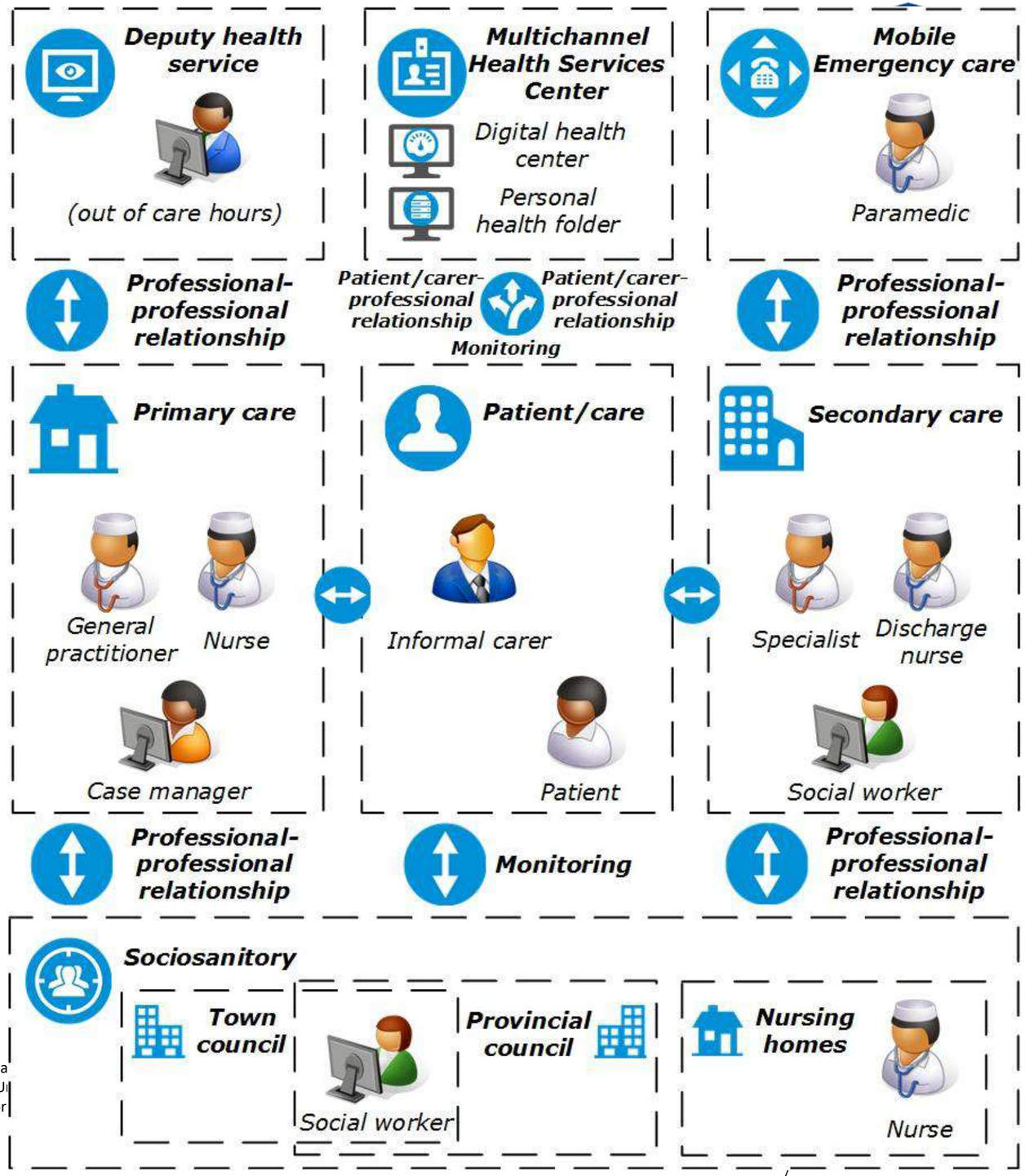
Typical country Digital Health System



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What is Telehealth?

Definition: Telehealth is a broad term that covers all health-related services and information delivered through telecommunications technologies, both clinical and non-clinical.
Essential Details:

- Scope Beyond Clinical: Includes telemedicine, remote education/training for doctors and nurses, administrative meetings, therapies, public health campaigns, preventive medicine, and population health management.
- Framework: Functions as an umbrella concept, with telemedicine as a subset focused on clinical interactions.
- Examples: Remote practitioner consultations, telepharmacy, telepsychology, group therapy, continuing medical education for rural health workers.
- Public Health Impact: Plays a significant role in disaster response, health system coordination, and community outreach.

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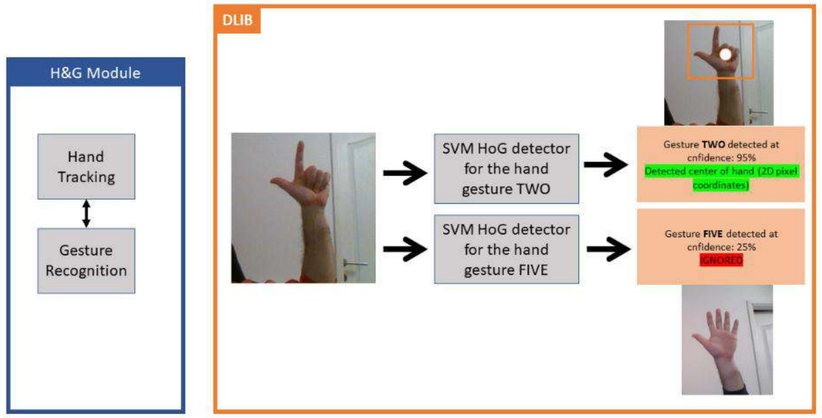
European Union, EIT RIS project “3D Virtual Navigation which integrates high-resolution stereo depth camera with medical imaging systems with ‘in the air’ real control of surgeon’s hands”

European Union, EIT Jumpstarter project “Efficient Motion Detection Algorithm for 3D Medical Data”

European Union, H2020 project “Multi-level integration for patients with complex needs (CareWell)”

European Union, EIT RIS project “Gesture-based Human Machine Interface for Guided Orthopedic Surgery”

BICRO project “Medical Imaging and Diagnostics on the Move (MIDOM)”



List of recent relevant digital health projects

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Public health expenditure is constantly rising globally

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Public health expenditure varies significantly across countries, but overall, there has been a trend of increasing investment in public health worldwide.

According to the World Health Organization (WHO), global health expenditure has been steadily rising over the years. In 2019, the global average expenditure on health was around 9.2% of GDP. In some countries, this percentage is even higher.

For example, in the United States, public health expenditure accounted for approximately 17.7% of GDP in 2019. These numbers indicate a recognition of the importance of public health and a commitment to investing in healthcare systems to improve population health outcomes.

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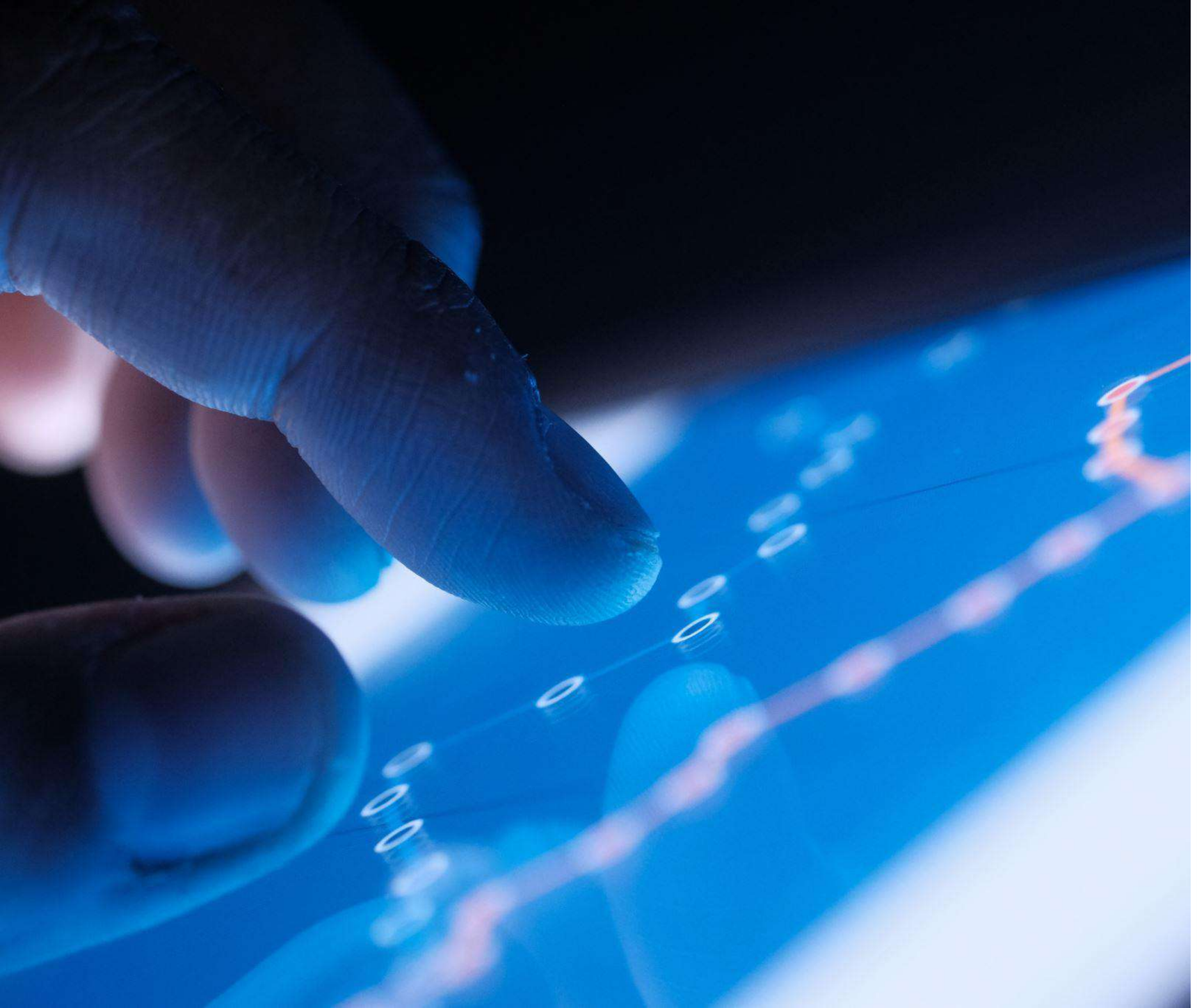
Despite the economic crisis, the market potential of digital health is strong



The market potential of digital health has been robust, even during economic crises. The COVID-19 pandemic has further accelerated the adoption and acceptance of digital health technologies.

According to a report by Grand View Research, the global digital health market size was valued at USD 137.7 billion in 2022 and is expected to reach USD 680.3 billion by 2027, growing at a compound annual growth rate (CAGR) of 23.9% during the forecast period.

This growth is driven by factors such as the increasing prevalence of chronic diseases, the need for remote patient monitoring, the demand for efficient healthcare delivery systems, and technological advancements in areas like telemedicine, wearable devices, and health apps.

Despite the economic crisis, the market potential of digital health is strong

mHealth systems offer the potential to alleviate the strain on clinic-based diagnosis and treatment by providing remote and decentralized healthcare services.

According to a report by Allied Market Research, the global mHealth market was valued at USD 96.2 billion in 2024 and is projected to reach USD 230.4 billion by 2027, growing at a CAGR of 22.3% during the forecast period.

This growth is driven by factors such as the increasing adoption of smartphones and mobile apps, the need for remote patient monitoring and disease management, the demand for personalized healthcare solutions, and the expansion of telemedicine services.

These numbers indicate the market potential and growing recognition of mHealth systems as a viable solution to reduce the pressure on clinic-based diagnosis and treatment.

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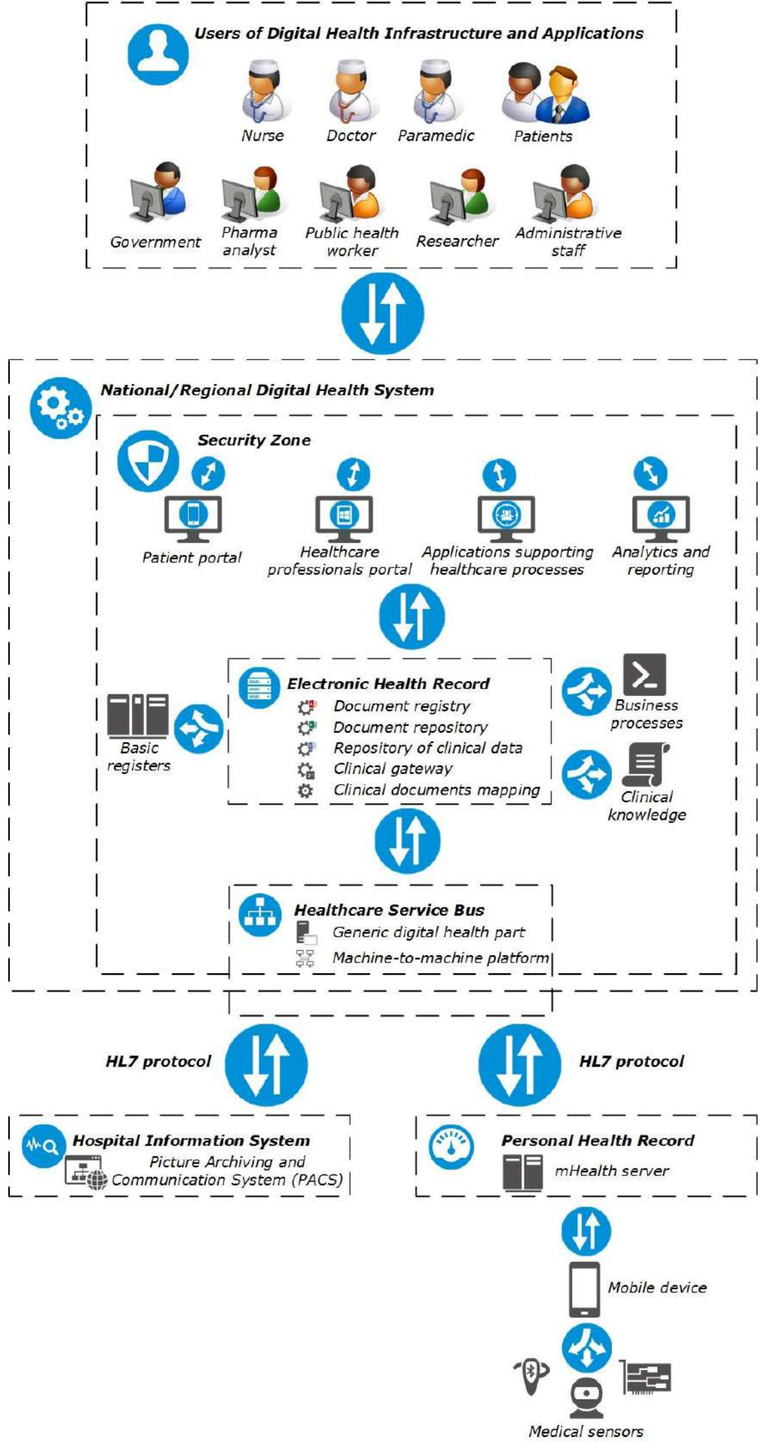


Architecture of a Digital health System

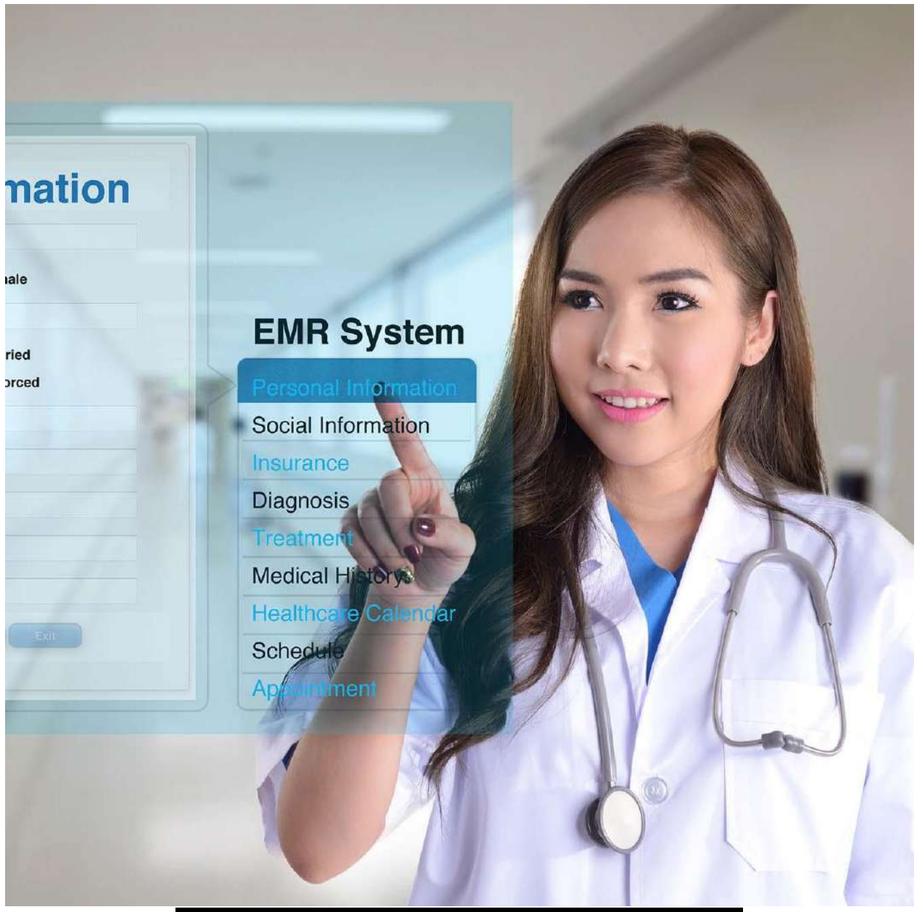
The most important thing when integrating mHealth system with digital health infrastructure is which part of data stays locally in mHealth system, and which part becomes part of the central EHR

Too much data pollutes EHR and makes it unusable, too few makes it unreliable. There is no unique answer, and it is definitely dependable on the specific healthcare process and the type of measurement.

Therefore, EHR's module Clinical documents mapping is one of the crucial modules in successful integration of mHealth solutions within national digital health implementations.

Complex and high volume data, such as medical images, are due to it's volume and communication/storage costs usually kept at the source PACS, referenced within EHR and retrieved by demand.

On some rare occasions, where it is clinically important, physician might decide to include some representative image into medical information stored centrally within EHR. This communication setup, allows complex diagnostics to be performed by remote specialists, offering higher level of care while reducing systems costs.



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To fully understand the challenges of creating secure, interconnected electronic health records, it is important to review the content and purpose of a medical record, regardless of the form it takes

Every time a patient is treated by a health care provider, a record is made of the encounter. This record includes information that the patient provides, such as medical history, as well as the physician's assessment, diagnosis, and treatment plan. Medical records beside textual data also contain diagnostic images and videos, and metadata connected with them that indicate the results and other medical procedures.

This chronological electronic health record is an important business and legal document. It is used to support clinical treatment decisions, to document services provided to patients for billing purposes, and to document patient conditions and responses to treatment should a legal case arise.

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The application of eHealth solves the problem of the lack of specialized personnel, unnecessary execution of multiple diagnostic imaging and rapid exchange of information and remote diagnostics

Application of ICT in health care and improving the overall health system and services are nowadays defined in most national strategies for the development of health in the world. Following this, eHealth as a set of systems and services that enable the sharing of medical diagnostic imaging data remotely is an important factor in the achievement of these strategies.

The increased availability of medical imaging technologies that yield 4D data (3D + time), combined with the low-bandwidth requirements of telemedicine, generate demands for new medical image compression methods. Medical imaging generates large amounts of data.

What is eHealth?

Definition: eHealth stands for the integration of information and communication technology (ICT) in health-related fields, from clinical processes to administrative functions.
Essential Details:

- Technologies Included: Electronic Health Records (EHRs), electronic prescribing, imaging archiving, teleconsultation platforms, and data analytics software.
- Infrastructure Role: Acts as the digital backbone for telemedicine/telehealth, supporting interoperability, safe storage, and secure access to patient information.
- Advantages: Enables population-level analytics, evidence-based medicine, easier coordination among multiple providers, and improves health system efficiency and transparency.
- Key Considerations: System integration, user authentication, data standards, GDPR/HIPAA compliance, and scalability.

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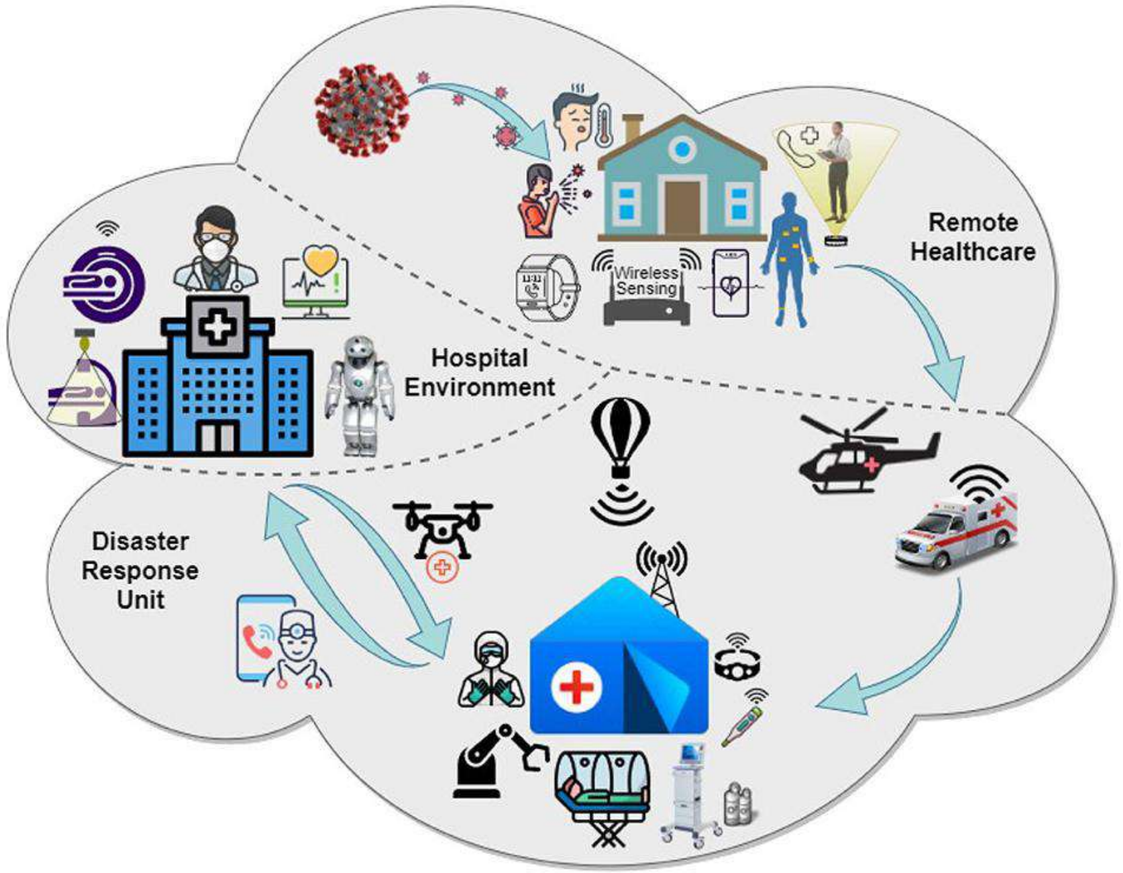
Croatian example

Croatian Central Healthcare Information System (CEZIH) is currently connecting and providing full support for number of business processes for 2300+ GP offices, 250+ pediatric care offices, 250+ women health offices, 2000 dentist offices, 150+ offices for school children medical care, 120 laboratories, 1300+ pharmacies, 1100+ specialist conciliar outpatient healthcare facilities and partially supporting functionalities for data exchange with 60+ hospitals (note: population of Croatia is approx. 4 million).

There are currently over 60 ICT vendors providing SW & services in this framework. The system of this complexity could not be designed and implemented without interoperability principles and continuous connection infrastructure.

The system on average processes over 50M ePrescriptions yearly (for perspective: approx. 11 times population of the country), 15M eReferrals and e.g. 48M practitioners' reports (GP & other).



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Telemonitoring as a Subset

Definition: Telemonitoring is the remote tracking and reporting of patient health indicators (like blood pressure, glucose, heart rate) using digital devices connected to health provider networks.
Essential Details:

- How It Works: Devices worn or used by patients (home or hospital) automatically record and transmit health data over secure networks for ongoing surveillance by clinicians.
- Applications: Chronic disease management (diabetes, hypertension, COPD), post-surgical recovery, elderly care, and infectious disease tracking.
- Advantages: Facilitates early intervention, reduces hospitalization rates, supports personalized and preventive medicine, and enables real-time alerts for urgent conditions.

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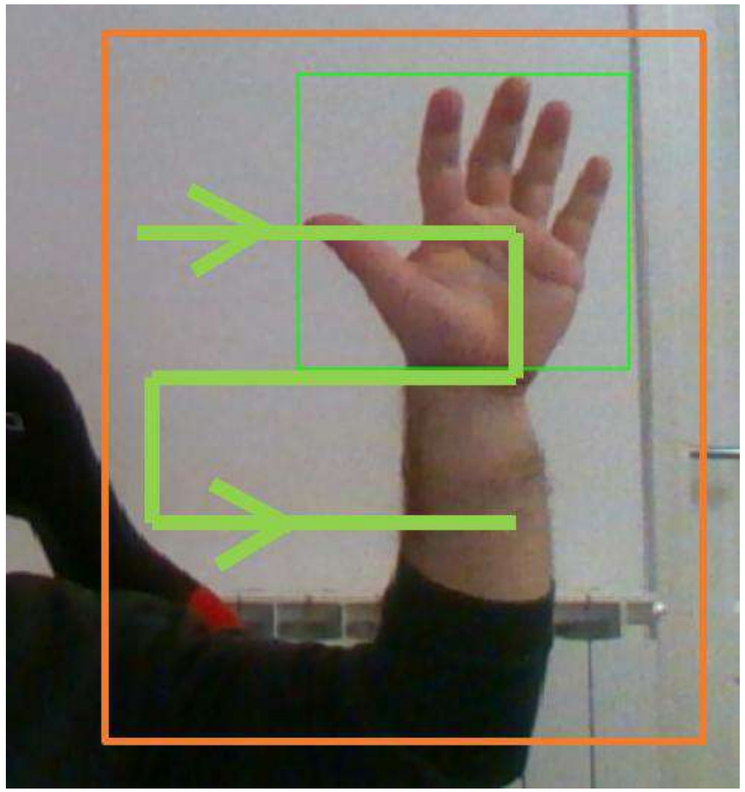
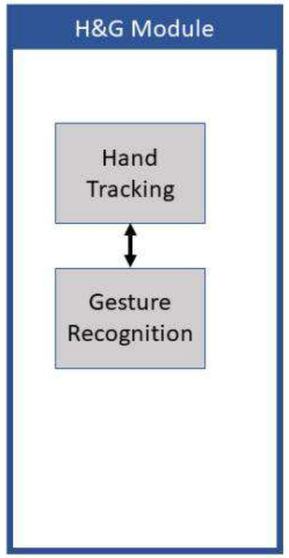
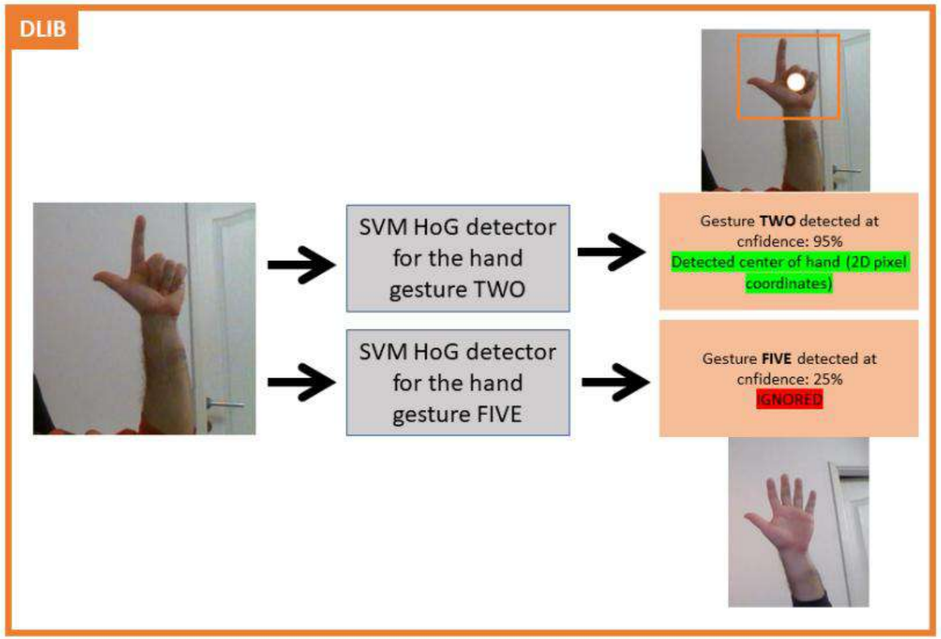
Example of Gesture detection in telemonitoring







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What is mHealth?

Definition: mHealth (mobile health) utilizes mobile devices such as smartphones, tablets, and wearable technology to deliver healthcare services and information.
Essential Details:

- Features: Mobile apps for disease management, fitness tracking, medication reminders, public health messaging (SMS), mobile diagnostic devices, and teleconsultations via mobile platforms.
- Strengths in Accessibility: Critical for reaching rural, remote, and resource-limited populations; allows direct-to-patient engagement and health monitoring outside traditional clinics.
- Use Cases: Pandemic contact tracing, prenatal care education, rapid screening surveys, SMS-based medication adherence, and remote symptom tracking.
- Technical Aspects: Focus on interface usability, connectivity (cellular/data networks), integration with health platforms/EHRs, and privacy management.

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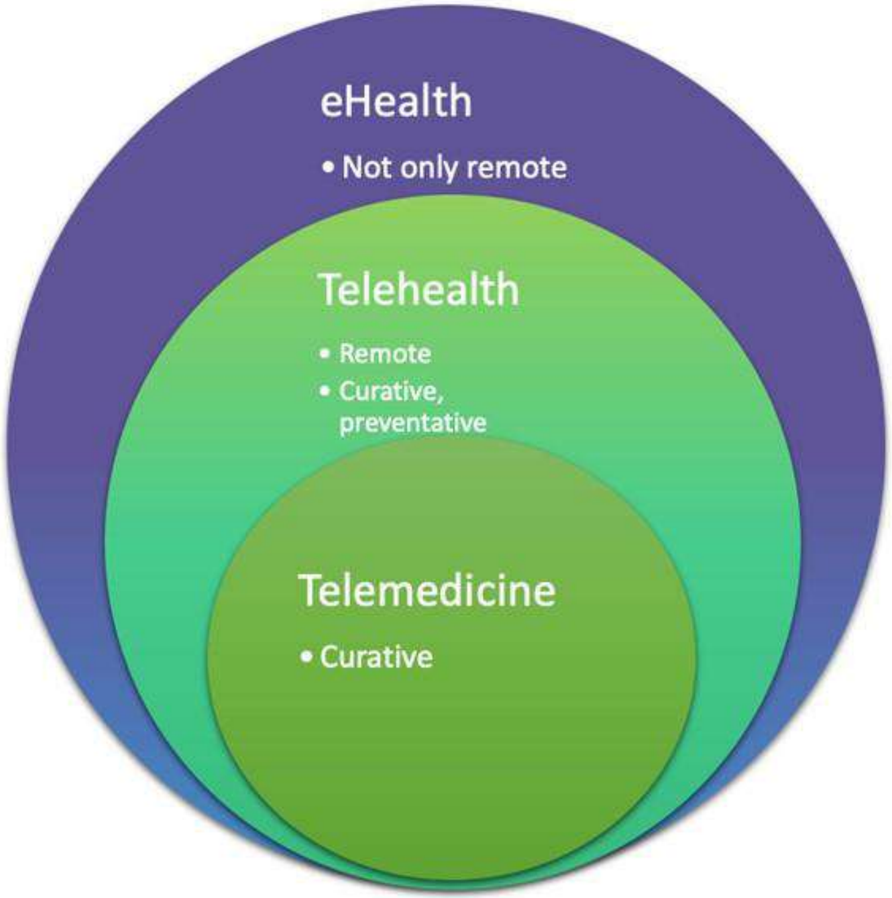
Differences and Relationships Diagram



Telemedicine: Remote clinical care only
Telehealth: All telemedicine plus education/training/administration
eHealth: All ICT healthcare applications, including telemedicine and telehealth
mHealth: All digital health activities delivered by mobile devices, may overlap telemedicine/telehealth/eHealth
Explanation: Shows that telemedicine is always clinical, telehealth is broader, eHealth is the infrastructural context, and mHealth is mode-specific (mobile-driven).

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Telemedicine Example in Practice

Scenario: Patient in a rural community connects with a cardiologist via secure video call. Cardiologist reviews recent test results uploaded through an EHR portal, recommends changes to medications, and schedules follow-up with local clinician.

- Workflow: Data transmission, real-time specialist feedback, integrated EHR documentation.
- Key Results: Improved access to expertise, lower travel costs, timely care for complex problems.

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Telehealth Example in Practice

Scenario: Regional health system conducts a live online continuing medical education session for remote clinicians, using interactive polling, document sharing, and Q&A chat features. Includes administrative updates and guidelines for outbreak management.
Advantages: Builds professional capacity, supports consistent standards, enhances collaboration between isolated providers.

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eHealth Example in Practice

Scenario: National health network implements a secured EHR platform linking hospitals, clinics, and public health agencies. Allows authorized providers to access full medical histories, previous diagnostic images, prescriptions, and allergy information anytime, anywhere.
Benefits: Reduces paperwork, eliminates duplication, enables coordinated team-based care, streamlines billing and reporting.

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mHealth Example in Practice

Scenario: Diabetic patients use a mobile health app to log blood sugar levels, receive timely alerts when readings are out of range, access education videos, and chat with health coaches. SMS reminders prompt medication at the correct time.
Impacts: Empowers self-care, advances preventive care, timely support, improved compliance, targeted interventions.

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Summary of Key Concepts

Telemedicine: Remote clinical care using ICT.
Telehealth: Encompasses telemedicine plus education, public health, admin.
eHealth: ICT framework for all digital healthcare activities; backbone for storing, managing, accessing data.
mHealth: Leverages mobile devices and apps for individual and public health interventions.

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Why Accurate Definitions Matter

- Clarity for Policymakers: Ensures laws, regulations, and reimbursement policies correctly address relevant technologies and activities.
- Health System Planning: Facilitates integration and interoperability when deploying digital health systems.
- Education and Training: Prevents confusion among students, trainers, and practitioners.
- Data Security/Privacy: Avoids legal and ethical issues by clarifying data handling responsibilities and technological boundaries.
- Research and Innovation: Enables meaningful comparison and evaluation of programs, initiatives, and interventions.

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References & Further Reading

World Health Organization (WHO): Telemedicine and eHealth official documents.
Centers for Disease Control and Prevention (CDC): Digital health guidelines.
European Commission: eHealth policies and regulations.

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