Quality Improvement in Tuberculosis

Advanced Tuberculosis Diagnostics Course 2018
McGill University, Montreal, Canada

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Co-director of UCSF Implementation Science Training Program
Objectives

- Differentiate between coverage vs. quality
- Define quality of care
- Understand data on current quality of TB care
- Describe framework for quality improvement
Case Study of Coverage vs. Quality:
Xpert MTB/RIF testing for tuberculosis in Uganda

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Global Context

- 1/3rd of TB patients worldwide are not being diagnosed or treated

- Significant donor and country investment in novel diagnostics

- Rapid scale-up of molecular testing (Xpert MTB/RIF)
Uganda Context

- Among global leaders in Xpert scale-up
- >300 GeneXpert devices (hub-and-spoke model)
- >400,000 Xpert MTB/RIF cartridges
- GxAlert for real-time monitoring and reporting
Xpert Performance Evaluation to facilitate Linkage to TB care (XPEL TB study)

AIMS

 To characterize the process of TB diagnosis at health centers linked to Xpert testing sites

 To identify modifiable barriers to high-quality TB diagnostic services
  • Provider-level
  • Patient-level
  • Health system-level

 To develop and test a theory-driven intervention to improve the quality of TB diagnostic services
Methods-1

- Study setting
  - 24 health centers (spokes) linked to 16 Xpert testing sites (hubs)
  - Selected based on 2015 NTLP case notification data

- Study design: Prospective cohort study

- Participants: All adults undergoing TB evaluation
Methods-2

Data collection from routine data sources

- Data sources: Presumptive TB register, TB laboratory register, Xpert requisition forms, TB treatment register

- GxAlert server data used to ensure complete capture of Xpert results
# Quality of TB diagnostic evaluation

<table>
<thead>
<tr>
<th>2594 adults undergoing pulmonary TB evaluation</th>
<th>%</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicator 1:</strong> Proportion referred for sputum-based TB testing</td>
<td>81%</td>
<td>55 – 96%</td>
</tr>
<tr>
<td><strong>Indicator 2:</strong> Proportion completing recommended TB testing (if referred)</td>
<td>55%</td>
<td>13 – 80%</td>
</tr>
<tr>
<td><strong>Indicator 3:</strong> Proportion treated within 14 days (if smear- or Xpert-positive)</td>
<td>73%</td>
<td>60 – 100%</td>
</tr>
<tr>
<td><strong>Indicator 4:</strong> Cumulative probability of being diagnosed and treated</td>
<td><strong>33%</strong></td>
<td><strong>4 – 77%</strong></td>
</tr>
</tbody>
</table>

Davis JL, Katamba A et al. AJRCCM. 2011
Farr K, Nalugwa T et al. ERS International Congress. 2017
Utilization of Xpert testing

- 17% (365/2091) of patients referred for Xpert testing
  - 34% (267/779) of HIV-positive adults
  - 7% (98/1312) of HIV-negative adults

- <5% (14/365) of patients referred for Xpert as first-line test

- <50% (20/48) of Xpert-positive patients initiated treatment within 14 days
  - Median time-to-treatment: 7 days (IQR 1 – 17)

High coverage of Xpert testing services ≠ High quality care

Farr K, Nalugwa T et al. ERS International Congress. 2017
High quality care

- What does it mean to you?

- The degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge

  -- U.S. Institute of Medicine
Conceptualizing Quality of Care

- Structure
  - Community Characteristics
  - Delivery System Characteristics
  - Provider Characteristics
  - Population Characteristics

- Process
  - Health Care Providers
    - Technical Processes
    - Interpersonal Processes
  - Public & Patients
    - Access
    - Acceptance
    - Adherence

- Outcomes
  - Health Status
  - Functional Status
  - Satisfaction
  - Mortality
  - Cost

Donabedian A. JAMA 1988;260:1743-8
Assessing Quality Outcomes/Impact
World Health Organization

Quality health services should be:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective</td>
<td>Providing evidence-based health care services</td>
</tr>
<tr>
<td>Safe</td>
<td>Avoiding harm to people for whom care is intended</td>
</tr>
<tr>
<td>People-centered</td>
<td>Providing care that responds to individual preferences, needs and values</td>
</tr>
</tbody>
</table>

To realize the benefits of quality health care, health services must be:

<table>
<thead>
<tr>
<th>Term</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Timely</td>
<td>Reducing wait times and harmful delays</td>
</tr>
<tr>
<td>Equitable</td>
<td>Providing care that does not vary in quality by socio-demographic factors</td>
</tr>
<tr>
<td>Integrated</td>
<td>Providing care that is coordinated across levels</td>
</tr>
<tr>
<td>Efficient</td>
<td>Maximizing the benefit of available resources and avoiding waste</td>
</tr>
</tbody>
</table>
HIGH QUALITY HEALTH SYSTEM FRAMEWORK

FOR PEOPLE

PROCESS OF CARE
- COMPETENT CARE & SYSTEMS
- POSITIVE USER EXPERIENCE

QUALITY IMPACT
- BETTER HEALTH
- CONFIDENCE IN SYSTEM
- ECONOMIC BENEFIT

LEARNING / IMPROVEMENT

FOUNDATION
- POPULATION health needs & expectations
- GOVERNANCE policy, financing, non-health sectors
- PLATFORMS access to and organization of care
- WORKFORCE numbers, skill, support
- TOOLS equipment, medicines, data

EQUITABLE

RESILIENT

EFFICIENT
<table>
<thead>
<tr>
<th>FOUNDATION</th>
<th>POPULATION</th>
<th>GOVERNANCE</th>
<th>PLATFORMS</th>
<th>WORKFORCE</th>
<th>TOOLS</th>
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Chin and Hanson, JID 2017
- 21% initially seek care in informal private sector
- Assumed no TB diagnostic or treatment services available
• 39% initially seek care in private sector (L0-2)
• Minimal coverage of TB diagnostic/treatment services at L0-2
• 41% initially seek care in public sector
• Majority (60%) seek care at L0/L1
• Modest coverage of TB diagnostic/treatment services at L1 and minimal coverage at L0
Lack of alignment between where patients are seeking care and:

- PLATFORMS – top-down organization of TB services
- WORKFORCE – where workforce has adequate skill and support to diagnose and treat TB
- TOOLS – where equipment and medicines to diagnose/treat TB are available

Lack of alignment more pronounced in the private sector but also prominent in the public sector
PROCESS OF CARE

COMPETENT CARE & SYSTEMS

POSITIVE USER EXPERIENCE
Simulated patient studies in India, Kenya, China

Das J et al. Lancet Infect Dis 2015


Results for simulated TB case in the non-NTP sector

**Simulated patient:** Classic case of suspected TB (2-3 weeks of productive cough, fever, weight loss – “presumed TB”)

<table>
<thead>
<tr>
<th>Location</th>
<th>% Correctly Managed</th>
<th>% Referred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mumbai, India</td>
<td>45%</td>
<td>2%</td>
</tr>
<tr>
<td>Patna, India</td>
<td>35%</td>
<td>2%</td>
</tr>
<tr>
<td>Nairobi, Kenya</td>
<td>33 – 40%</td>
<td>4% - 10%</td>
</tr>
<tr>
<td>China – 3 provinces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Village Clinics</td>
<td>28%</td>
<td>28%</td>
</tr>
<tr>
<td>Township Centers</td>
<td>38%</td>
<td>18%</td>
</tr>
<tr>
<td>County Hospitals</td>
<td>90%</td>
<td>5%</td>
</tr>
</tbody>
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Monitoring of routine data – Uganda public sector

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Farr K, Nalugwa T et al. ERS International Congress. 2017
TB Care Continuum - India

TB Care Continuum – South Africa

Naidoo P. et al. JID 2017
Proportion with catastrophic total costs due to TB
(preliminary results from selected national surveys)

- Total costs, including income loss and non-medical expenditures
- Income loss dominates in many settings
QUALITY OF TUBERCULOSIS CARE

PROCESS OF CARE

- 2 Months Diagnostic Delay
- Only 1/2 Drug Susceptible TB
- Only 1/5 MDR-TB
- Only 1/5 LTBI
- Patients lost to follow-up: 4%-38%

QUALITY IMPACT

- Costs
- Wait times
- Satisfaction

- 10.4 Million new cases
- 490,000 new MDR-TB cases
- 1.7 Million deaths
- Case fatality = 16%
- 240,000 MDR-TB deaths

POPULATION

- 50%-60% patients begin seeking care in informal & private sectors

GOVERNANCE

- 52% HBCs recommend Xpert MTB/RIF as initial test
- 47% have implemented this
- In 8 low-income HBCs, domestic funding represents <7% of NTP budget needs

PLATFORMS

- 1.1 microscopy labs per 100,000
- 1.3 DST per 5 million

WORKFORCE

- 3 health care providers seen before diagnosis
- Limited accessibility to TB services at community level
- 28%-45% of providers correctly manage tuberculosis cases

TOOLS

- 10 sputum smears for every Xpert test in HBCs
- 20% are receiving bedaquiline and delamanid

FOUNDATIONS

RESILIENT

EFFICIENT

Danielle Cazabon, Tripti Pande, Catherine Arsenault, Margaret Kruk, Madhukar Pai
How can we improve the quality of TB care?
Quality Improvement

- Systematic approach to identifying, understanding and correcting problems in processes of care
- Applied to healthcare:

“…combined and unceasing efforts of everyone—healthcare professionals, patients and their families, researchers, payers, planners and educators—to make the changes that will lead to better patient outcomes (health), better system performance (care) and better professional development.” -- Batalden PB et al. Qual Saf Health Care 2007
Quality Improvement Principles

Fundamental concept of improvement:
“Every system is perfectly designed to achieve exactly the results it achieves.”

Principles of improvement:
1. Understanding work in terms of processes and systems
2. Developing solutions by teams of providers and patients
3. Focusing on patient needs
4. Testing and measuring effects of change
5. Peer learning
Quality Improvement Models and Tools

- QI Models – framework for establishing QI processes within an organization
  - Model for Improvement
  - LEAN

- QI Tools – formal methods used to measure, analyze or disseminate QI efforts
  - Run-charts
  - Process maps
  - Root cause analysis
Impact of performance feedback on TB diagnostic evaluation at 6 Level IV health centers in Uganda

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Performance Feedback*</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Difference</td>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>Referred for sputum examination</td>
<td>N=838</td>
<td>N=608</td>
<td>10%</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>72%</td>
<td>82%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completed sputum examination</td>
<td>74%</td>
<td>84%</td>
<td></td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Initiated treatment if smear-positive</td>
<td>72%</td>
<td>85%</td>
<td>13%</td>
<td>.07</td>
<td></td>
</tr>
<tr>
<td>Received ISTC-adherent care</td>
<td>52%</td>
<td>67%</td>
<td>16%</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

* 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

Impact of process re-design on TB diagnostic evaluation at 4 Level IV health centers in Uganda

<table>
<thead>
<tr>
<th>TB Diagnosis Step</th>
<th>Baseline Process</th>
<th>Re-designed Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB screening and referral for testing</td>
<td>Clinician-directed</td>
<td>Registration clerk for all patients</td>
</tr>
<tr>
<td>Smear microscopy</td>
<td>Spot-morning ZN</td>
<td>Single-sample LED FM</td>
</tr>
<tr>
<td>Xpert testing</td>
<td>• Selected patients</td>
<td>• All smear-negative patients</td>
</tr>
<tr>
<td></td>
<td>• Intermittent putum transport to testing hub</td>
<td>• Daily sputum transport to testing hub via motor bike</td>
</tr>
</tbody>
</table>

Shete PB, Nalugwa T et al. IJTLD. 2017
### Impact of process re-design: single-arm interventional study

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Intervention (N=4 sites, 1212 patients)</th>
<th>Control (N=24 sites, 1780 patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referred for sputum examination</td>
<td>99%</td>
<td>81%</td>
</tr>
<tr>
<td>Completed sputum examination</td>
<td>99.6%</td>
<td>55%</td>
</tr>
<tr>
<td>Initiated treatment if smear-positive</td>
<td>85%</td>
<td>73%</td>
</tr>
<tr>
<td>Received ISTC-adherent care</td>
<td>84%</td>
<td>33%</td>
</tr>
</tbody>
</table>

### Xpert Utilization

- Xpert testing: increased from 25% → 91% of smear-negative patients
- Treatment of Xpert-positive patients: increased from 45% → 76%

Shete PB, Nalugwa T et al. IJTLD. 2017
Sustaining and scaling quality improvement efforts

HEALTHQUAL model

Quality Management Program Domains
- Organizational structures for improvement
- Planning
- Leadership
- Patient & community involvement
- Data systems that measure performance
- Linking process measures to outcomes
- Knowledge management/communication
- Staff capacity-building: training and coaching
- Peer learning
- Evaluation

Adopted by HIV/AIDS programs in 15 PEPFAR-supported countries

Agins B and Ikeda D, HEALTHQUAL
A public health approach to quality management

NTPs are just starting to consider Quality Management Programs

<table>
<thead>
<tr>
<th>Country</th>
<th>QI program?</th>
<th>Lab EQA?</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>Yes (new NSP)</td>
<td>Yes</td>
</tr>
<tr>
<td>Philippines</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>South Africa</td>
<td>Yes (new NSP)</td>
<td>Yes</td>
</tr>
<tr>
<td>Pakistan</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>DR Congo</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Ghana</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Cambodia</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Uganda</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>China</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Yes (pilot)</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Take-away messages

- Poor quality care is a major driver of poor health and economic outcomes for TB patients
- Quality improvement requires involvement of “everyone” in continuous cycles of planning, measurement, testing and iteration
- Scaling and sustaining QI requires a centrally-managed program
- Next steps
  - Identify effective/cost-effective models for scaling-up QI within NTPs
  - Develop and adapt interventions to address common process barriers
  - Develop and adapt models for peer learning within and between NTPs
  - Continued advocacy to improve foundations of care
Thank you!

Uganda TB Implementation Research Consortium:

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