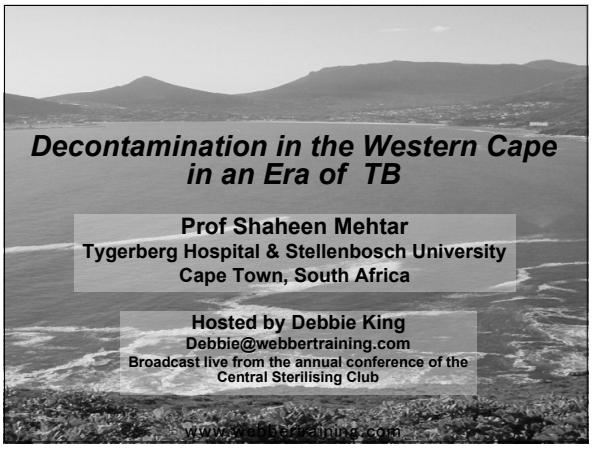
Decontamination in the Western Cape in the Era of TB

Prof. Shaheen Mehtar, Stellenbosch University, Cape Town, South Africa

Broadcast live from Central Sterilising Club conference www.csc.org.uk



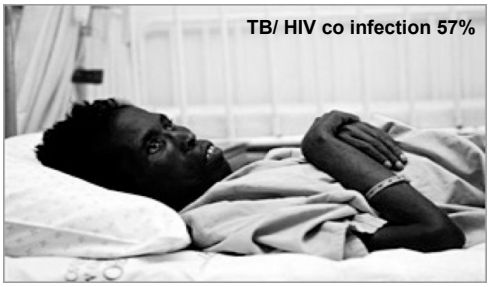
Lecture Plan

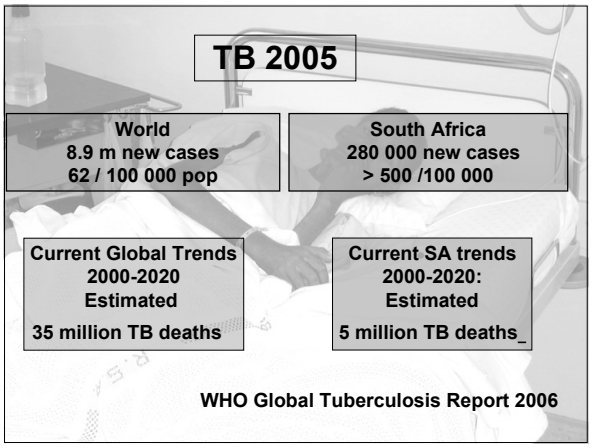
- Disease Profile in South Africa
  - TB in South Africa
  - TB in the Western Cape & TBH
- Dealing with Communicable Disease
  - Revitalization of SSD
  - Training in Decontamination & Sterilization
  - Implementing CDC TB guidelines
- Conclusions

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 statistics - SA, UK & USA 2005

Per 100 000 pop	S Africa	UK	USA
Notification rate (annual)	570	14	5
New cases (est)	285000	8494	13500
Incidence	600	14	5
HIV prevalence in TB	57	6.7	15

WHO, Global TB Bull, 2005

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Factors affecting TB control programme outcomes in South Africa

Patient Factors

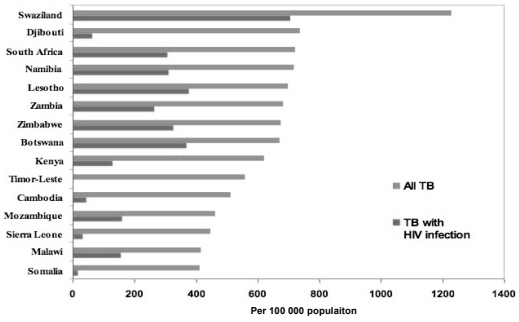
- Poverty & overcrowding
- Poor access to services
- Traditional beliefs regarding illness and treatment
- Treatment side effects
- Stigmatization and fear
- Direct and indirect costs
- Substance use
- Social mobility
- External locus of control
- HIV / AIDS

Factors affecting TB control programme outcomes in South Africa

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)*

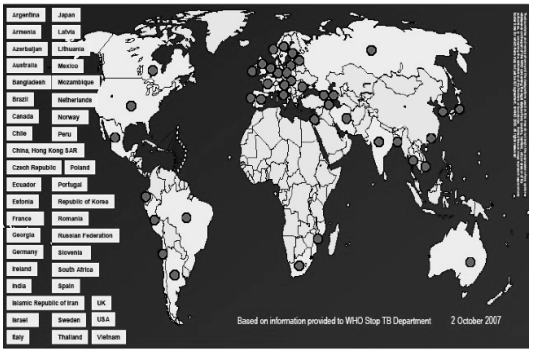
Region	2000		2004	
	MDR	XDR	MDR	XDR
Industrialised	20	3	33	6
Central & South America	48	6	55	6
Europe/ West Asia	55	9	35	14
Africa & Middle East	17	0	23	1
Asia excl South Korea	81	0	70	1

Former Russian States- upto 60% MDR TB

(WHO, IULTD, WHO report 2008)

Countries with XDR-TB Confirmed cases to date

WHO



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XDR-TB- S Africa

XDR-TB- Report from KZN (2007)

- 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 admisison
  85% had the similar genotype
- Nosocomial transmission a strong possibility!

Gandhi et al. Lancet 2006

Modeling XDR Transmission

S. Basu, et. al. Lancet 2007; 370:1500-07

Intervention	Est. % XDR averted
Community-based treatment and deferred hospitalization	< 10%
Rapid drug susceptibility assays	2 – 4%
Involuntary detention (without isolation rooms)	3%
Improved natural ventilation, Air filtration, UV air disinfection	33%
Personal protective measures - Respirators and masks – enforced	2% total cases 1/3 cases in staff
Voluntary counseling and testing with ARV therapy	1% of admitted patients 24% in the community.

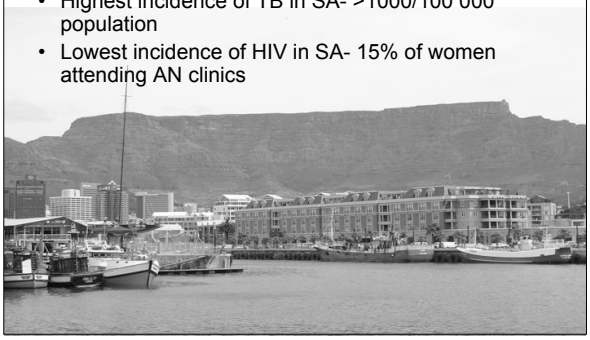
Modeling XDR Transmission

S. Basu, et. al. Lancet 2007; 370:1500-07

Intervention combinations	Est. % XDR averted
Reducing length of stay + enforced use of respirators and masks	28% (21-33%)
Add natural ventilation	37% (26-40%)
Add drug susceptibility assay, hospital based VCT with ARV, and separation of patients in 5 bed units	48% (34-50%)

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

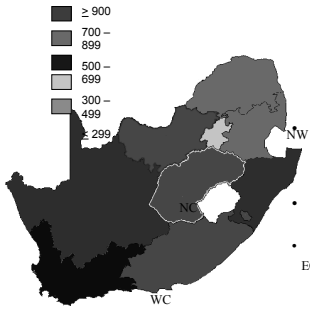


Tuberculosis Historical Background

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



Western Cape: 2005

- **TB burden 47 603 Cases**
  - **Incidence: > 900/100,000**
  - **Treatment outcomes NSP**
  - **Cure 70% Completion 79%**
  - **Death 3,2%**
  - **Failure 1,8%**
  - **Transfer 3,3%**
  - **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%**

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Audit of Western Cape
Healthcare facilities
for Decontamination and Sterile Services
2005

Sterile Services in W Cape

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

Protective clothing used during cleaning instruments

gloves	latex	domestic	heavy duty	vinyl	none
	10	0	3	1	1
masks	paper	surgical			none
	3	1			11
Aprons	Thin plastic	Domestic	Butcher's apron	Cotton gown	none
	11		1	2	1
overshoes	7				
hair cover	9				

Respiratory circuits cleaning

Units = 110		Study time = 7/7		
Cleaning	All	Ward	EO Unit	NS
Resp Equip.	3596	1089	2492	24
	%	30.2	69.1	0.7
Nurse time spent cleaning 54.45 h/wk				

No of autoclaves per unit

Autoclave/ unit	1	2	3	5	>5
SSD units	2	4	5	1	3
Not working	0	3	2	0	2

Units where autoclaves not working on day of survey= 7/15

Heat sensitive item processing

Method	n
EO	10
Pasteurisation	2
2% glutaraldehyde	4
plasma	1

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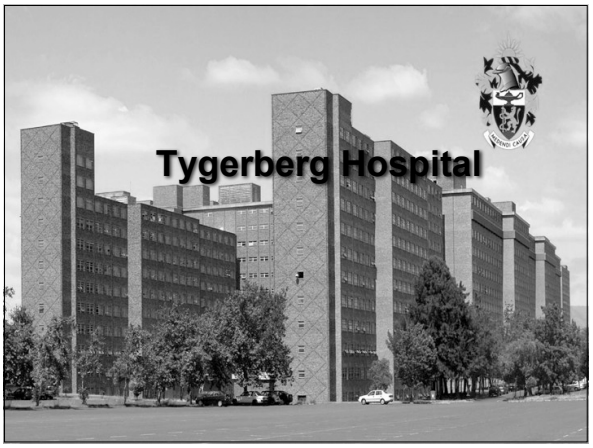

IPC in TB - TBH- 6/12

- **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%)

D Sissolak- MPH Thesis 2007, Staffordshire Uni

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%)

Spec	wds	Masks	glove	apron	N95	SR door	SR Curtains	SR NPV*
A&E	**3**	2	3	2	0	1	3	0
ObGy	**6**	4	6	2	**2**	5	3	0
I Med	**7**	7	7	2	**4**	7	7	0
ICUs	**8**	8	8	8	**6**	8	8	0
Paed	**8**	8	8	5	**2**	7	5	0
Surg	**9**	5	9	6	0	9	8	0
Other	**2**	2	2	1	0	2	2	0

*Negative Pressure Ventilation

Usage of PPE by nursing staff = 98%

Point Prevalence - TBH - TB Cases April 2008

Ward	Total	TB Patients	%age
Cardio-Thor	22	2	9.1
Resp ICU	*17*	*8*	*47.1*
Int Med	21	7	33.3
Int Med	28	9	32.1

TB cases among staff in '07

Place of work	Nurse	Dr	other
ID ward	1		
Ventilation plant			1
cleaners			2 +1
Ante natal High Care	1		
Kitchen staff			4
Radiography student			1
OPD orthopoedics	1 +1		
Med records			1
Resp ICU		1	
Mortuary			1
Med student		1	
Total	**4**	**2**	**11**

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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!

Towards a Diploma in Decontamination & Sterilization

- 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

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

Course	2006	2007	2008
IPC Short courses	38*	58*	?
Non IPC practitioners	12*	36*	?
IPC practitioners (basic)	0	11	?
PDIC (enrolled= 29)	11	7	?
Basic D&S	34	48	70
Intermediate D&S	18	12	25
Advanced D&S	0	? 2	?

*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 Differences

- ✓ 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 CO_2 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**

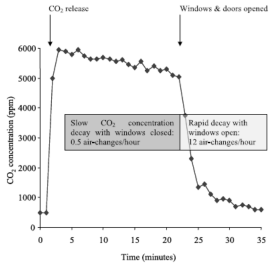


Figure 1. Measurement of Ventilation

Escombe RA, et al. PLoS Medicine, 2007; 4:2

MDR ward- alternative

Open windows & door for ventilation

Bed curtains around patients' beds

Care givers: instructed in IPC

Windows open, sunlight

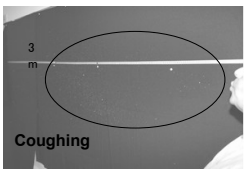
Same precautions as HCW if tending patient

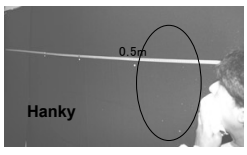
CDC guidelines (level III)

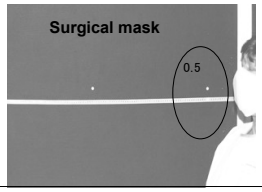
- Personal Protective clothing
- ✓ Respiratory masks
  - ✓ Surgical masks- inadequate for MTB protection
  - ✓ N95 or equivalent for all TB patients
  - ✓ Fit well- face seal fitting test
  - – Respiratory inspection and checking

- **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





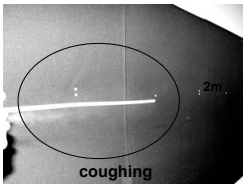


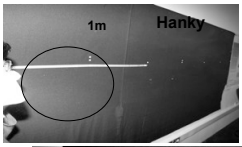
Coughing- 3m

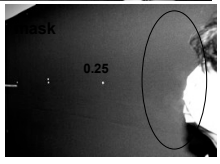
Hanky- 0.5m

Surgical mask- 0.5m

Aerosol demonstration







Coughing- 2m

Hanky- 1m

Surgical mask- 0.25m

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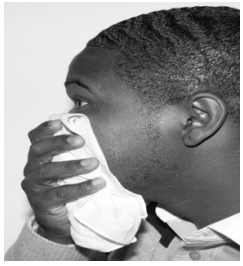
Cough etiquette



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.

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