Children in the evolving TB epidemic

Ben Marais
Robert Koch 1843-1910
"GERM THEORY"

Louis Pasteur 1822-1895
OF DISEASE
Web of causation

- **Mycobacterium tuberculosis**
- **Crowding**
- **Exposure**
- **Infection**
- **Disease**
- **Tobacco smoke**
- **Diabetes**
- **Malnutrition**
- **HIV**
- **Poverty**
What is shaping the evolution of the global TB epidemic?

Host factors

1) Demographic & disease shifts
   - Increasing population density
   - Increasing wealth/health disparity
   - More vulnerable people
     Old age
     Immune therapy
     HIV
     NCDs (Diabetes mellitus, chronic lung disease)
The possibility of eradicating TB is essentially a function of a country’s economic development level - Canetti, 1962

TB incidence rates & socio-economic level, New York, 1973
(SE level estimated on the basis of education, occupation and income)

HIV induced age & gender shift

HIV prevalence among pregnant women  
<10% in 1996  >20% in 2004

Lawn SD et al. CID 2006; 42: 1040-7
Active Case Finding Project - Cambodia

High Prevalence
Target Community

TB suspects
& HH Contacts

CXR

Microsc/
GeneXpert

House-to-house visit
Invite ADULT contacts and TB suspects to ACF sessions

Screen all TB suspects with mobile X-ray
ACF detects older patients

Age distribution of cases by case finding method

- Median age
  - PCF-before: 48
  - ACF: 55

P < 0.001
Linking in the Children

Screen all HH Contacts.

Prioritize <5: Current cough / Fever / Fatigue / FTT

Screen-negative

Alert HC of TB contact
Deliver INH on next meds delivery

Provide preventive therapy along with TB Rx to source case

Screen-positive

Re-evaluate in 1-week. Resolution of symptoms?

Yes

No

Refer to HC for evaluation

Provide preventive therapy along with TB Rx to source case

Alert HC of TB contact
Deliver INH on next meds delivery
Child TB Notifications & Classification of Disease Since 2005

>75% cases clinically Dx cervical adenitis
Provincial Breakdown: EPTB in Children

- 60% of cases diagnosed in 3 provinces
- Almost 30% in one province alone

N=5 375 (2011)
SUMMARY

Poor access to Dx services
Limited CXR facilities
Sputum smear-based diagnosis
Pediatric investigations ONLY done at pediatric referral hospitals
HCWs only able to diagnose EPTB clinically

Presentation of disease at tertiary facilities:
Severe, complicated, and chronic
(Abd. TB, bone/joint TB, Potts, extensive lung disease)
Among children >5 years
Indicating acute illness in the most vulnerable (<5 years) may be missed
TB epidemic evolution

Environment
- TB control efforts
  - Drug-resistant strains
  - Sputum sm- disease

Vaccination
- Circumvent BCG protection
Children with drug-resistant TB reflect successful transmission of these strains.

TB with any drug resistance

MDR TB

XDR TB

TDR TB
Epidemic spread of MDR-TB

**Dogma:** Drug resistant strains have reduced pathogenicity

Middlebrook G. Science 1953

Modelling: small sub-population of relatively fit MDR strains may eventually outcompete all other strains

Cohen T. Nature Med 2004

Work with clinical strains showed limited competitive cost associated with drug resistance

Gagneux S. Science 2006

**Analysis of all MDR-TB specimens identified in Jhb, SA**

434 adult pts diagnosed from 2004-2007

- 238 (54.8%) of isolates were resistant to ALL 4 first line drugs (HRES)
What can we do to reduce transmission?

- Early effective treatment
- Contagiousness avoided
- No treatment

Transmission

Percent smear positive

Time since diagnosis, months
Risks of a poor TB control program

![Bar chart showing the percentage of potentially infectious, dead, and cured individuals with or without treatment.]

Bull Int Union Tuberc 1978; 53(2): 70-75
## Ethical issues

### Individual vs community

<table>
<thead>
<tr>
<th>Individual Human Rights perspective</th>
<th>Community perspective</th>
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<tbody>
<tr>
<td>No personal harm</td>
<td>Community protection</td>
</tr>
<tr>
<td>Individual benefit</td>
<td>Common good</td>
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<tr>
<td>Autonomy</td>
<td>Fairness</td>
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<td>Justice</td>
<td>Reciprocity</td>
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Millennium Development Goals

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Global partnership for development

The evolving Global Health Agenda
Post MDG - Sustainable health targets
Medical ethics
The third dimension

One world – One health

As biodiversity disappears, ecosystems become weak and inefficient, threatening the health and maintenance of all life.