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Implementation Science – rationale and application to TB diagnostics research

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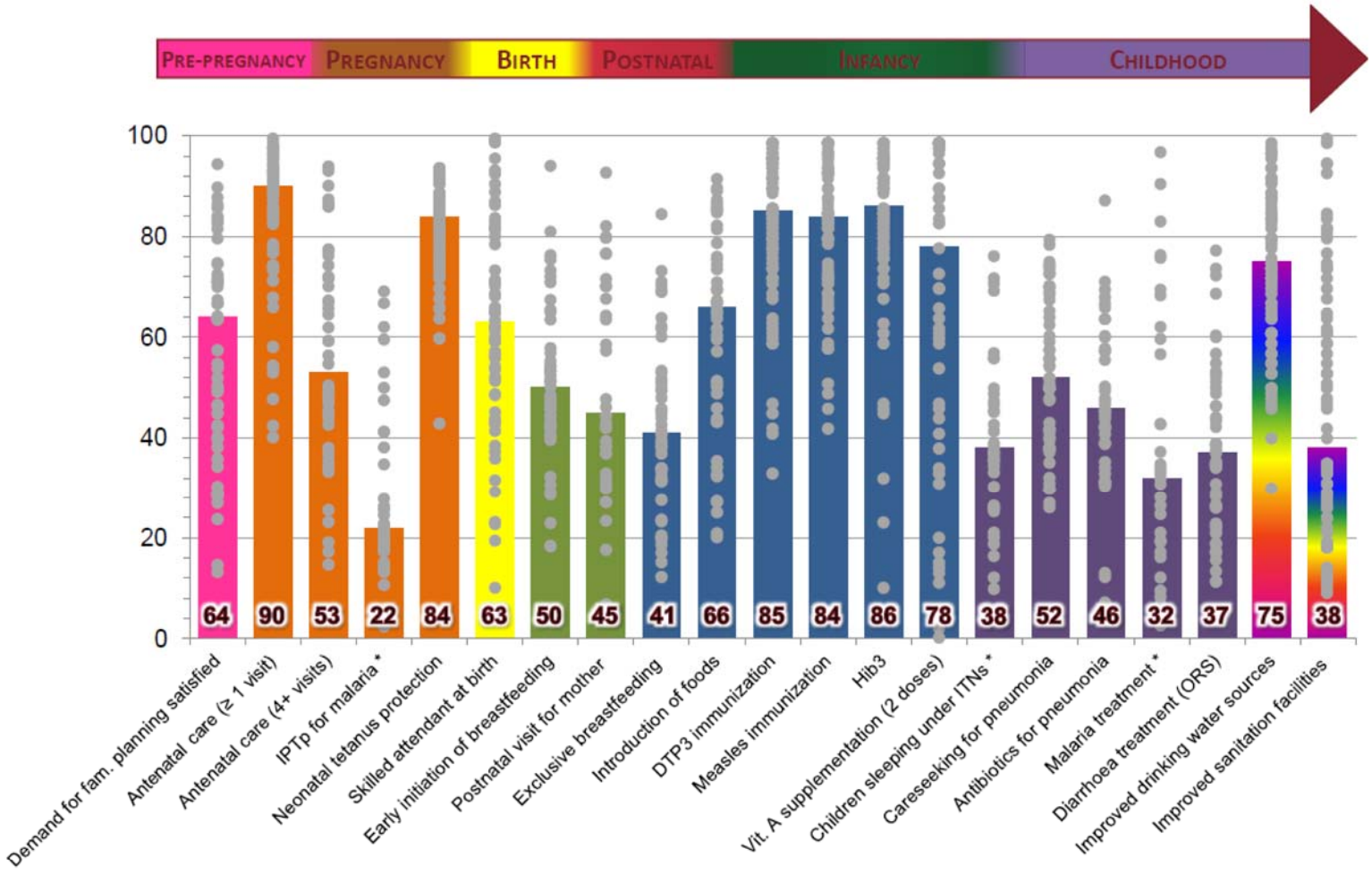
Talk Outline

- Describe need for implementation science
- Define implementation science and describe key features
- Case Study: Designing a strategy to facilitate uptake of TB evaluation guidelines


THE LATEST RESEARCH SHOWS THAT
WE REALLY SHOULD DO SOMETHING
WITH ALL THIS RESEARCH

We often known what to do…..



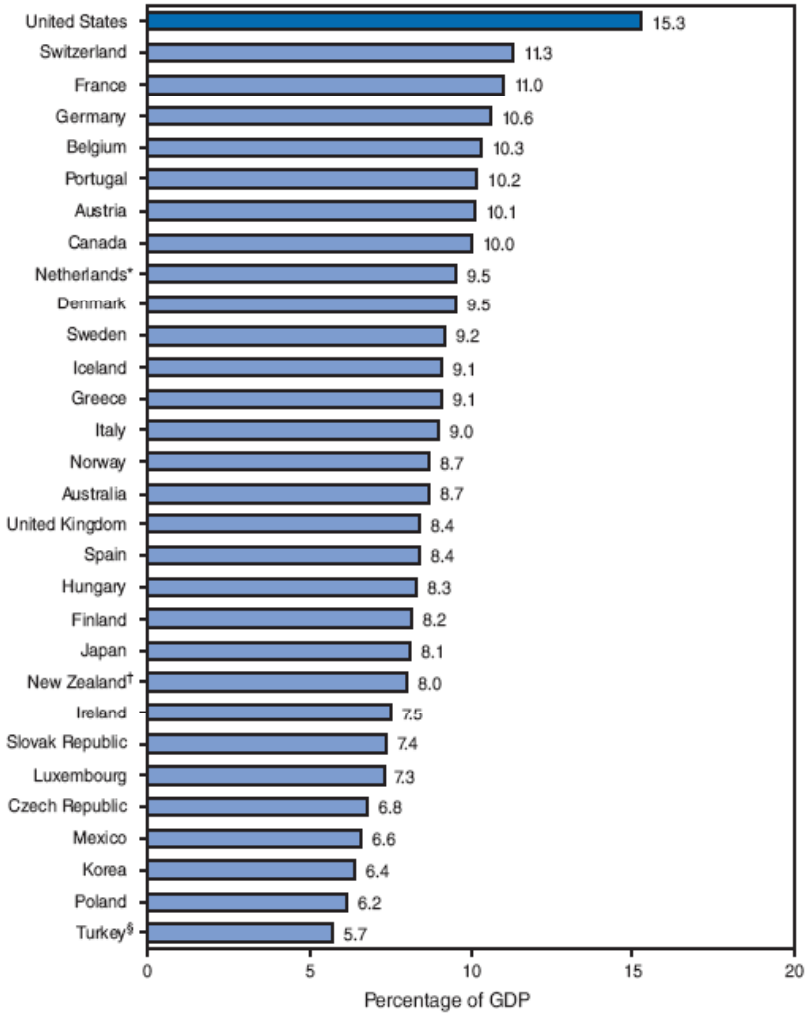
…..but not how to get it done

The “implementation problem”

“Many evidence-based innovations fail to produce results when transferred to communities in the global south, largely because their implementation is untested, unsuitable or incomplete”

Madon T, et al. Science 2007.

Spend so much…



Get so little…

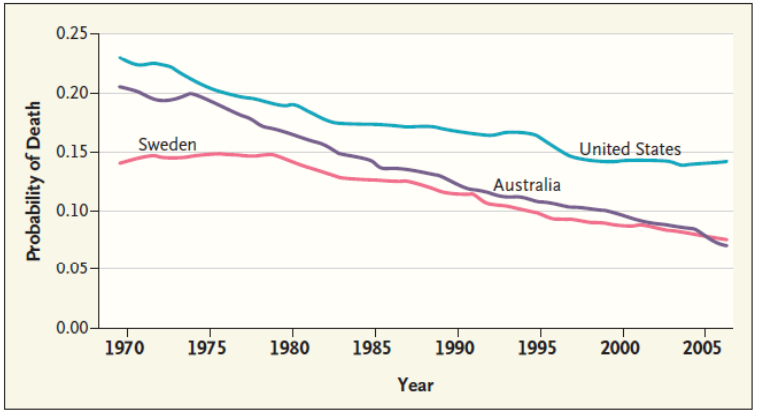
World Health Rankings

-infant mortality 39th

-female mortality 43rd

-male mortality 42nd

-life expectancy 36th

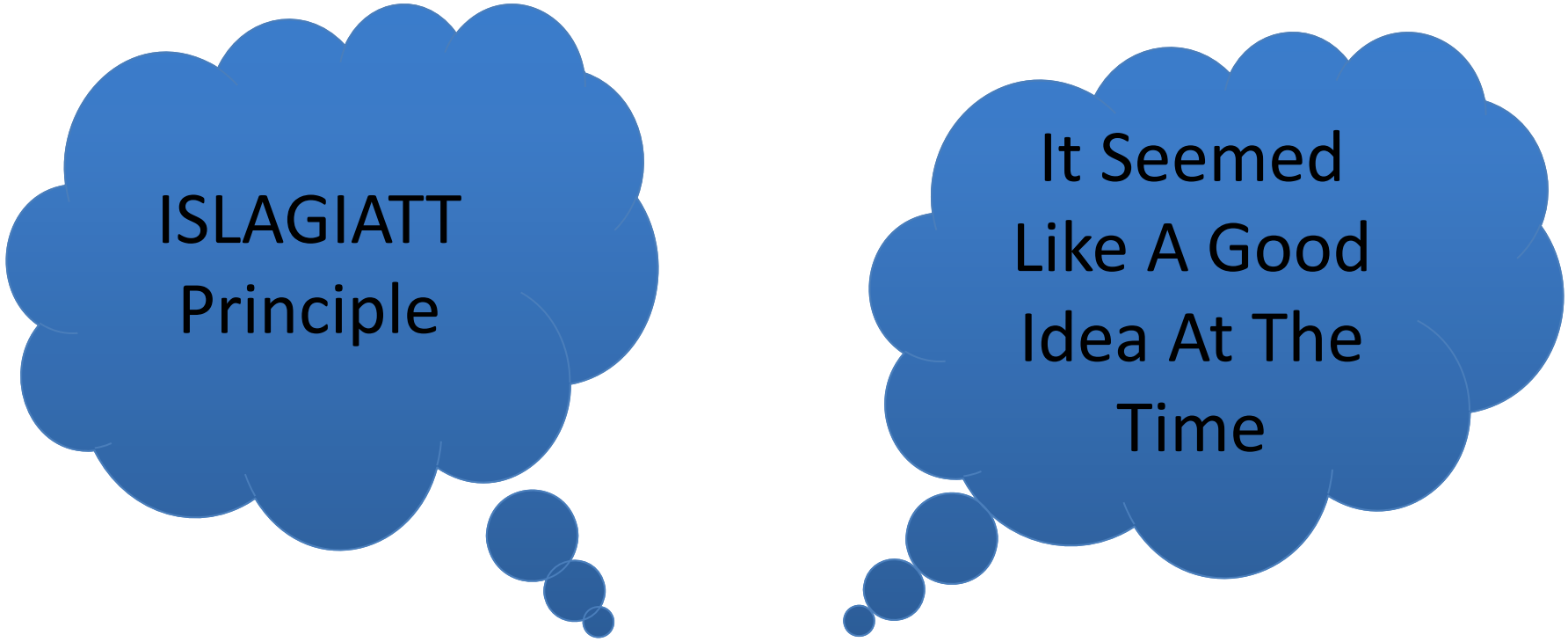


Probability of Death for Boys and Men 15 to 60 Years of Age in Sweden, Australia, and the United States, 1970–2007.

Data are from the Australian Bureau of Statistics, the U.S. National Center for Health Statistics, and the World Health Organization.

Murray C et al. NEJM 2010

Traditional approach to implementation



Martin Eccles

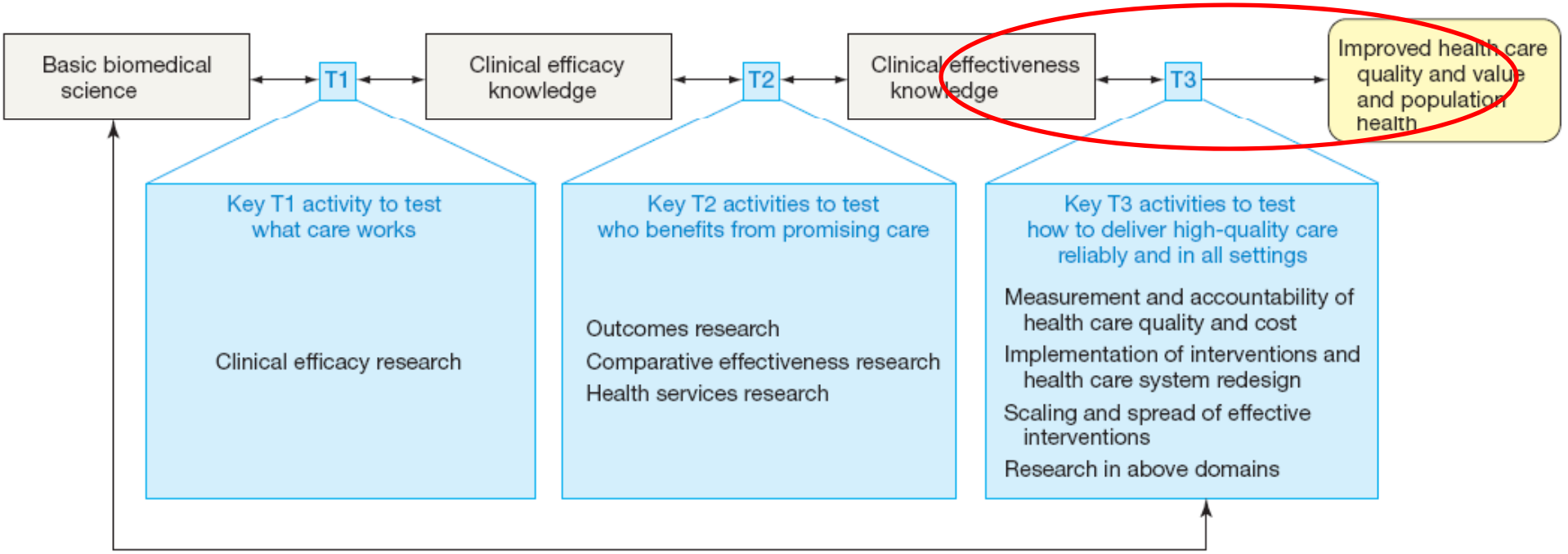
KEY PROBLEM – Does not identify or address factors critical for successful implementation

What are the consequences?

- New research takes **too long** to get adopted
- Many interventions are **not aligned** with needs/priorities of patients and communities
- Providers lack **tools** to implement relevant and effective interventions
- **Variation** in effectiveness and/or practice in different settings not understood or planned for

Translational Pathways

Figure. The 3T's Road Map



T indicates translation. T1, T2, and T3 represent the 3 major translational steps in the proposed framework to transform the health care system. The activities in each translational step test the discoveries of prior research activities in progressively broader settings to advance discoveries originating in basic science research through clinical research and eventually to widespread implementation through transformation of health care delivery. Double-headed arrows represent the essential need for feedback loops between and across the parts of the transformation framework.

Dougherty D et al. JAMA 2008

Implementation Science

- Study of **methods or strategies to promote** the systematic uptake of proven interventions into routine clinical practice. In this context, it includes the study of **influences** on the **behavior** of patients, providers, and organizations in either healthcare or population settings.

  -- *Implementation Science Journal*

- Study of **methods to promote** the integration of research findings and evidence into healthcare **policy and practice**. It seeks to understand the **behavior** of healthcare professionals and other stakeholders as a key variable in the sustainable uptake, adoption, and implementation of evidence-based interventions

  -- *NIH Fogarty International Center*

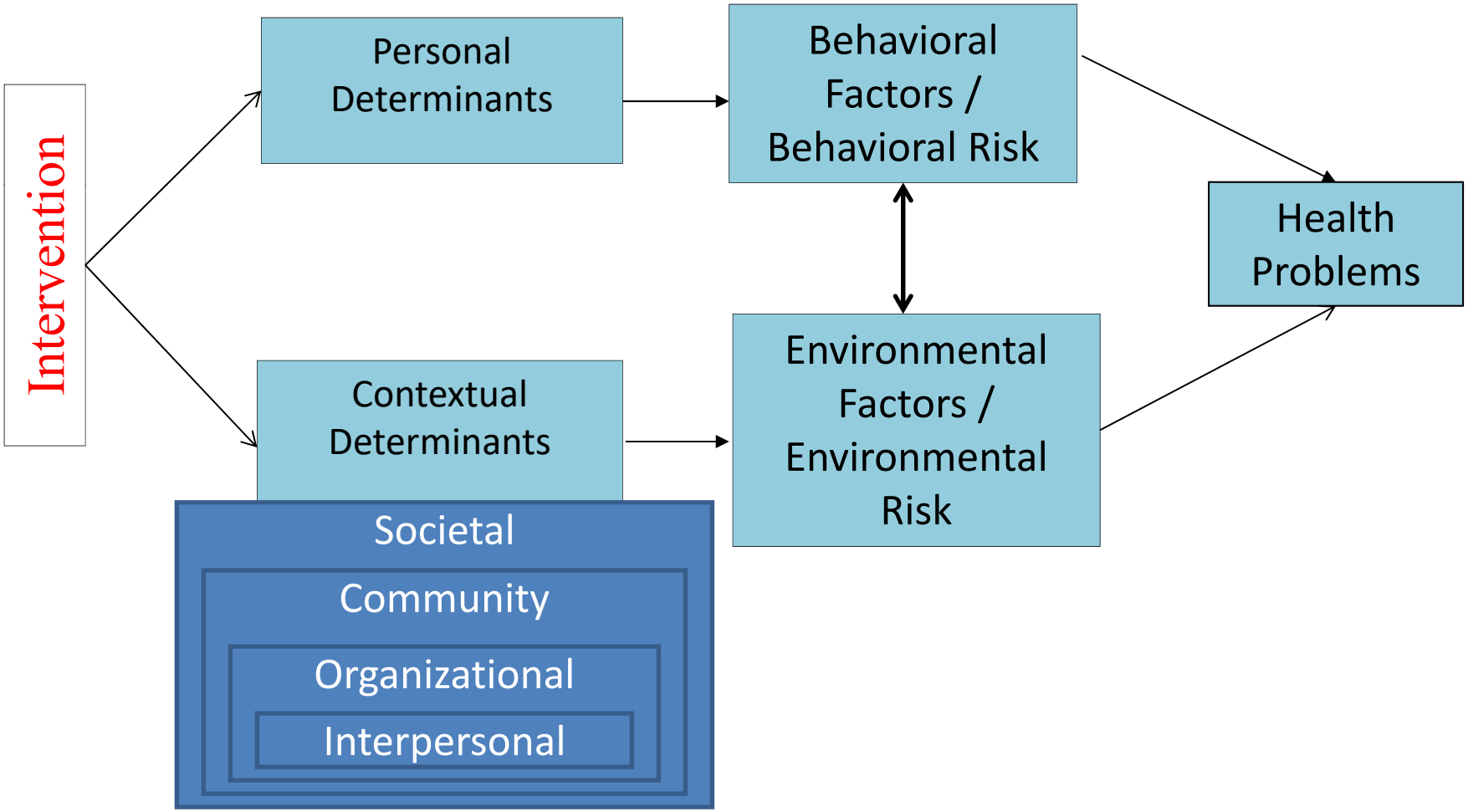
- Study of processes used in the implementation of initiatives and **contextual factors** that affect these initiatives. The basic intent is to understand not only what is and is not working, but **how and why** implementation is going right or wrong, and testing **approaches** to improve it.

  -- *WHO*

Common themes across definitions

- More than just the validation of evidence-based practices in “real-world” settings
- Active facilitation required to improve the speed, quantity and quality of uptake of evidence in routine practice settings
- Implementation requires changing behavior
- Engagement with stakeholders essential at all stages

A focus on mechanisms of change



Use of theory/frameworks

1. Identify the determinants of behavioral/environmental risk factors

1. Create a causal model of the problem to specify determinants that are being targeted for change

1. Select intervention methods to match targets (i.e., design implementation strategy)

1. Inform evaluation of implementation strategy (*i.e.,* did it work and why or why not)

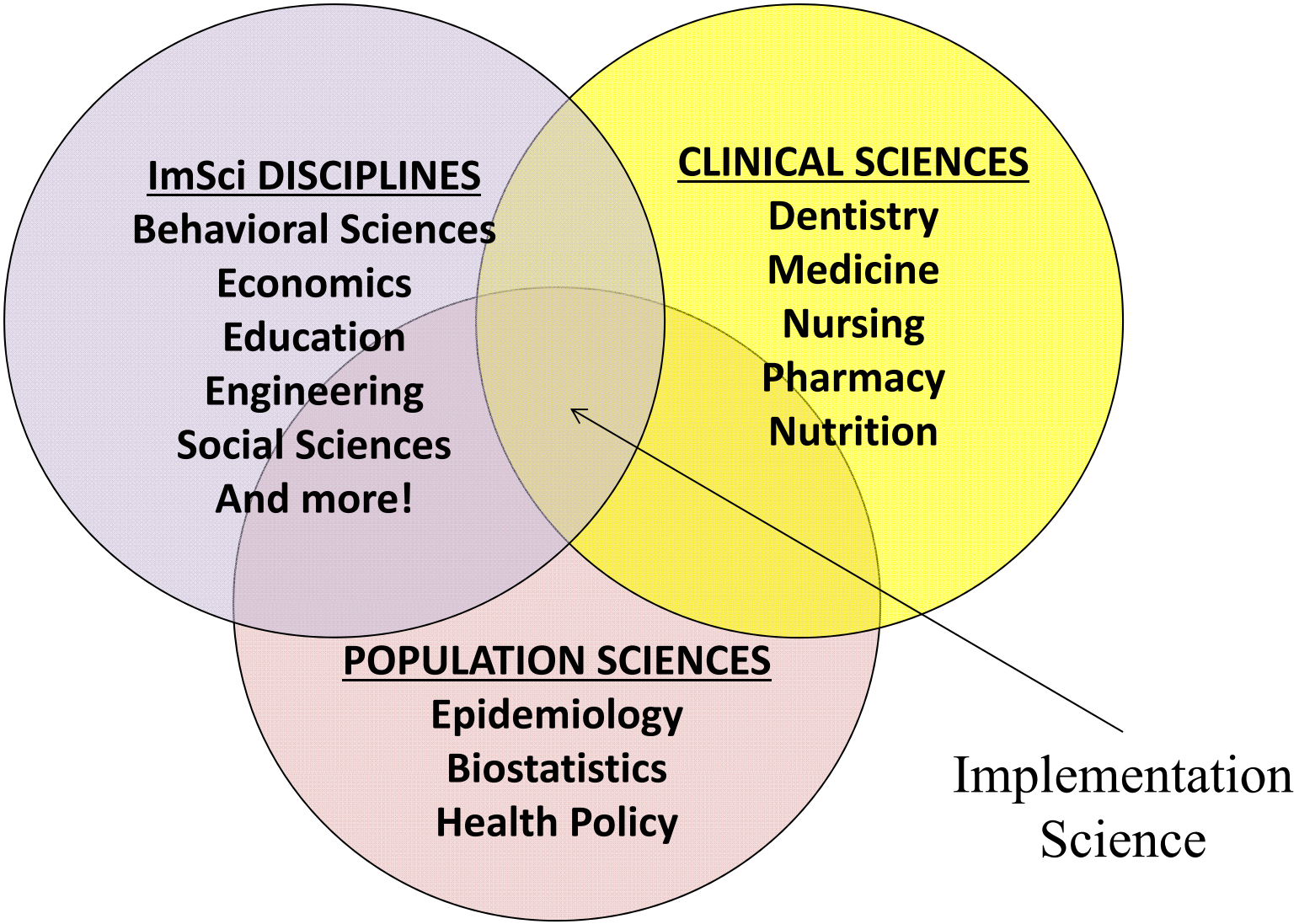
Planned Health Promotion

Table 1 Steps for developing a theory-informed implementation intervention

Step	Tasks
STEP 1: Who needs to do what, differently?	· Identify the evidence-practice gap · Specify the behaviour change needed to reduce the evidence-practice gap · Specify the health professional group whose behaviour needs changing
STEP 2: Using a theoretical framework, which barriers and enablers need to be addressed?	· From the literature, and experience of the development team, select which theory (ies), or theoretical framework(s), are likely to inform the pathways of change · Use the chosen theory(ies), or framework, to identify the pathway(s) of change and the possible barriers and enablers to that pathway · Use qualitative and/or quantitative methods to identify barriers and enablers to behaviour change
STEP 3: Which intervention components (behaviour change techniques and mode(s) of delivery) could overcome the modifiable barriers and enhance the enablers?	· Use the chosen theory, or framework, to identify potential behaviour change techniques to overcome the barriers and enhance the enablers · Identify evidence to inform the selection of potential behaviour change techniques and modes of delivery · Identify what is likely to be feasible, locally relevant, and acceptable and combine identified components into an acceptable intervention that can be delivered
STEP 4: How can behaviour change be measured and understood?	· Identify mediators of change to investigate the proposed pathways of change · Select appropriate outcome measures · Determine feasibility of outcomes to be measured

Michie et al 2005; 2012

Cutting-edge research



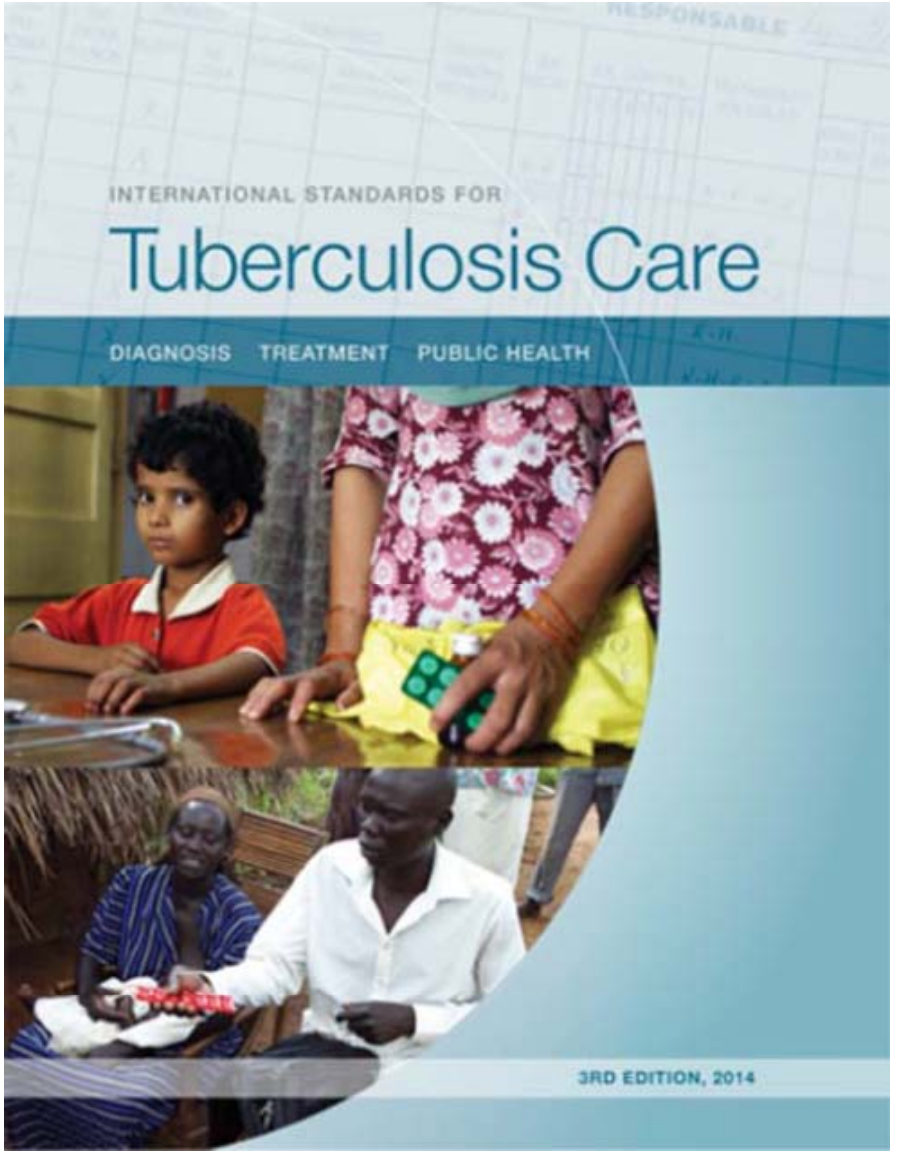
Implementation Science: Summary

- Urgent need for research to address the evidence-practice gap
- Implementation science uses theory-based approaches to develop and evaluate strategies to promote translation of effective health innovations into practice and policy
- Implementation science involves multi-disciplinary, team science

CASE STUDY:
Tuberculosis Guideline Observation and Adherence in Low-income countries (TB GOAL)

TB Evaluation Guidelines

- **Standard 2**: All persons with unexplained cough of at least 2 weeks' duration should be evaluated for TB
- **Standard 3a**: All persons who require TB evaluation should be referred for sputum-based microbiologic testing
- **Standard 3b:** All persons referred for sputum microscopy should have at least 2 smears examined
- **Standard 8:** Smear-positive patients should be prescribed anti-TB therapy



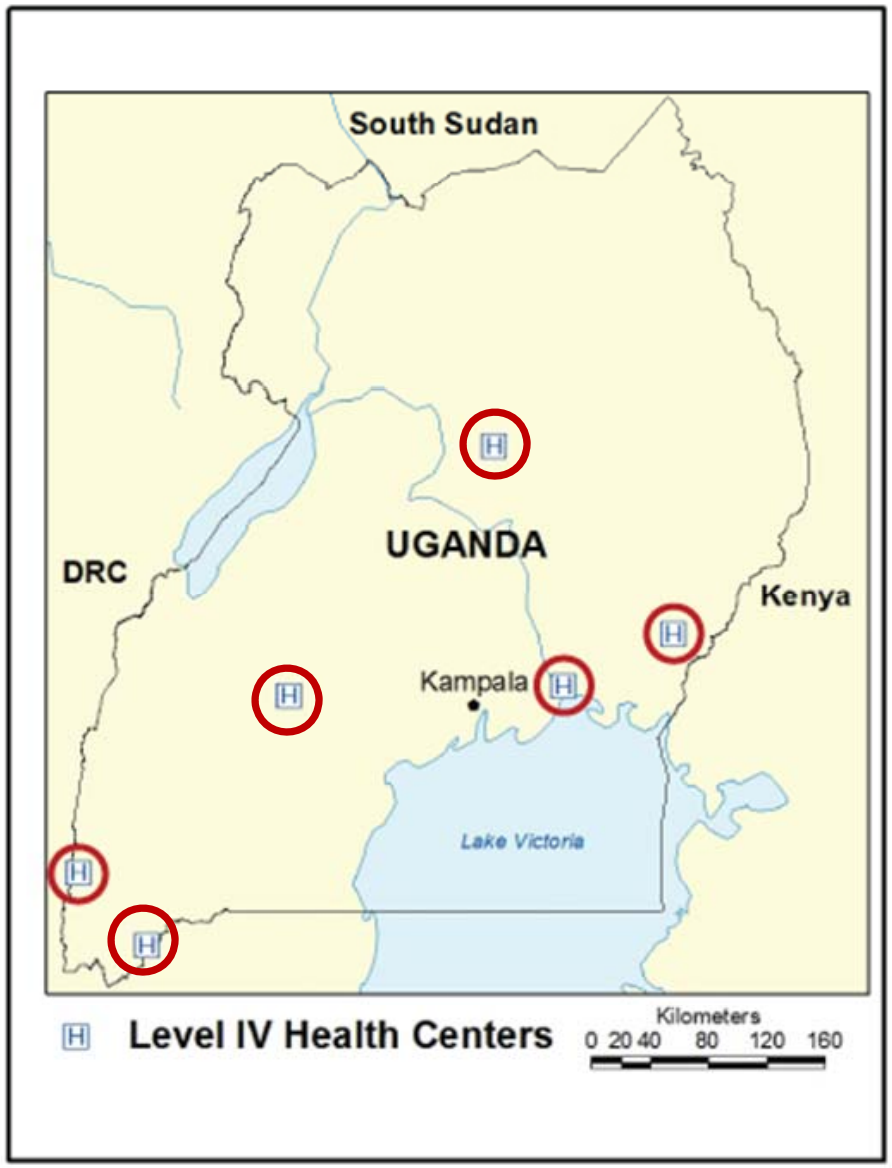
TB GOAL study

TB Guideline Observation and Adherence in Low-income countries

Study Objectives

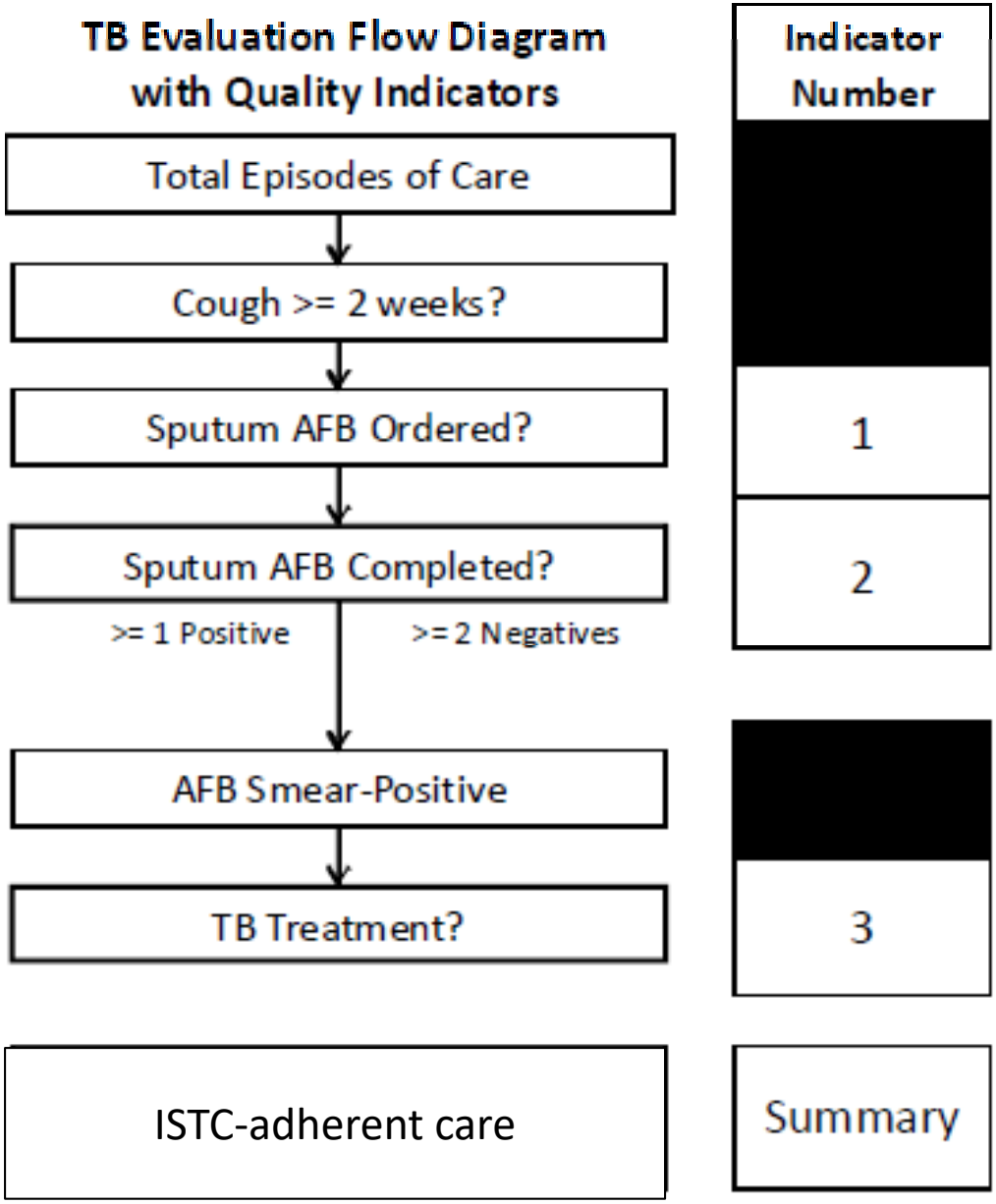
- To assess the quality of TB evaluation
- To identify modifiable barriers to TB evaluation
- To develop and test a theory-driven intervention to improve TB evaluation

Study setting



- Network of 6 Level IV health centers
- Partners
  - Uganda Ministry of Health
  - Makerere University
  - UCSF
- Electronic data collection (>100,000 patients/year)

ISTC Quality Indicators



Objective 1: “Define quality gap”

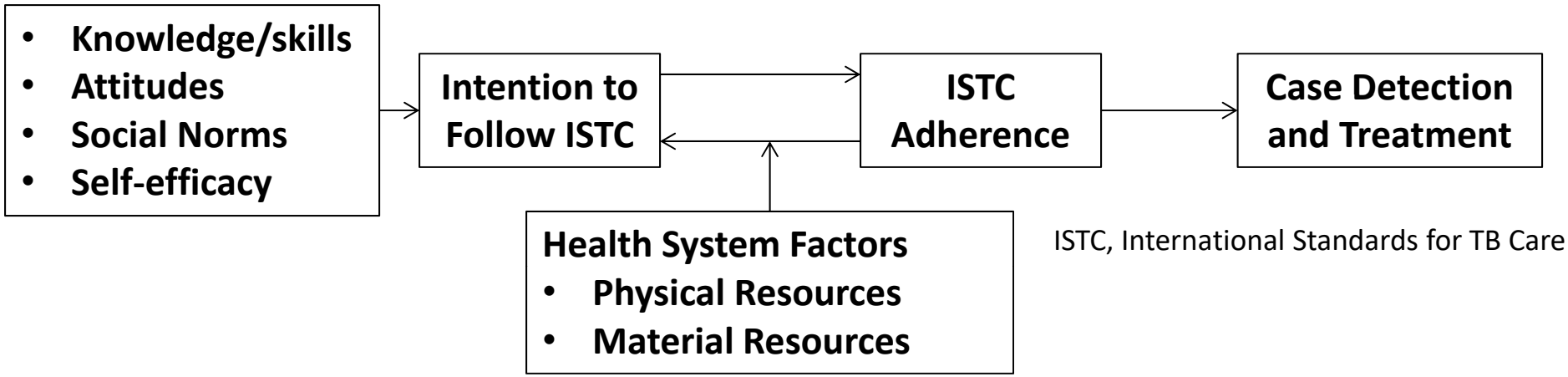
Q1 2009 (14,852 patients → 365 with cough >2 weeks)	
Standard 1: Referred for TB testing	21%
Standard 2: Completed TB testing (if referred)	71%
Standard 3: Treated for TB (if smear-positive)	73%
ISTC-adherent care	11%

ISTC, International Standards for TB Care

Davis JL, AJRCCM 2011

Objective 2: “Understand quality gap”

- Conceptual Model: Theory of Planned Behavior



ISTC, International Standards for TB Care

- Data collection
  - Key informant interviews
  - Field Observation
- Analysis
  - Transcribe interviews and field notes
  - Apply standard coding scheme to identify recurring themes

Health system barriers to TB evaluation

Clinic-level

- Poor infection control
- Limited private space
- Variable leadership

NTP-level

- Inconsistent oversight
- Stock-outs of reagents and drugs

Cattamanchi A, BMC Health Serv Res 2015

Key clinic barriers to TB evaluation

PRECEDE framework	Recurring themes
Predisposing factors (Knowledge, attitudes, beliefs, intention)	• Time and resource constraints → low self-efficacy • Low motivation of staff • Low sensitivity of sputum smear microscopy • Poor patient perception of care at government health centers
Enabling Factors (Factors that if addressed make it easier to initiate the desired behavior)	• Failure of patients to return after initial visit (due to time and costs) • Inability to track and follow-up patients → low-self-efficacy *"When they have a cough for more than 2 weeks they are sent to the lab. But the problem is they get the first sample and sometimes, actually most times they don't bring the second sample." "*
Reinforcing Factors (Factors that if addressed make it easier to continue the desired behavior)	• Lack of communication and coordination among staff • Insufficient oversight from NTP *"…Actually at times we have met but we don't meet [regularly], only when we realize there is a problem that's when we communicate and say why is this happening, then we try to rectify."*

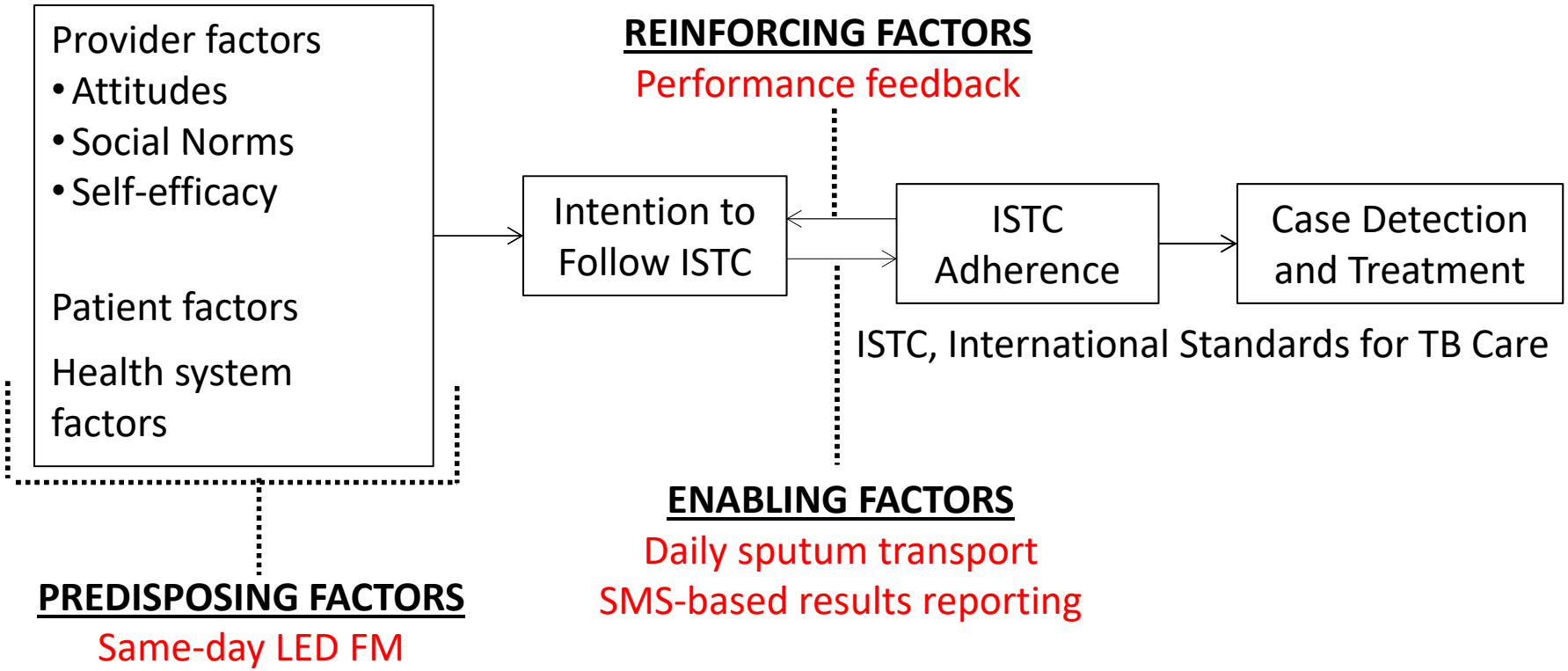
Cattamanchi A, BMC Health Serv Res 2015

Objective 3: "Improve quality gap": Theory-informed intervention

- Evidence review
- Stakeholder consultation
- Feasibility

1. Prioritize barriers
2. Select BCTs
3. Specify how BCTs delivered

Figure 1. Theory-informed barrier assessment and intervention design.



Intervention details: Same-day LED FM

- Goals
  - One sample, two smears
  - Provide TB diagnosis and treatment at initial visit
  - **Barriers targeted:** High laboratory workload, failure of patients to return after initial visit

- 5-day training at each health center
  - FM staining
  - Use of LED fluorescence microscope (PrimoStar iLED)
  - Identification of AFB: practice and proficiency testing
  - Re-organization of work flow

Intervention details: Daily sputum transport

- **Goals**
  - Daily transportation of sputum samples to xpert referral hub using motorcycle (Boda boda)
  - Link Smear negative patients to Xpert testing sites
  - **Barriers targeted:** Time and lack of resources, low staff motivation
- **Describe intervention**
  - Identification of motorcycle (boda boda) rider
  - Linking motorcycle rider with lab staff
  - Procedure and time of picking sputum sample (periheral Health Center (HC) and delivery to xpert HC

Intervention details: SMS-based results reporting

- Goals
  - Reduce delay of reporting results and initiation of treatment
  - **Barriers:** Inability to track & follow-up patients, Failure of patients to return after initial visit
- Describe intervention
  - Training on Installation and use of the GxAlert software
  - SMS reporting of results to patient & Health facility

Intervention details: Performance feedback

- Goals
  - Facilitate continuous quality improvement
  - **Barriers targeted:** Lack of communication/coordination, inconsistent oversight, stock-outs

- Report card provided to each site monthly
  - **PLAN**: Identify plans to improve performance
  - **DO**: Implement plans
  - **STUDY**: Review updated report card at staff meeting (facilitated by TB focal person)
  - **ACT**: Refine or change performance improvement plans

Pilot study

- Evaluate process metrics
  - Performance feedback: Interrupted time series study
    - Six health centers selected to receive intervention in random order
    - Outcomes measured at multiple time points before and after introducing the intervention
  - Other components: single-arm interventional study
    - Interventions piloted at 5 health centers
    - Outcomes measure post-intervention only

Impact of performance feedback

Outcome	Performance Feedback		
	Pre N=838	Post N=608	Difference
Received ISTC-adherent care	52%	67%	+16% (+8 to +23)
Referred for sputum examination	72%	82%	+10% (-7 to +27)
Completed sputum examination	74%	84%	+10% (-8 to +27)
Initiated treatment if smear-positive	72%	85%	+13% (-3 to +30)

Chaisson L, PLoS One, 2015

Feasibility of single-sample LED FM and daily sputum transport

Process metric	n/N	%
Two smears examined	1209/1214	99%
Sputum transported for Xpert testing if smear-negative or HIV-positive	933/1151	81%
Outcome	**n/N**	**%**
Treated on same-day if smear-positive	44/120	37%
Treated if smear-positive	104/120	87%
Treated within one week if Xpert-positive	19/41	46%
Treated if Xpert-positive	27/41	66%

Feasibility of SMS-based results reporting

Process Metric	N	%	Cumulative %
Xpert tests performed	245	--	--
Phone number entered	168	69%	69%
Phone number entered correctly	159	95%	65%
SMS sent by GxAlert	157	99%	64%
SMS delivered to mobile network	151	96%	62%
SMS received on patient handset	119	79%	49%

Conclusions from the Pilot Study

1. Single sample microscopy and daily sputum transport for Xpert testing are feasible

2. SMS-based reporting of results is successful for at least half of patients

3. Additional interventions are needed to ensure linkage to treatment

New Technology: GeneXpert Omni + Xpert Ultra

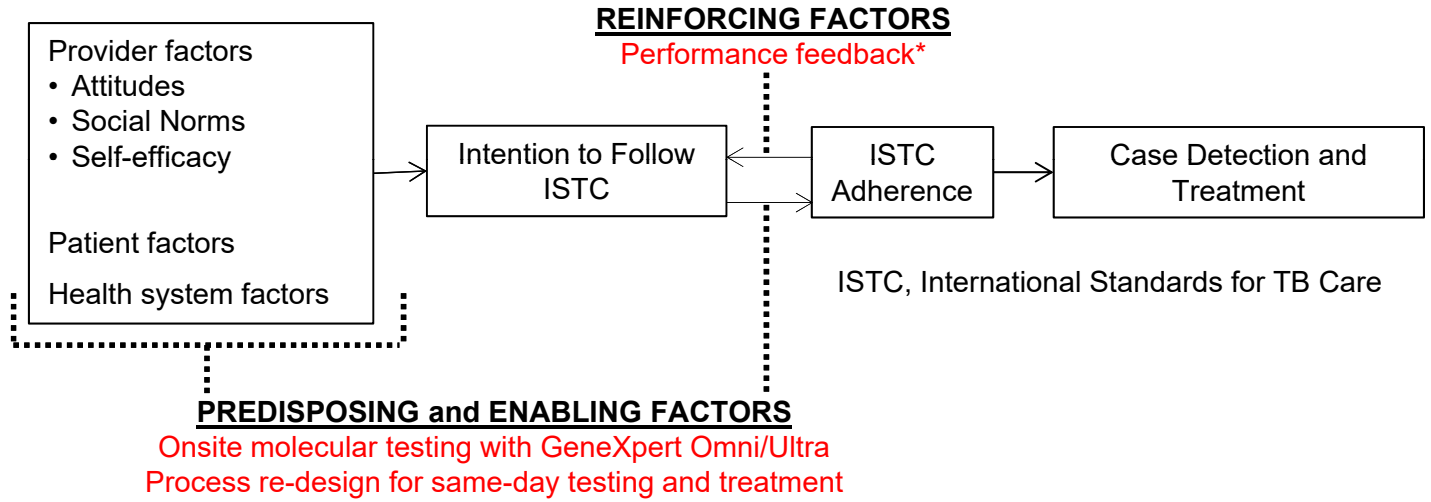
- GeneXpert Omni
  - Single-cartridge, POC platform
  - Low power consumption (solid-state)
  - Integrated battery (4 hours) + supplemental battery (12 hours)
  - Automatic connectivity

- Xpert Ultra
  - New multi-copy DNA targets
  - Increased sample volume
  - Time-to-result one hour

Rapid, onsite molecular testing at peripheral health centers in low-income countries

Modified Intervention

Figure 1. Theory-informed barrier assessment and intervention design.



Next Steps

- NIH/NHLBI-funded cluster-randomized trial with nested mixed methods and economic/transmission modeling studies
  - Aim 1:**To compare the yields of standard and SIMPLE TB diagnostic evaluation strategies**
  - Aim 2: **To identify processes and contextual factors that influence the effectiveness and fidelity of the SIMPLE TB strategy.**
  - Aim 3: **To compare the costs and epidemiological impact of standard and SIMPLE TB diagnostic evaluation strategies**

Selected Outcomes

- Aim 1: Effectiveness
  - Proportion diagnosed and treated for microbiologically-confirmed TB
- Aim 2: Implementation
  - Process metrics to assess fidelity
  - Patient/provider surveys to assess targeted barriers
  - Provide focus groups/interviews to understand variation in uptake
- Aim 3: Impact
  - Incremental Cost Effectiveness
  - Projected 10-year TB incidence and mortality

Thank you for Listening
Questions/Comments