How did we get to where we are today?

Lack of Institutional Tuberculosis Transmission Control

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Examples of lacking institutional TB transmission control

KZN
Tomsk Oblast
General Hospital in Peru
Importance of Transmission in Tomsk

- Retrospective study of the role of non-adherence and default and the acquisition of multidrug resistance

- Substance abuse was a strong predictor of non-adherence (OR 7.3 (2.89-18.46))
  - But non-adherence NOT associated with MDR-TB

- MDR-TB occurred among adherent patients who had been hospitalized in the course of therapy compared to those treated as out-patients
  - OR 6.34 (1.34 – 29.72) – began treatment in hospital
  - OR 6.26 (1.02 – 38.35) – hospitalized later during treatment
Role of Transmission Underestimated

• Prior treatment ≠ Acquired MDR
• Reinfection likely to be common throughout the world
  – Difficult to prove
• Control implications
  – Transmission control more critical
  – Vaccines may not work if natural infection not protective
  – Treatment of LTBI may have a limited benefit
Importance of the Unsuspected TB Case
Arzobispo Loayza Hospital


• 250 of 349 pts admitted to on female ward in 1997 were screened for TB
  – sputum
  – CXR
  – history
  – physical exam
Importance of the Unsuspected TB Case - 2
Arzobispo Loayza Hospital
(Emerg Inf Dis 2001; 7:123-7)

• 40 pts (16%) had positive cultures
  – 26/40 (65%) smear positive
  – 13/40 (33%) unsuspected
  – 8/40 (20%) had MDR
    • Incl. 6/8 MDR unsuspected
      – 3/6 were smear positive
Learning from the past

MDR in NYC and Miami
1985-1992
Tuberculosis in New York City—turning the tide

• “Epidemiologic patterns strongly suggest that the decrease in cases resulted from an interruption in the ongoing spread of M. tuberculosis infection, primarily because of better rates of completion of treatment and expanded use of directly observed therapy.

• Another contributing factor may have been efforts to reduce the spread of tuberculosis in institutional settings, such as hospitals, shelters, and jails.”
TB Resurgence - NYC (1985-92)

TB Case → MDR TB → Transmission → Cure 50%

Shelters, Jails, Hospitals

HIV +, HIV -

5 - 10% / year

5 - 10% / lifetime
Need to Massively Scale Up Transmission Control Globally
Famous Excuses for Ignoring Transmission Control

- DOTS alone will solve the problem
- MDR is less “fit”
- Community-based TB treatment is not possible
- Transmission control is not possible in resource-limited settings.
  - Too expensive
  - Workers won’t wear respirators
  - Most workers in high burden settings are already infected
    - *Important role of reinfection*
  - Patients will feel stigmatized
  - Ventilation systems are too expensive to install and maintain
  - UV is too “high tech” for poor settings – no expertise
Examples of what can be done

- NYC example – “turning the tide”
  - but resource intensive
- Basic triage and clustering in Haiti - PIH
  - new hospital designs
  - natural ventilation/UVGI
- Response to KZN outbreak – Tony Moll
  - simple ventilation strategies
- MDR hospital in Lesotho - PIH
  - Use of mechanical ventilation
  - Use of respirators - reusable alternative
- Vladimir Hospital interventions (Russia, CDC project)
  - Comparing cost-effectiveness of ventilation, filtration, UVGI
What can be done?

**Basic Transmission Control: Haiti**
TB Triage – PIH (Haiti)

Community based TB treatment

Hospitalized patients

- **General ward**
  - Sm -, HIV +/-

- **TB Pavilion**
  - Sm+, HIV-

- **6 isolation rms**
  - SM+ and HIV+
Isolation rooms
• 6 rooms off a common corridor
• 1 room with window closed – exhaust fan, UV lamp in the corner,
  • door hard to close due to negative pressure
• 1 room with window open –
  • no negative pressure
• Air from 2\textsuperscript{nd} room sucked into other 5 rooms
New PIH LaColline Hospital

- Open, wide outside corridors
- Decorative grates rather than doors
Isolation rooms now open to outside corridor:
• Similar exhaust fan
  • UV fixture not well placed

Pediatric ward
• Too few windows
• Sliding windows instead of louvered ones
  • Block half the opening
  • Closed in rain
Outdoor waiting areas

- Too few UV fixtures if used at all.

Older fenestrated building design
Natural Ventilation

• Geography specific
• Can provide large ventilation rates
• Low cost/maintenance
• Optimal for outdoor waiting areas, sputum induction, separating isolation rooms

• Not a panacea
  – Cannot control direction of airflow
• What happens at night, in cooler seasons, etc?
  – Unreliable except in certain geographies
• Windows closed, no ventilation = 0.3 ACH
• Windows closed & ventilation on = 16 ACH
• Windows open & mixer fans on = 67 ACH
Examples of what should **not** be done

- Open wards in high burden MDR/HIV areas
  - Lack of transmission control programs
    - No basic triage and separation
    - Inadequate air disinfection
    - No respirator use
- Funding of poor designs
  - New MDR hospital in Botswana
  - New MDR hospital in Swaziland*
  - Poor application of UV lamps in MDR hospitals in South Africa
New MDR Hospital - Gaborone

One million dollar renovation of old TB hospital
Poor design - multiple isolation rooms off common entry
UVGI – highly effective but poorly applied
MDR TB Hospital – South Africa
Positive Developments

• WHO sub working group on IC
  – Guidelines, monitoring indicators, coordination with HIV, respiratory infections, etc.
• Funding for TB IC through GFATM, PEPFAR, USAID
• Technical Training
  – TB-CAP
  – CDC
  – Harvard Intensive Course for Engineers and Architects
• Project “BREATHE” to develop better respirators (VAMC)
• New research on MDR transmission control
  – Escombe – UVGI reduced transmission 72% in Lima hospital
  – Novel transmission control interventions being tested
AIR, Experimental Plan

Guinea Pig Air Sampling

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<tr>
<th>Odd days</th>
<th>Even days</th>
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<td>UVGI or other intervention</td>
<td>3 patient rooms Plus common areas</td>
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Pt. TB RFLP

Intervention on/off on alternative days