Decontamination in the Western Cape in the Era of TB
Prof. Shaheen Mehtar, Stellenbosch University, Cape Town, South Africa
Broadcast live from Central Sterilising Club conference www.csc.org.uk

Lecture Plan
- Disease Profile in South Africa
  - TB in South Africa
  - TB in the Western Cape & TBH
- Dealing with Communicable Disease
  - Revitalization of SSD
  - Training in Decontamination & Sterilization
  - Implementing CDC TB guidelines
- Conclusions

Disease Profile - South Africa
- Communicable Diseases (2006, HST Report)
  - TB - 930/100 000 population
  - HIV- 27% of total population
  - TB/HIV co infection 57%
  - Rarely VHF- sporadic
  - Diarrhoeal disease- high morbidity in summer
  - Prion Disease- not reported in humans
- Hospital acquired (nosocomial)
  - Acinetobacter spp
  - Klebsiella pneumoniae (ESBL+)
  - MRSA

TB in South Africa
- TB/HIV co infection 57%

TB statistics - SA, UK & USA 2005

<table>
<thead>
<tr>
<th></th>
<th>S Africa</th>
<th>UK</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per 100 000 pop</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notification rate (annual)</td>
<td>570</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>New cases (est)</td>
<td>285000</td>
<td>8494</td>
<td>13500</td>
</tr>
<tr>
<td>Incidence</td>
<td>600</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>HIV prevalence in TB</td>
<td>57</td>
<td>6.7</td>
<td>15</td>
</tr>
</tbody>
</table>

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Factors affecting TB control programme outcomes in South Africa

**Patient Factors**

- Poverty & overcrowding
- Poor access to services
- Traditional beliefs regarding illness and treatment
- Treatment side effects
- Stigmatization and fear
- Direct and indirect costs
- Substance use
- Social mobility
- External locus of control
- HIV / AIDS

**Clinic Factors**

- Inadequate teamwork
- Discontinuity of care
- Task orientation
- Little patient education
- Rigid opening hours
- Long waiting times
- Overcrowding
- Poor ventilation

**TB & HIV co-infection in Africa**

**Definitions - Drug resistance in TB**

- Multi-drug Resistant- (MDR)
  - Resistance to rifampicin and isoniazid
- Extremely Drug Resistant- (XDR)
  - Resistant to rifampicin and isoniazid PLUS
  - Any fluoroquinolone
  - and capriomycin, amikacin and kanamycin

**MDR & XDR-TB global (% of all reported cases) (MMWR 55/11)**

<table>
<thead>
<tr>
<th>Region</th>
<th>2000</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MDR</td>
<td>XDR</td>
</tr>
<tr>
<td>Industrialised</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Central &amp; South America</td>
<td>48</td>
<td>6</td>
</tr>
<tr>
<td>Europe/ West Asia</td>
<td>55</td>
<td>9</td>
</tr>
<tr>
<td>Africa &amp; Middle East</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>Asia excl South Korea</td>
<td>81</td>
<td>0</td>
</tr>
</tbody>
</table>

**Countries with XDR-TB**

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XDR-TB- S Africa

- 544 patients with MTB
- 39% had MDR TB
- 6% of MDR- TB patients had XDR-TB
- All 44 XDR-TB patients tested and HIV +
- median survival with XDR = 16d (2-210d)
- 55% had no previous anti-TB treatment
- 67% had history of recent hospital admission
- 85% had the similar genotype
- Nosocomial transmission a strong possibility!

Gandhi et al. Lancet 2006

Western Cape

- 9 million population increasing by 15% each year
- Highest incidence of TB in SA- >1000/100 000 population
- Lowest incidence of HIV in SA- 15% of women attending AN clinics

Tuberculosis Historical Background

In southern Africa linked to the discovery of diamonds and gold, industrialization and massive migrant labour to the (then)
Transvaal republic.
- Western Cape used as a TB sanatorium for European TB patients in 1800’s
- Cape Town always been a “TB hot spot”

SA: TB incidence in 2004
- TB burden 47 603 Cases
  - Incidence: >900/100,000
  - Treatment outcomes NSP
  - Cure 79% Completion 79%
  - Death 3.2%
  - Failure 1.8%
  - Transfer 3.3%
  - MDR
  - Default 11.9% (19.5% in 1996)
  - High Re-treatment burden: 30%
- MDR Drug Resistance Prevalence
  - MRC Survey 1995 & 2001-2002:
    - Western Cape
      - New: 1%
      - Re-treatment: 4%

SA: TB incidence in 2004

Western Cape: 2005
- TB burden 47 603 Cases
  - Incidence: >900/100,000
  - Treatment outcomes NSP
  - Cure 79% Completion 79%
  - Death 3.2%
  - Failure 1.8%
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  - MRC Survey 1995 & 2001-2002:
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      - New: 1%
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Audit of Western Cape Healthcare facilities for Decontamination and Sterile Services 2005

Sterile Services in W Cape

<table>
<thead>
<tr>
<th>Sterile Services: hospitals- n= 20</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical equipment washed on wards</td>
<td>55</td>
</tr>
<tr>
<td>SSD on site</td>
<td>60</td>
</tr>
<tr>
<td>SSD stores separated</td>
<td>95</td>
</tr>
<tr>
<td>SSD policy</td>
<td>40</td>
</tr>
<tr>
<td>SSD reception area separated</td>
<td>37</td>
</tr>
<tr>
<td>Cleaning equipment appropriately</td>
<td>33</td>
</tr>
<tr>
<td>Batch recall</td>
<td>40</td>
</tr>
<tr>
<td>Endoscopy cleaned in ventilated area</td>
<td>30</td>
</tr>
</tbody>
</table>

Protective clothing used during cleaning instruments

<table>
<thead>
<tr>
<th></th>
<th>gloves</th>
<th>latex</th>
<th>domestic</th>
<th>heavy duty</th>
<th>vinyl</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>masks</td>
<td>10</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>masks</td>
<td>paper</td>
<td>3</td>
<td>1</td>
<td></td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>aprons</td>
<td>Thin plastic</td>
<td>Domestic</td>
<td>Butcher's apron</td>
<td>Cotton gown</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>overshoe</td>
<td>11</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hair cover</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Respiratory circuits cleaning

<table>
<thead>
<tr>
<th>Units</th>
<th>110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study time = 7/7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cleaning</th>
<th>All</th>
<th>Ward</th>
<th>EO Unit</th>
<th>NS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resp Equip.</td>
<td>3596</td>
<td>1089</td>
<td>2492</td>
<td>24</td>
</tr>
<tr>
<td>%</td>
<td>30.2</td>
<td>69.1</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Nurse time spent cleaning</td>
<td>54.45 h/wk</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No of autoclaves per unit

<table>
<thead>
<tr>
<th>Autoclave/ unit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>&gt;5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSD units</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Not working</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Units where autoclaves not working on day of survey</td>
<td>7/15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heat sensitive item processing

<table>
<thead>
<tr>
<th>Method</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>EO</td>
<td>10</td>
</tr>
<tr>
<td>Pasteurisation</td>
<td>2</td>
</tr>
<tr>
<td>2% glutaraldehyde</td>
<td>4</td>
</tr>
<tr>
<td>plasma</td>
<td>1</td>
</tr>
</tbody>
</table>

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IPC in TB - TBH- 6/12
• During study period to TBH = 33263 admissions
• MTB confirmed cases = 394 (1.2%)
  – OPD- 17.3%
  – IP- 83%
• HIV status (199/394) 50.5% pos
• Microbiology on 394 cases
  – Smear pos 110 (28%)
  – Culture pos 306 (77.7%)
  – Sensitivity testing 140 (46%)
    • MDR 13/140 (9.3%)

Potential Exposure & IPC Risk
• TAT for results
  • Smear 9 hr
  • Culture 27d
  • Sensitivity 42d
• LOS
  – MDR – LOS- 36 days
  – Non MDR- LOS- 17 days
• Potential exposure to MTB - 22 days (mean)
• Mortality
  – Overall: 3.1%
  – Mortality associated with TB= 9.4%

Audit of TB facilities TBH- ’07
Total number of beds= 1269; single rooms (SR)= 292 (23%)

<table>
<thead>
<tr>
<th>Spec</th>
<th>wds</th>
<th>Masks</th>
<th>glove</th>
<th>apron</th>
<th>N95</th>
<th>SR door</th>
<th>SR Curtains</th>
<th>SR NPv*</th>
</tr>
</thead>
<tbody>
<tr>
<td>A&amp;E</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>OR/Gy</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>I Med</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>IDUs</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Paked</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Surg</td>
<td>9</td>
<td>5</td>
<td>9</td>
<td>6</td>
<td>0</td>
<td>9</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

*Negative Pressure Ventilation
Usage of PPE by nursing staff = 98%

Point Prevalence - TBH - TB Cases
April 2008

<table>
<thead>
<tr>
<th>Ward</th>
<th>Total</th>
<th>TB Patients</th>
<th>%age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardio-Thor</td>
<td>22</td>
<td>2</td>
<td>9.1</td>
</tr>
<tr>
<td>Resp ICU</td>
<td>17</td>
<td>8</td>
<td>47.1</td>
</tr>
<tr>
<td>Int Med</td>
<td>21</td>
<td>7</td>
<td>33.3</td>
</tr>
<tr>
<td>Int Med</td>
<td>28</td>
<td>9</td>
<td>32.1</td>
</tr>
</tbody>
</table>

TB cases among staff in ’07

<table>
<thead>
<tr>
<th>Place of work</th>
<th>Nurse</th>
<th>Dr</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID ward</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ventilation plant</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaners</td>
<td>2 +1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antenatal High Care</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen staff</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiography student</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPD orthopedics</td>
<td>1 +1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Med records</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resp ICU</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortuary</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Med student</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>2</td>
<td>11</td>
</tr>
</tbody>
</table>

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Tygerberg Hospital
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Bronchoscopy Area
- Number of Bronchoscopy per month- 80
- Number of 'scopes = 12
  - Adult- 6
  - Paediatric- 4
- On site cleaning
  - No exhaust system
  - No control of chemical disinfectant used
  - SOP either not present or not followed

Developing D & S Services

What is being done?
- Appropriate management structures for SSD
- Establishing career paths
- Revitalization of SSD departments & services
- Audit cycles and QA

Training! Training! Training!
- Training in IPC
  - training for all operators
  - Training of ward staff
  - Training of managers
- Incorporating Decontamination and Sterilization in Postgraduate Dip in IC
- Developing a training qualification Dip in SSD

Towards a Diploma in Decontamination & Sterilization

Challenges to training in IPC
- English was not the first language therefore complex written teaching is difficult to understand
- Computers and computer skills are lacking and therefore distance learning is not currently possible
  The learning culture relies heavily on instruction and less on self-study or research.
- There is no clearly established career path yet.

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Training Format
- **Basic principles** of IPC and D & S rather than practice has been adopted
- Practice is based on local conditions within those principles
- One sixth of the time spent in contact teaching
  - Lectures
  - Ward rounds and practical work on the wards
- Five-sixth spent applying what is learnt in place of work
  - Completion of log books or portfolios
  - Writing a project of how the teaching is applied to local work conditions
- Only Certificates of Competence are issued from SUN after examination for all courses
- Students are allowed to re-sit the examination once.
- A site supervisor is appointed for each student

Decontamination & Sterilization
- **Fundamental Course** (1/2d)
  - Attended by all SSD operators
- **Basic Course** (5d)
  - Covers principles of decontamination, sterilization including clinical equipment, endoscopes, ward items including MTB
- **Intermediate Course** (10 wk)
  - Dove-tails into the PDIC D & S module
- **Advanced Course** (10 wk)
  - Recognised by IDSc, UK
  - Exchange of students with SSDs in the UK (2009)
  - Towards a Diploma in D&S

Number completed training
<table>
<thead>
<tr>
<th>Course</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPC Short courses</td>
<td>38*</td>
<td>58*</td>
<td>?</td>
</tr>
<tr>
<td>Non IPC practitioners</td>
<td>12*</td>
<td>36*</td>
<td>?</td>
</tr>
<tr>
<td>IPC practitioners (basic)</td>
<td>0</td>
<td>11</td>
<td>?</td>
</tr>
<tr>
<td>PDIC (enrolled= 29)</td>
<td>11</td>
<td>7</td>
<td>?</td>
</tr>
<tr>
<td>Basic D&amp;S</td>
<td>34</td>
<td>48</td>
<td>70</td>
</tr>
<tr>
<td>Intermediate D&amp;S</td>
<td>18</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Advanced D&amp;S</td>
<td>0</td>
<td>?</td>
<td>2</td>
</tr>
</tbody>
</table>

*Including Namibia, Botswana
*2008- expanding to other countries

IMPLEMENTING GUIDELINES
- The problems of the Industrialised countries are not those of Africa!
- The guidelines and policies do not always apply
- Principles not practice!

Implementing Guidelines
- TB in SA = 1000/ 100 000 population
- Exposure is very common- almost everyone infected
- Infecting load = 50 infectious particles
- TB disease related to HIV
- Natural ventilation can dramatically reduce TB load
- Cost considerations
- TB in USA = 5/ 100 000 population
- Low exposure rates
- Low burden of HIV & TB co infection
- Mechanical ventilation in HCF
- UV used to clear circulating air.

CDC- Guidelines for MTB- can SA implement these?
- **Level I- CDC**
  - Written plan for rapid identification, isolation and effective treatment
  - Training and counselling of HCW dealing with TB
  - Supervision by well trained staff
- **In South Africa**
  - Training inadequate: being extended
  - Implementing effective work practice
  - No screening of workers for TB
  - Protection of HIV positive workers
  - Need to include the Community

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CDC guidelines (Level II)

Adequate ventilation in all high risk areas
- Local area exhaust ventilation- in all patient areas
- Directional airflow from clean to less clean
- Dilution and removal of contained areas- exhaust ventilation- 220 CFM/ person through HEPA filter
- Disinfection of air by UV light

South Africa
- For Western Cape this would mean ALL Healthcare areas where patients are seen
- Exhaust ventilation cannot be maintained
- Too expensive
- UV light not proven valuable in uncontrolled environment

Natural ventilation effect

- Used CO₂ clearance from
  - Mechanically ventilated rooms
  - Natural ventilation
- 368 experiments carried out
- Natural ventilation clearance = 28 ACH
- Mechanical negative- pressure rooms = 12 ACH
- Wells-Riley airborne infection model prediction
  - 33% in negative pressure rooms
  - 11% in natural ventilated rooms


Natural ventilation effect

- Used CO₂ clearance from
  - Mechanically ventilated rooms
  - Natural ventilation
- 368 experiments carried out
- Natural ventilation clearance = 28 ACH
- Mechanical negative- pressure rooms = 12 ACH
- Wells-Riley airborne infection model prediction
  - 33% in negative pressure rooms
  - 11% in natural ventilated rooms


MRR ward- alternative

Open windows & door for ventilation
Bed curtains around patients’ beds
Care givers: instructed in IPC
Windows open, sunlight
Same precautions as HCW if tending patient

CDC guidelines (level III)

- Personal Protective clothing
  - Respiratory masks
  - Surgical masks- inadequate for MTB protection
  - N95 or equivalent for all TB patients
  - Fit well- face seal fitting test
  - Respiratory inspection and checking

- In South Africa
  - Everyone would have to wear masks all the time!
  - Surgical masks for sens TB patients
  - N95 masks for MDR and XDR TB
  - Bed curtains for in patients
  - Cough rooms for sputum sampling- exhaust ventilation not common
  - Engineering Maintenance difficult

Cough (droplet) demonstration

Coughing- 3m
Hanky- 0.5m
Surgical mask- 0.5m

Aerosol demonstration

Coughing- 2m
Hanky- 1m
Surgical mask- 0.25m

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Cough etiquette

Cough Rooms
- Small confined space where patient goes in to produce sputum
- Usually it is a toilet or sluice which doubles up as a cough room
- Patient may or may not be supervised while producing sample
- Exhaust ventilation is usually not present
- Sometimes patients nebulised to produce a good sample.
- STAFF AT RISK if not protected!

Summary
- Decontamination a major problem in developing countries
- Needs simple applications of complex principles to ensure safe processing
- SSD service improvements are being developed but are slow
- Nosocomial transmission of communicable diseases especially TB & HIV is still a major risk in Africa.

The 2008 British Teleclass Series

Central Sterilising Club
The Original Decontamination Forum

www.csc.org.uk

July 22
Progress Report from the Chief Nursing Officer
Dr. Christine Beasley, Department of Health

September 16
C. difficile Prevention Better than Cure
Dr. Mark Wilcox

November 15
Becoming a Transformational Leader
Dr. Peter Wells

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