APPLIED HEALTH INFORMATICS

Foundations of Health Informatics

Roles, Workforce Frameworks & Informatics in LMICs

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Lesson Overview

This lesson integrates health informatics workforce frameworks with real-world implementation contexts in low- and middle-income countries (LMICs).

Rather than treating roles, technology, and context as separate topics, this lesson shows how they are deeply interconnected in determining whether digital health initiatives succeed or fail.

Students will move from global frameworks to applied case studies, building conceptual understanding and practical analytical skills.

Lesson Objectives

By the end of lesson, learners will be able to:

- ❑ Describe the WHO Digital Health Workforce Framework and explain why it was created to support national digital health strategies.
- ❑ Differentiate key informatics roles and understand how competencies vary across clinical, technical, data, and leadership functions.
- ❑ Explain OpenHIE as both a technical architecture and a governance framework
- ❑ Analyze infrastructure and human capacity constraints in LMICs and how they influence system design.
- ❑ Identify leapfrogging opportunities while recognizing their risks and limitations.
- ❑ Apply lessons from case studies to explain patterns of both failure and success.
- ❑ Evaluate workforce gaps and connect them to sustainability challenges in digital health projects.

Why Workforce Matters in Health Informatics

Digital health is often mistakenly framed as a technology problem.

In reality, most digital health failures stem from human and organizational issues, not software defects.

Key reasons workforce matters:

- ❑ Digital systems must fit real clinical and public health workflows.
- ❑ Data quality depends on trained users who understand why data matters.
- ❑ Systems require ongoing maintenance, governance, and adaptation.

Health informatics is therefore a sociotechnical discipline, meaning outcomes are shaped by the interaction between people, processes, and technology.

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Why Workforce Matters in Health Informatics

Technology Alone Does Not Improve Health

Digital health interventions fail most often due to:

- ❑ Poor governance and ownership
- ❑ Skills mismatches
- ❑ Lack of contextual understanding
- ❑ Inadequate long-term workforce planning

Health informatics is a sociotechnical discipline — success depends equally on:

- ❑ People
- ❑ Processes
- ❑ Technology

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WHO Digital Health Workforce Framework – Purpose

The WHO Digital Health Workforce Framework defines:

- ❑ Who does digital health work
- ❑ What competencies they need
- ❑ How roles differ across health systems

The WHO Digital Health Workforce Framework provides guidance to countries on how to:

- ❑ Identify essential digital health roles
- ❑ Define required competencies
- ❑ Plan sustainable workforce development

WHO Digital Health Workforce Framework – Purpose

The framework was developed in response to widespread problems such as donor-funded systems with no local capacity, unclear job roles, and overreliance on short-term consultants.

It emphasizes institutionalization of skills, not just project-based staffing.

It supports:

- ❑ Workforce planning
- ❑ Capacity building
- ❑ Sustainable digital health investments

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WHO Workforce Framework – Role Categories

The framework groups roles into four functional domains:

- Health Service Delivery Roles
  - Frontline clinicians, nurses, community health workers
  - Use digital tools for clinical care, reporting, and decision support
  - Require usability-focused training and workflow integration

- Health Informatics & Data Roles
  - Health informaticians (informaticists), data analysts, monitoring and evaluation officers
  - Translate raw data into actionable information
  - Ensure data quality, analytics, and ethical use

WHO Workforce Framework – Role Categories

The framework groups roles into four functional domains:

- Digital Health Technology Roles
  - Software developers, system administrators, system architects, IT support staff
  - Responsible for system configuration, maintenance, and integration
  - Must understand health context, not just coding

- Leadership & Governance Roles
  - Policy makers, digital health strategists, CIOs, program managers
  - Set strategy, standards, budgets, and accountability mechanisms
  - Their digital literacy directly affects system success

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Core Competency Domains

Across all roles, the framework highlights **four foundational competency areas**:

- ❑ Digital & ICT literacy: Ability to use, adapt, and troubleshoot digital tools.
- ❑ Data governance and ethics: Understanding privacy, consent, security, and responsible data use.
- ❑ Interoperability and standards: Ability to work with shared data models, terminologies, and exchange protocols.
- ❑ Change management and systems thinking: Skills to manage organizational transformation and resistance.

Competency depth differs, but no role can completely ignore any domain. None can operate in isolation

Career Pathways in Health Informatics

- Health informatics careers are:
  - Often interdisciplinary rather than linear
  - Built through a combination of formal education and applied experience
- Examples:
  - A nurse trained in data use becomes a clinical informatics lead
  - A public health officer transitions into HIS program management
  - A software engineer develops domain expertise and becomes a health systems architect

Career pathways depend heavily on **institutional support and recognition** of informatics roles.

Career advancement often depends more on **applied experience** than formal titles.

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Mapping Informatics Roles Locally - REFLECTION

Consider informatics roles within a real health system:

- ❑ Identify existing job titles and informal roles
- ❑ Which roles are missing or underdeveloped?
- ❑ Examine who manages data, systems, and decisions
- ❑ Assess whether roles are clearly defined or overlapping
- ❑ Are competencies formalized or learned on the job?

This exercise builds awareness of hidden workforce gaps, not just visible technology gaps.

DO NOT POST YOUR RESPONSE. THIS IS A SELF-REFLECTION

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Introduction to OpenHIE

What is OpenHIE?

- OpenHIE (Open Health Information Exchange) is:
  - A global community of practice
  - An architecture and standards framework
  - A guide for designing interoperable national health information systems

- OpenHIE (Open Health Information Exchange) is a global initiative that provides:
  - Architectural guidance for national health information systems
  - A community of practice for implementers
  - Shared design principles focused on interoperability

OpenHIE does not prescribe specific software, it prescribes how systems should work together.

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OpenHIE Architecture – Key Components

OpenHIE defines shared services called “registries” and “repositories”.

- **Client Registry**: Ensures individuals are uniquely identified across systems.
- **Facility Registry**: Maintains authoritative records of health facilities.
- **Provider Registry**: Tracks health workforce identities and affiliations.
- **Terminology Services**: Standardize codes for diseases, drugs, and procedures.
- **Health Information Exchange Layer**: Enables secure data exchange between systems.

Together, these components prevent fragmentation and duplication

Why OpenHIE Matters for LMICs

LMICs often face a proliferation of disconnected systems.

- ❑ OpenHIE supports LMIC health systems by:
  - o Avoiding vendor lock-in
  - o Encouraging modular, replaceable system design
  - o Aligning investments under national governance
  - o Supporting long-term system sustainability

It emphasizes governance first, technology second.

It is focused on standards and stewardship

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Informatics in LMIC Contexts

Digital health in LMICs operates under distinct constraints not typical in high-income settings:

- ❑ Limited infrastructure and connectivity
- ❑ High disease burden
- ❑ Workforce shortages
- ❑ Complex political and donor ecosystems
- ❑ Fragmented funding

Understanding these realities is critical before designing or implementing digital systems

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Infrastructure Constraints in LMICs

- Common challenges include:
  - Unreliable electricity requiring backup power solutions
  - Weak internet connectivity necessitating offline-capable systems
  - Limited local hardware repair and replacement capacity
  - Aging hardware
  - High costs of system maintenance

These constraints strongly influence design choices, favoring simplicity and resilience

- Design implications:
  - Offline-first systems
  - Low-bandwidth solutions
  - Simple, resilient architectures

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Human capacity Constraints

- Human infrastructure is often a larger bottleneck than technology:
  - Few trained informaticians (informaticists) and system administrators
  - Heavy reliance on short-term consultants
  - Minimal institutional memory due to staff turnover
  - Limited continuing education
  - Competing clinical workloads

Without deliberate workforce investment, systems become unsustainable once projects end.

This creates a **capacity paradox**: systems exist, but skills to maintain them do not.

Leapfrogging Opportunities

What is Leapfrogging?

Leapfrogging allows LMICs to bypass outdated legacy systems and adopt modern digital solutions directly.

Examples include:

- ❑ Mobile-based (mHealth) data collection instead of paper forms
- ❑ Cloud hosting instead of on-premise servers
- ❑ National digital health platforms rather than facility-by-facility systems

Leapfrogging works best when paired with strong governance.

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Leapfrogging Opportunities

Successful leapfrogging often involves:

- ❑ Mobile data collection instead of paper
- ❑ National DHIS2 rollouts
- ❑ SMS-based patient engagement
- ❑ Biometric patient identification

However, leapfrogging does not eliminate governance needs.

While promising, leapfrogging can fail if:

- ❑ Systems are implemented without local capacity
- ❑ Technology outpaces policy and regulation
- ❑ External solutions ignore local workflows

Leapfrogging is not a shortcut; it is a strategic choice requiring planning.

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Case Study – Nigeria (Context)

Nigeria's digital health landscape is characterized by:

- ❑ A large, decentralized health system
- ❑ Strong donor presence
- ❑ National adoption of DHIS2 for routine reporting

Nigeria has invested heavily in:

- ❑ National Health Management Information Systems & DHIS2 at scale
- ❑ Digital disease surveillance

Despite technical progress, governance and coordination challenges persist.

Challenges persist due to:

- ❑ Decentralized governance
- ❑ State-level capacity variation
- ❑ Political and funding discontinuity

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Nigeria – Why Informatics Projects Struggle

Common issues why informatics projects struggle in Nigeria include:

- ❑ Weak alignment between federal and state-level priorities
- ❑ Parallel donor systems with limited interoperability
- ❑ Lack of subnational informatics workforce capacity

The result is partial adoption without institutional ownership.

Lesson: Technology scale does not guarantee system adoption.

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Case Study – East Africa (Context)

Countries such as Kenya, Tanzania, and Rwanda demonstrate:

- ❑ Strong national digital health strategies
- ❑ Emphasis on interoperability standards
- ❑ Clear institutional leadership
- ❑ Emphasis on local capacity building

Success Factors/Key enablers include:

- ❑ Government ownership of digital health agendas
- ❑ Regional collaboration and knowledge sharing
- ❑ Alignment with OpenHIE principles
- ❑ Long-term workforce development programs
- ❑ Strong national digital health strategy integrated into broader health system reforms

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Why Digital Health Projects Fail (LMIC context)

Across LMICs, failure is often driven by:

- ❑ Poor alignment with user workflows
- ❑ Lack of user alignment
- ❑ Inadequate training and support
- ❑ Lack of data use culture
- ❑ Absence of sustainability planning
- ❑ Ignoring cultural and political context

Technical functionality alone does not ensure success.

Failure is usually systemic, not technical.

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Role of Workforce in Project Failure (LMIC context)

Projects fail when:

- ❑ No one owns the system
- ❑ Informatics roles are unclear or undervalued
- ❑ Skills are outsourced and knowledge is not transferred to local staff
- ❑ Leadership lacks digital health literacy

A capable, empowered workforce is the strongest predictor of long-term success

Workforce capacity is the single strongest predictor of sustainability.

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Integrating Frameworks, Workforce, and Context

Successful digital health systems align:

- ❑ Frameworks (WHO guidance, OpenHIE architecture)
- ❑ People (skills, leadership, governance)
- ❑ Context (infrastructure, politics, culture)

Ignoring any one element weakens the entire system.

None can succeed alone.

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Key Takeaways

- Health informatics is fundamentally about **people**
- Digital health success depends more on **people** than software
- Workforce planning must be intentional, long-term and precede system design
- LMIC constraints demand contextualized, adaptive and resilient solutions
- Leapfrogging offers opportunity but not shortcuts
- Sustainable digital health requires long-term capacity investment
- Frameworks provide guidance but leadership enables impact

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Assessment Alignment – Discussion Forum

Discussion Prompt Guidance

- ❑ Using publicly available information, and applied systems thinking, analyze:

1. Workforce gaps in a local or LMIC health system that offers oncology services
2. Missing roles or competencies
3. How gaps contribute to project failure or inefficiency
4. Practical strategies to strengthen capacity

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