Welcome!

Lecture 1:

Introduction to AI in

Global Health Research

Dr. Pascal Tyrrell PhD & Dr. Jean Carlo Segura Aparicio MD

MiDATA

Course Summary

This course, *AI in Global Health Research*, introduces students to the principles and practice of implementation research (IR) in the context of global health, with a strong emphasis on the integration of artificial intelligence (AI) and emerging technologies. Students progress from foundational concepts in global health and IR to advanced topics like technological innovation, ethics, and equity.

The course blends theory, case studies, and practical skills to prepare students to design, conduct, and evaluate context-sensitive, ethically sound, and technologically informed IR projects.

Who we are…

Pascal Tyrrell, PhD   *Associate Professor*

Department of Medical Imaging, Temerty Faculty of Medicine
Institute of Medical Science, Temerty Faculty of Medicine
Department of Statistical Sciences, Faculty of Arts and Science
University of Toronto

Jean Carlo Segura Aparicio, PhD   *Associate Professor*

Department of Health Information Systems, State Distance University Of Costa Rica
Institute of Medical Science, Temerty Faculty of Medicine
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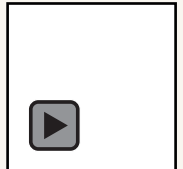
with the support of…

Stefan Aguiar

PhD Candidate, Head TA

4th Year PhD Candidate in the Department of Supportive Care, Princess Margaret Cancer Centre, Institute of Medical Science, Temerty Faculty of Medicine, University of Toronto

Yan Qing Lee

Undergraduate Student

University of Toronto 4th Year Undergraduate Student, Computer Science & Psychology Double Major. Volunteer at MiDATA Lab.

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Course Structure: Global Classroom!
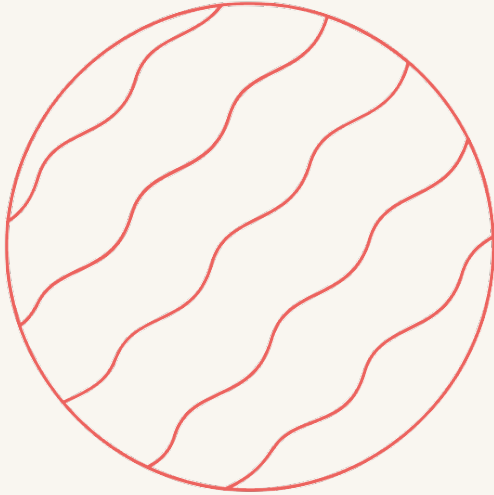
Partners:
Universidad de Costa Rica (Costa Rica)
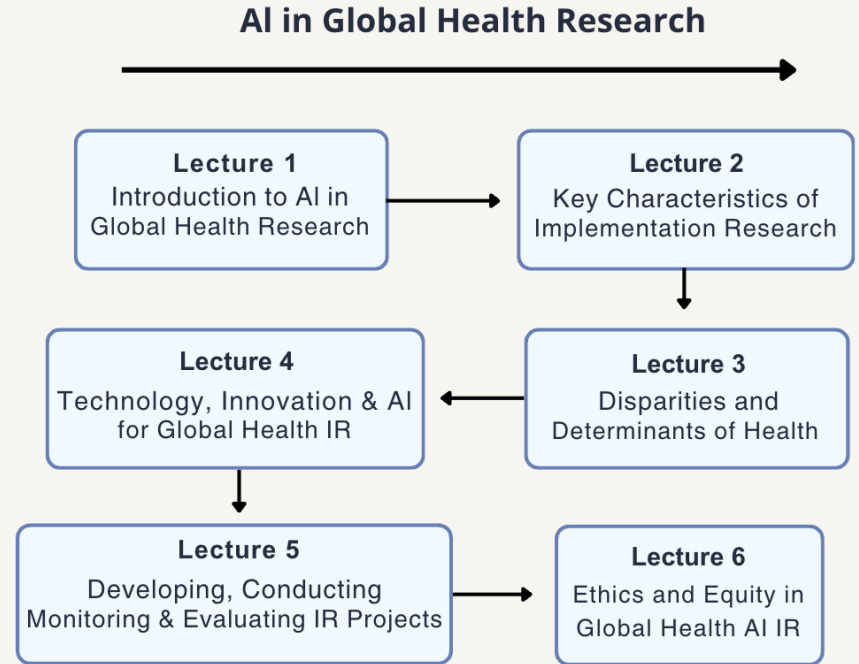Universidad de las Américas Puebla (Mexico)

Benefits
- Diverse perspectives on global health challenges
- Cross-cultural learning opportunities

Course Breakdown

Goal: Exploring global health research through implementation research, exploring how AI can boost the effectiveness of IR, and getting practical experience by working on a final research proposal

AI in Global Health Research

Lecture 1
Introduction to AI in Global Health Research

Lecture 2
Key Characteristics of Implementation Research

Lecture 4
Technology, Innovation & AI for Global Health IR

Lecture 3
Disparities and Determinants of Health

Lecture 5
Developing, Conducting Monitoring & Evaluating IR Projects

Lecture 6
Ethics and Equity in Global Health AI IR

Lecture 1 – Introduction to AI in Global Health Research

Establish the foundation: what is global health research, why does implementation matter, and how can AI enhance it?

Role: Lays the conceptual groundwork for IR and AI integration.

Lecture 2 – Key Characteristics of Implementation Research

Define IR's features (i.e. demand-driven, context-sensitive, multidisciplinary), and introduce IR frameworks like stakeholder and institutional analysis.

Role: Builds the methodological lens through which all later topics are examined.

Lecture 3 – Disparities and Determinants of Health

Explore the contextual factors (i.e. environmental, socioeconomic, cultural, institutional) that influence health outcomes and intervention success.

Role: Deepens the understanding of *why* context analysis is critical in IR.

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Lecture 4 – Technology, Innovation & AI for Global Health IR

Digital tools, AI applications, and innovative approaches to overcome barriers in IR, and challenges like the digital divide.

Role: Demonstrate *how* technology can be applied within IR's frameworks

Lecture 5 – Developing, Conducting, Monitoring & Evaluating IR Projects

Provide practical guidance for proposal writing, research design, and M&E strategies, to integrate context, stakeholders, and technology into actionable plans.

Role: Move from theory into practical skills for executing IR

## Lecture 6 – Ethics and Equity in Global Health AI IR

Ethical principles, equity considerations, and governance frameworks, that ensure interventions are fair, culturally respectful, and inclusive.
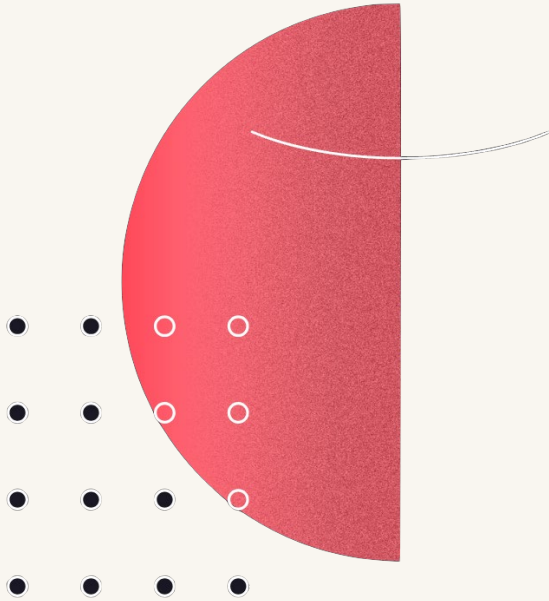
Role: Embeds ethics and equity as non-negotiable elements across all stages of IR

Key Takeaways

- Global health research addresses disparities and needs context-specific solutions.
- Implementation Research (IR) focuses on *how* to apply proven interventions in real-world settings.
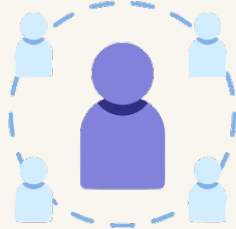- AI can enhance IR by improving data analysis, prediction, and decision-making.
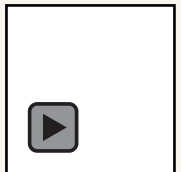
Key Concepts in
Global Health Research
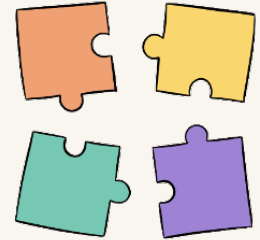
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What is Global Health Research (GHR)?

Global health research– research that addresses health disparities across global populations using interdisciplinary methods

Social, economic, and environmental determinants of health

Collaboration among stakeholders
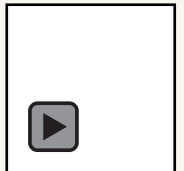
Interdisciplinary approach

Examples: Pura, Ngäbe app project

Juanilama (Lippia alba)

Pura Vida ... en Betania!

Reflect!

How can AI be used to improve healthcare delivery in low   -
resource settings, and what are the potential risks or
challenges of implementing AI   -based solutions in these
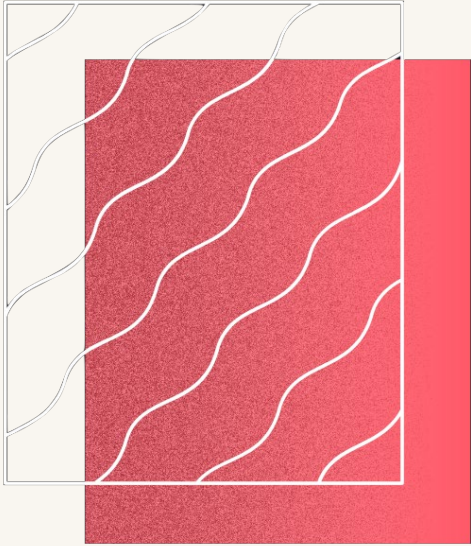contexts?

Role of AI in Global Health

Applications:

•Predictive analytics and diagnostics

•Resource allocation and optimization

•Health system monitoring

Challenges:

•Ethical considerations

•Bias in AI models

•Limited resources in low -income settings

Introduction to Implementation Research

What is Implementation Research (IR)?

Implementation research – systematic research addressing barriers to implementing health interventions

- A **tool** within global health research

Goals of IR:

- Improve healthcare delivery and outcomes
- Adapt interventions to specific contexts
- Facilitate evidence-based decision-making

# What is Implementation Research (IR)?

Steps in the IR Cycle:
1. Contextualize challenges
2. Develop a proposal
3. Plan and conduct the project
4. Monitor and evaluate the project
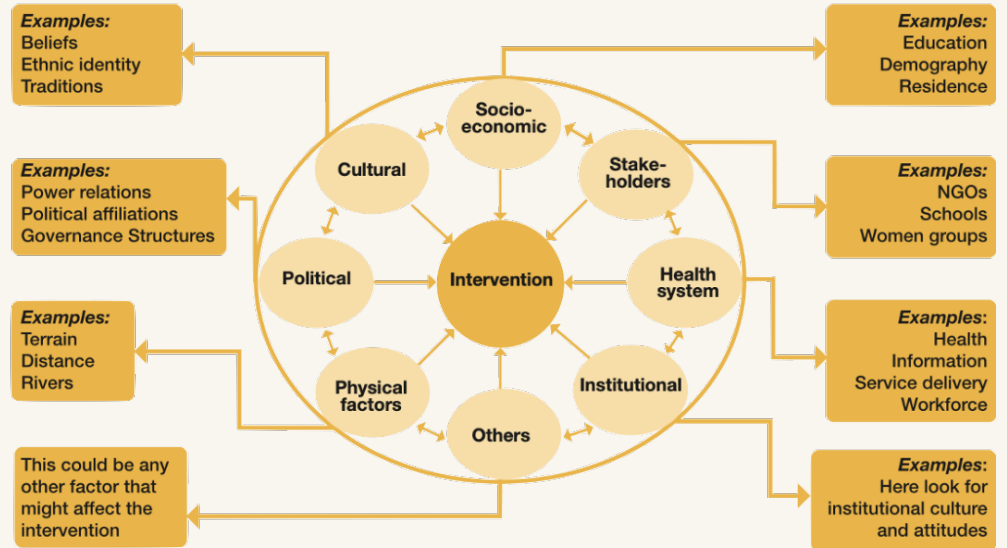5. Analyze and present data
6. Disseminate research findings

It's very contextual – it's tailored to local needs and adaptable across settings

Figure 1: The six steps of the implementation research cycle
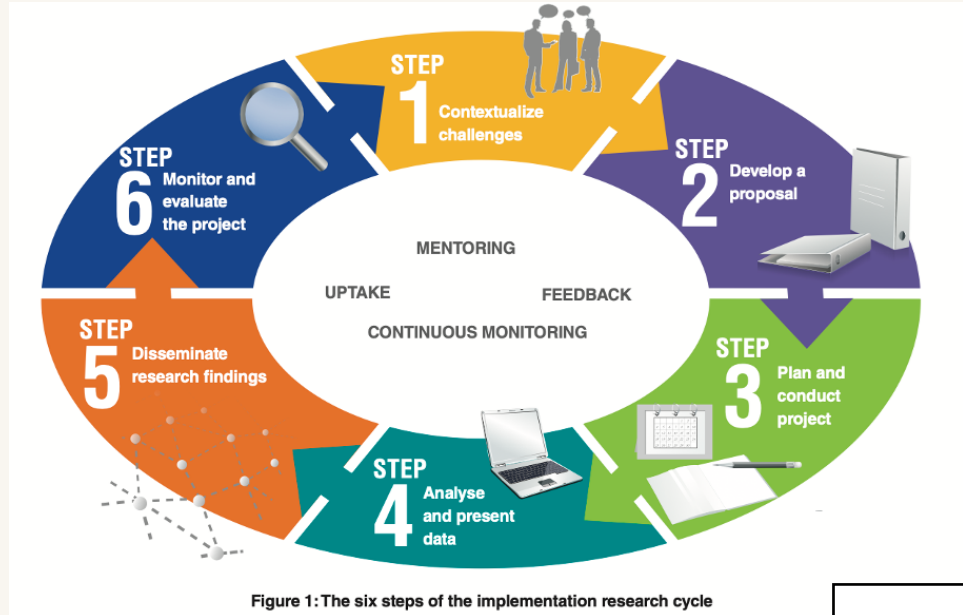
Interacting Domains of Contextual Considerations

Key Factors to Analyze:

- **Physical and demographic**
  e.g. location, infrastructure
- **Socioeconomic**
  e.g., income, education
- **Health system**
  e.g. workforce, technology
- **Cultural and political**
  e.g. beliefs, gov. policies
  (More on this in Lecture 3)

Examples:
Beliefs
Ethnic identity
Traditions

Examples:
Education
Demography
Residence

Examples:
Power relations
Political affiliations
Governance Structures

Examples:
NGOs
Schools
Women groups

Examples:
Terrain
Distance
Rivers

Examples:
Health
Information
Service delivery
Workforce

This could be any other factor that might affect the intervention

Examples:
Here look for institutional culture and attitudes

Socio-economic

Cultural

Stake-holders

Political

Intervention

Health system

Physical factors

Others

Institutional

End of Lecture 1

Next up Lecture 2: Key Characteristics of Implementation Research
- Understanding the core characteristics and guiding principles of IR