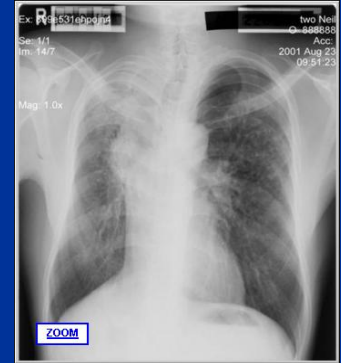


The crisis of TB in the mines

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The crisis of TB on the mines

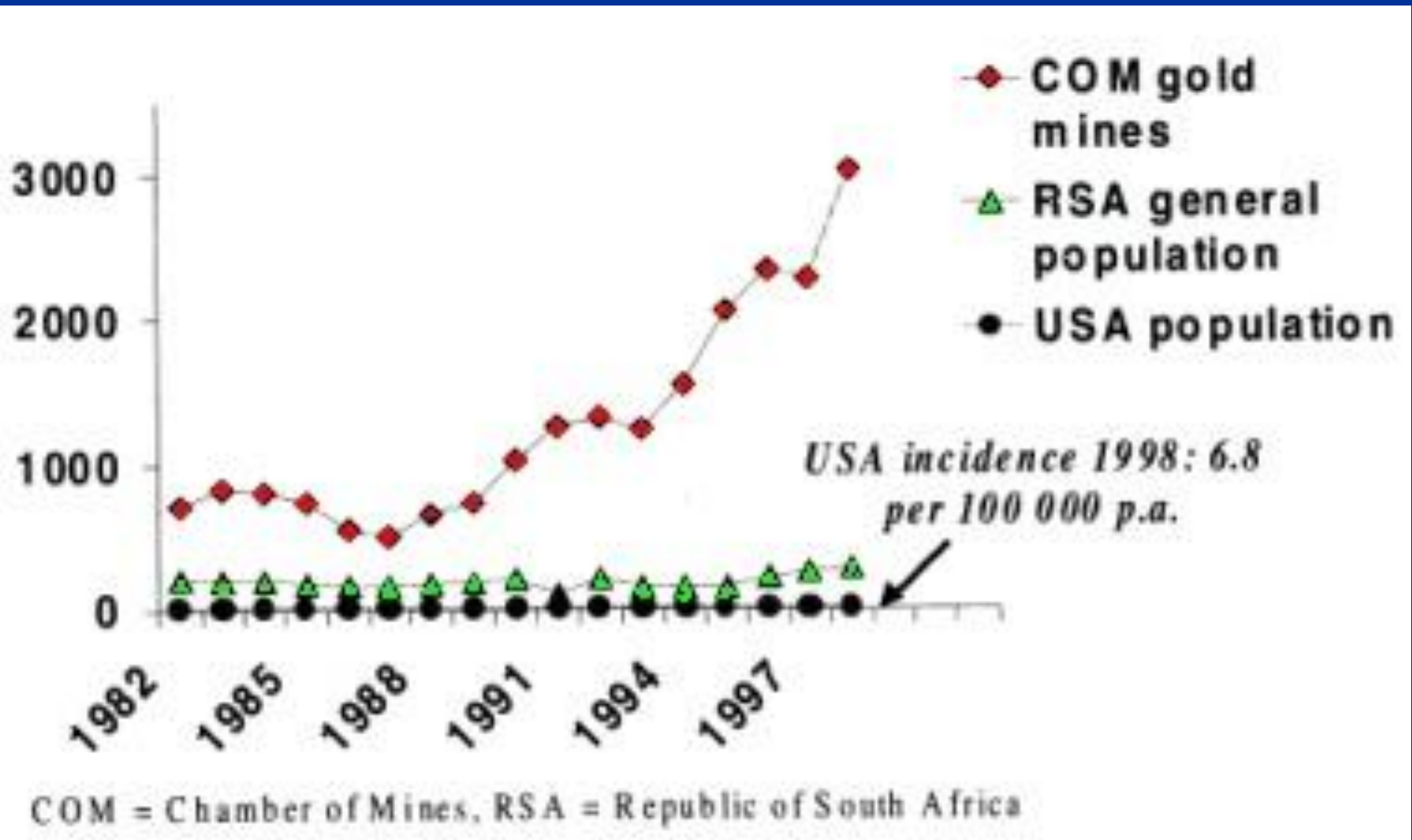


1. **Current epidemiology**
2. Underlying causes - which are amenable to change?
3. Externality: ex-miners and the migrant sick
4. Implications for national planning

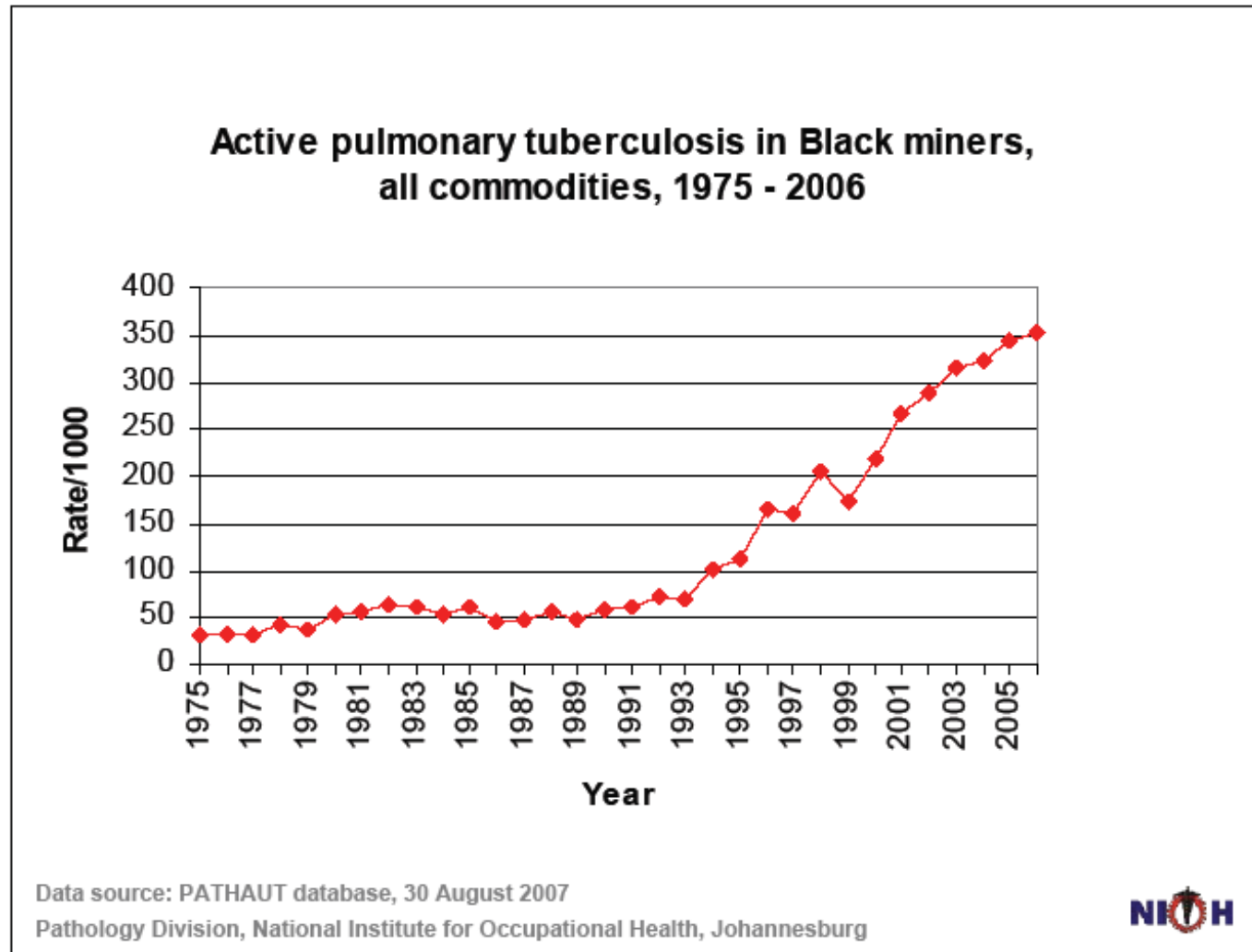
Tuberculosis/HIV in gold mining

Measure (study)	
Incidence (e.g. Glyn 2010)	Approx 3 per 100 p-y (1-7 per 100 p-y)
Prevalence of latent TB infection (Hanifa 2009)	89%
Recurrence rate of PTB (Glynn 2010)	HIV+: 19 per 100 p-y HIV- : 7.7 per 100 p-y
Proportion of DR cases (Calver. 2010)	MDR: 3.6% XDR: 0.2% ?
HIV infection (e.g. Corbett 2004, Girdler Brown 2008)	22-30%

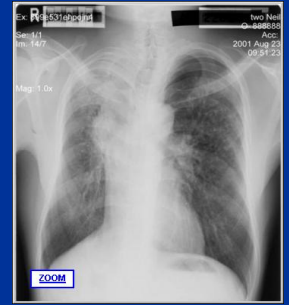
TB incidence in the gold mines, 1982-1999



Active PTB at autopsy(/1000), 1975- 2005

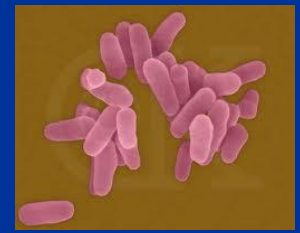


The crisis of TB on the mines



1. Current epidemiology
2. Underlying causes –which are amenable to change?
3. Externalities: ex-miners and the migrant sick
4. Implications for national strategy

Individual risk factors for PTB



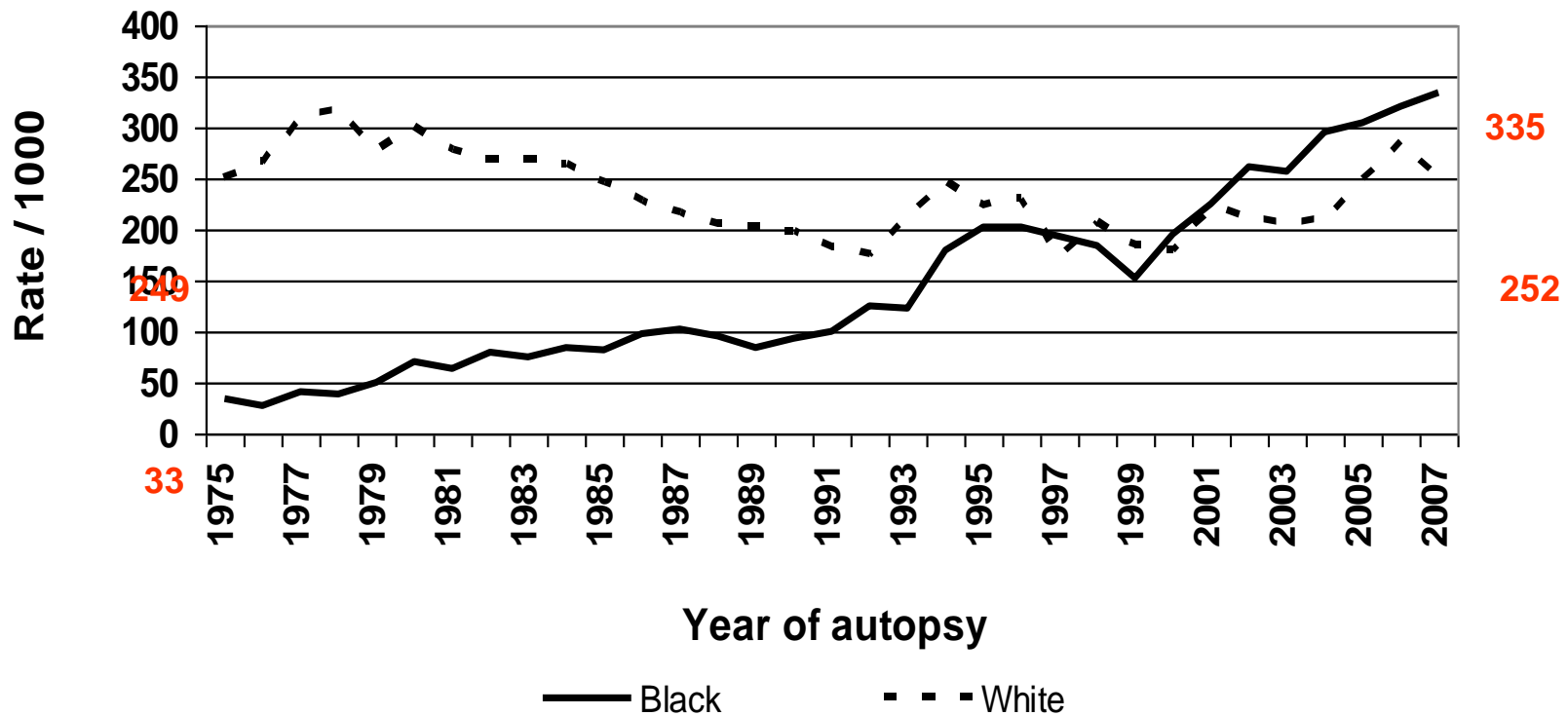
Risk factor	Action	Challenge
Resistant TB	Specialised regimens	Case holding
HIV infection	Detection and early treatment	Education
Latent TB	Treatment	
Previous TB/lung damage	?	Risk education
Age	?	
Silicosis	Early detection	?Out of dust,
Silica dust load in lung	Individual protection	?Limit service

Contextual or population factors for PTB

Risk factor	Action	Challenge
TB prevalence	Early detection, and treatment and case holding	
HIV prevalence	Risk reduction	
Latent TB prevalence	Mass IPT	
Migrant labour	?	Regional cooperation
Crowding	Smaller unit/family housing on mines	?Underground
Silica dust levels	Dust control	Enforcement

Silicosis at autopsy (/1000), 1975 – 2007

Silicosis at autopsy in gold miners, 1975 - 2007



Silicosis: diffuse fibrosis of the lungs due to inhaling silica dust

Normal x-ray



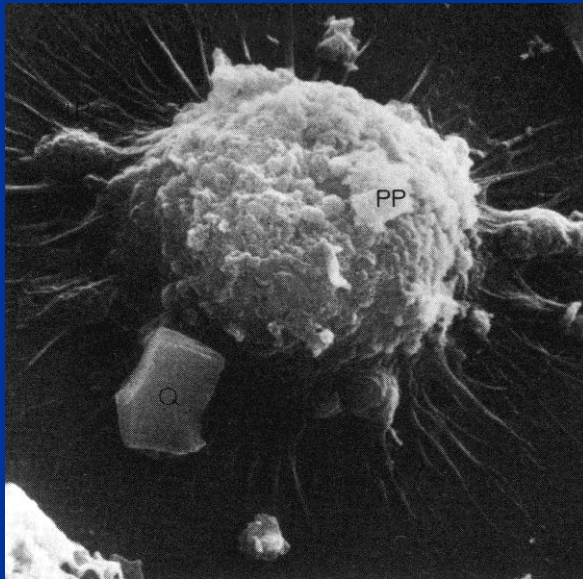
Extensive silicosis



- Proposition: Silicosis, and probably a silica filled lung, is a form of acquired immune deficiency

Fatal attraction

Lung macrophage
and silica particle

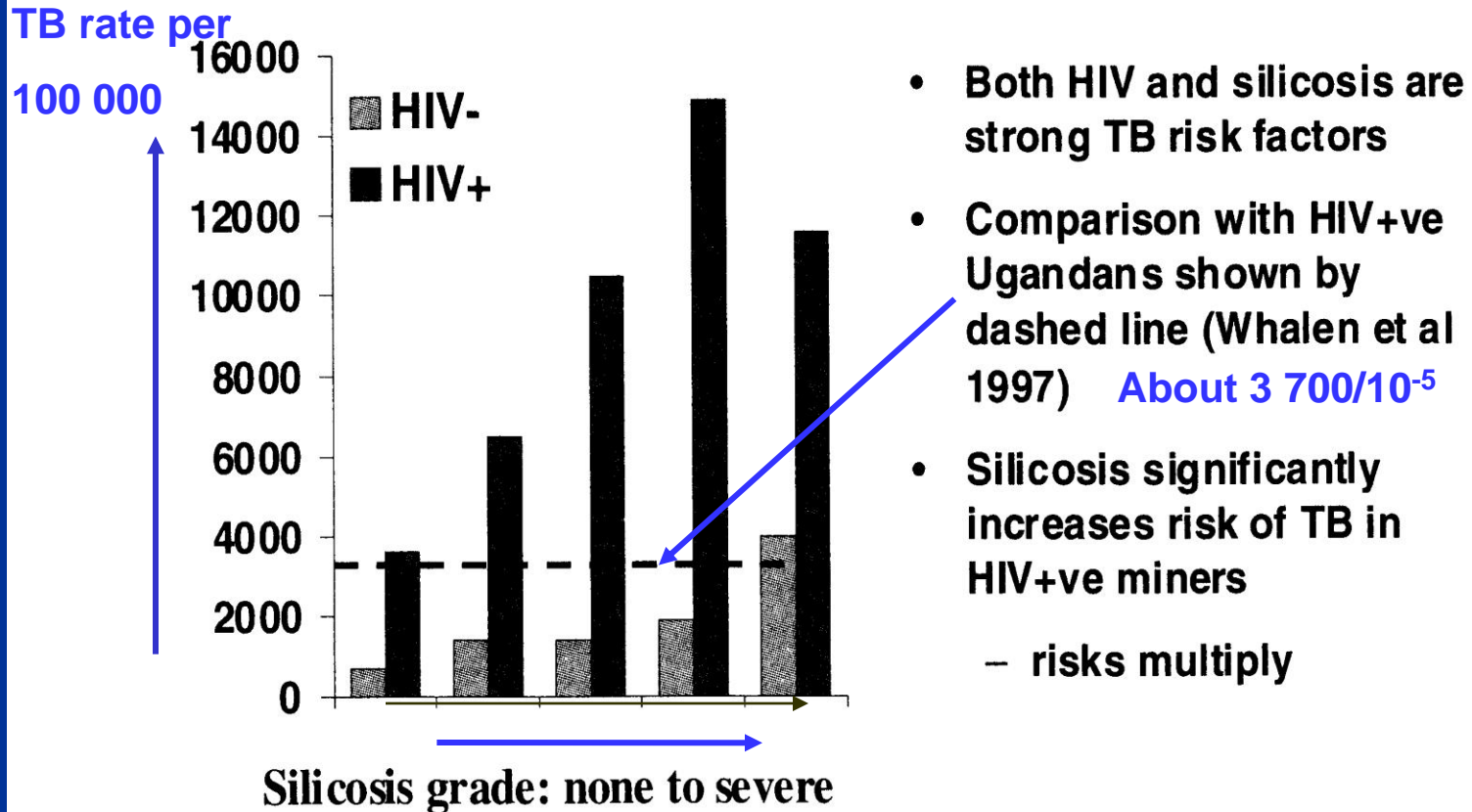


Impairs

Lung macrophage
and tubercle bacilli



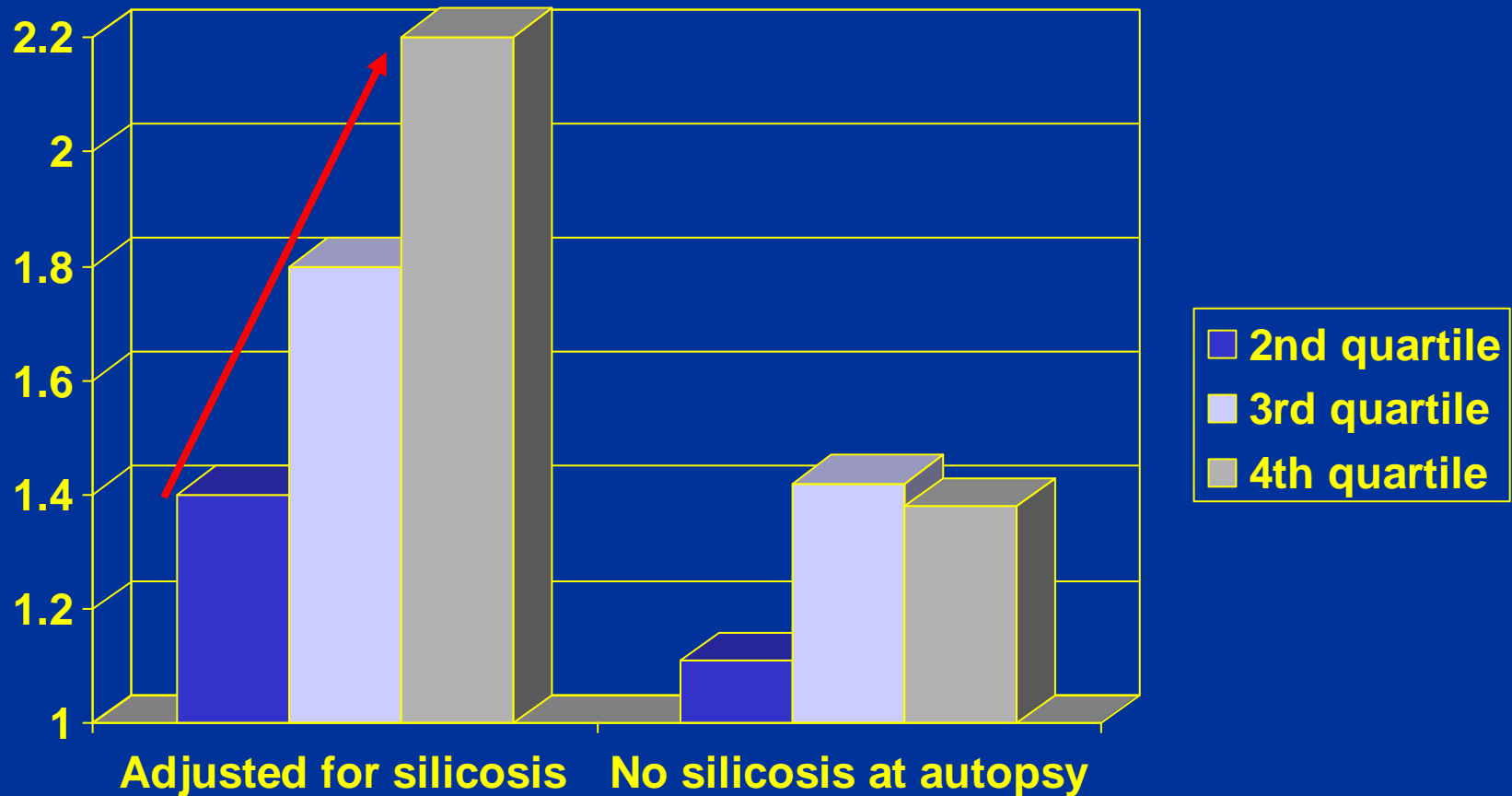
Powerful interaction between HIV and silicosis in the effect on PTB



- Both HIV and silicosis are strong TB risk factors
- Comparison with HIV+ve Ugandans shown by dashed line (Whalen et al 1997) About 3 700/10⁵
- Silicosis significantly increases risk of TB in HIV+ve miners
 - risks multiply

Data from Corbett et al 2000

Cumulative silica exposure (by quartile) and relative odds of PTB at autopsy

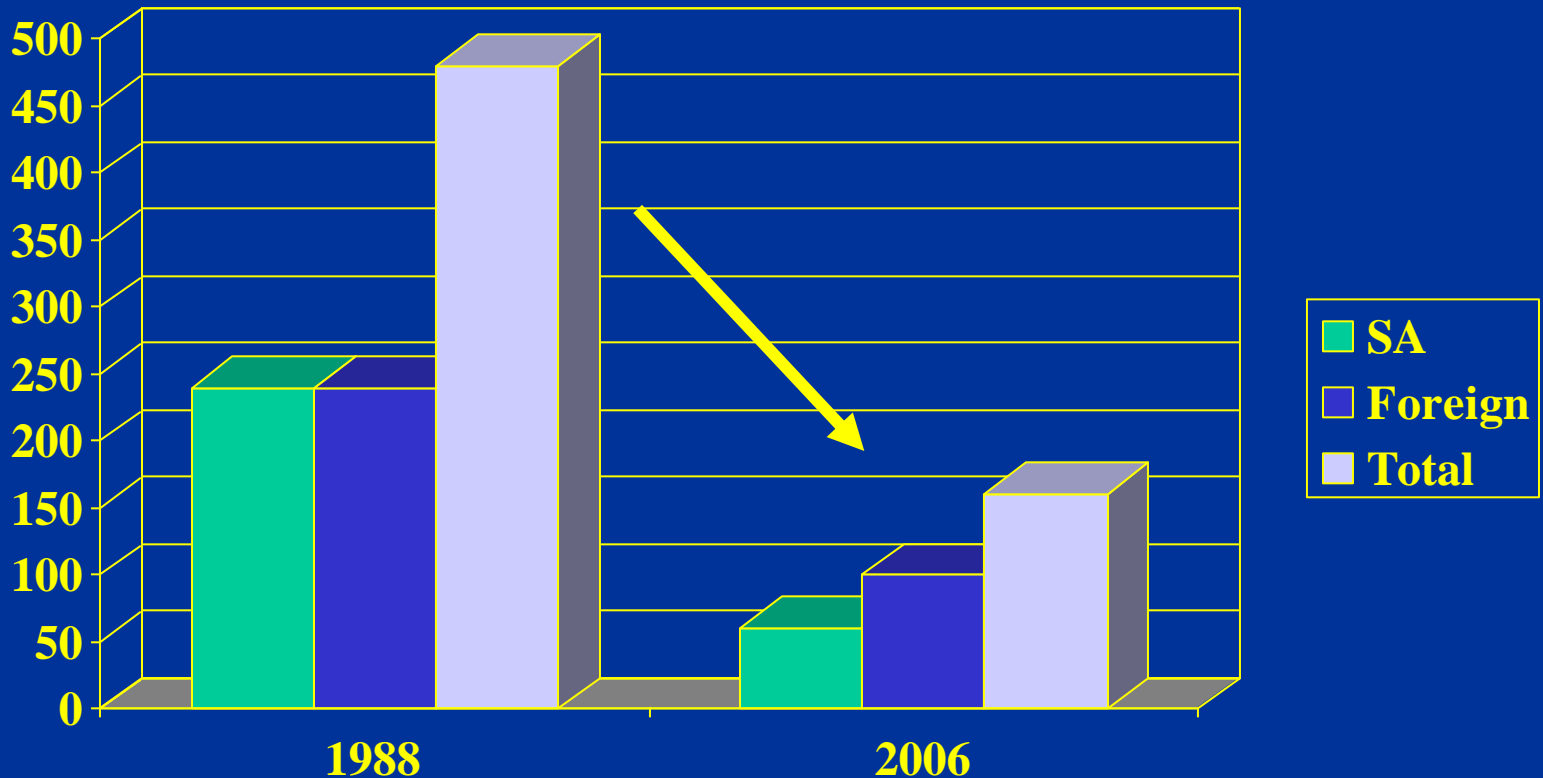


The crisis of TB on the mines

1. Current epidemiology
2. Underlying causes – which are amenable to change?
- 3. Externalities: ex-miners and the migrant sick**
4. Implications



Employment on the SA gold mines, 1988- 2006



→ There are now many more ex-miners than miners

Prevalence of silicosis and previous PTB in former goldminers

Study	Silicosis	PTB history
Botswana (ex-) (Steen et al. 1997)	31%	29% (Rx)
Transkei (ex-) (Trapido et al.1998)	24-36%	51% (Rx)
Recently employed, older Basotho (Girdler-Brown et al. 2008)	24%	26% (hx)

PTB among ex-miners – risk persistence

*White miners: 99/120 (85%) PTB cases were diagnosed after leaving mine service. Average duration from last exposure was 8 years.*¹

PTB incidence in Basotho ex-miners 2-3 years out of service – 3 000/100 000.² Active prevalence: 6%!

There has never been a *long term* follow up study of black miners after they have left mining service.

¹Hnizdo and Murray. Occup Environ Med 1998;55:496-502

²Park et al. 2009, Am J Ind Med 2009;.



Mining and impact on general population risk of TB in Southern Africa

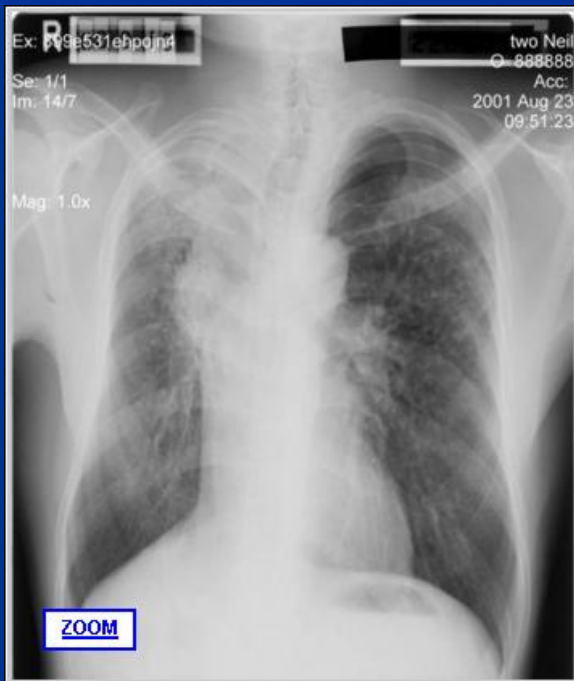
- 10% increase in mining production → 1% increase in TB incidence (23 000 cases)¹.
- ..”mining not only increases the hazards of TB among directly exposed individual miners but significantly increases the risks of TB spread to the general community in sub-Saharan African countries”.¹
- Huge health system challenges of treating a very large silica exposed/silicotic migrant population across a number of countries, against a background of rising drug resistance.

¹Stuckler, et al. Am J Public Health 2010. 10.2105/AJPH.2009.17564610

The crisis of treatment continuity in a migrant population

- Inadequate understanding by mineworker of the nature of TB vs calculus of income retention
- Poor continuity of care/medical record
- Underdeveloped and overburdened rural and neighbouring country health services
- Little monitoring of the situation

Cure? PTB is a chronic disease, even if treatment successfully completed



•Lung fibrosis

•Lung function loss

•Increased risk of TB recurrence

•Increased risk of other lung disease, e.g. MOTTs

→ Proposition: A TB diagnosis in a miner is a lifelong diagnosis

The crisis of TB on the mines

1. Current situation
2. Trends
3. Underlying causes – the role of dust
4. Externalities- ex-miners and the migrant sick
- 5. Some implications for national strategy**
 1. Governance
 2. Elimination of silicosis/dust control
 3. Services for ex-miners

“Governance”¹

- Private vs public interest – mining vs the rest?
- Regional coordination
- Overcoming state fragmentation
- The concept of mineworker “entitlement”

¹Stuckler et al. 2010

Elimination of silicosis/ dust control

- Mining industry has committed itself to elimination of silicosis (2003 “undertaking”) (Not possible at target dust levels).
- *Control of dust and silicosis needs to be seen as essential part of TB control programme at company, national and regional level*
- Notion of protective silica occupational exposure limit (OEL) *for tuberculosis* needs to be considered



Services for ex-miners

1. Recognition (HIV and TB)
2. Treatment including IPT
3. Compensation (poverty relief)



- Part of a regional mutually supported network
- Industry funded
- Vertical programme
- Doctor run node with nurse run satellites

Mining should have an expanded section
in the new HIV and TB strategic plan