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# Risks in Laboratories

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17.03.2008 Münchenwiler 2008

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## Risks in laboratories



Most reports deal with HCW and include some lab technicians, if at all!

- Part I Introduction
- Part II ...hardly any reports
- Part III Details from selected labs

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## Transmission of TB to laboratory personnel

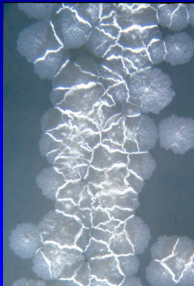
Infectious dose for humans: < 10 AFB

- disease prevalence in population
- characteristics of the environment:
  - size of compartment, ventilation
  - pathogen (concentration of droplet nuclei, proximity to the infectious patient or specimen, infectiousness of the specimen, duration of exposure)
- type of activity of lab personnel


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## M. tuberculosis complex




- Group 3 organism ('can cause severe disease in humans, serious hazard to personnel, risk of spreading, usually effective prophylaxis and therapy available')
- Class 3 activity
- P3 facility



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## Risk no. 1: Aerosols!



- pouring liquids
- pipetting
- mixing liquids
- dropping tubes
- breaking tubes during centrifugation
- other risks

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Safety is a matter of resources and training!

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## Management of the risk associated with working with TB

- ◆ administrative controls to reduce exposure
- ◆ environmental controls to reduce number of droplet nuclei in the air
- ◆ personal respiratory protection
- ◆ management of technical equipment (BSC, centrifuges, negative pressure, etc.)
- ◆ TRAINING

MMWR 2005;54:1-141

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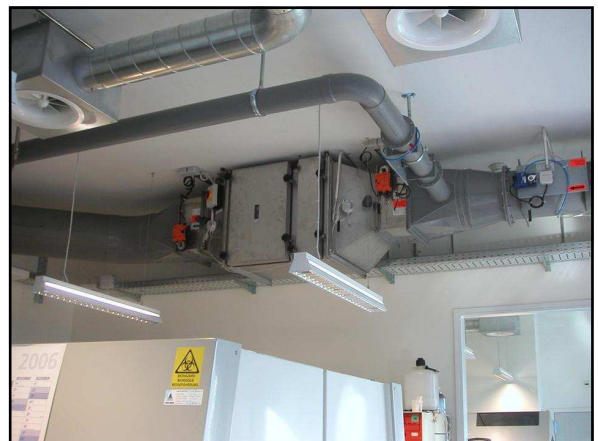
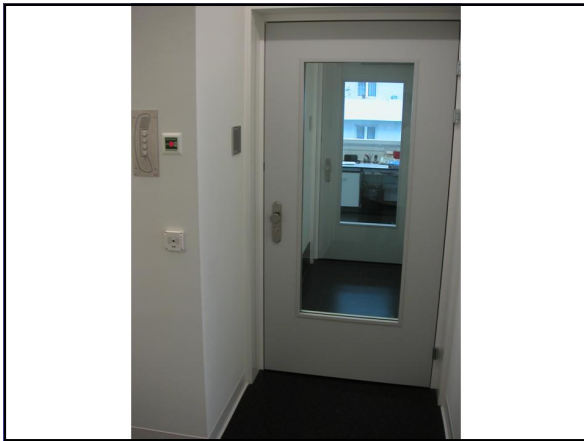
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## Swiss Federal Regulations (ESV...)

- ◆ restricted access
- ◆ negative pressure
- ◆ passage through two doors equipped with self-closing devices ('Schleuse')
- ◆ HEPA filtration of exhaust air
- ◆ ease of decontamination in case of spills (floors, ceiling, surfaces, utilities)
- ◆ water disposal (inactivation)
- ◆ disposal of microorganisms (autoclave within P3)
- ◆ BSC II
- ◆ etc.!

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**...hardly any reports**

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**Assessment of biological risk in mycobacteriology laboratories (1)**

*Vaquero et al. Int J Lung Dis 2003;7:879-885*

- ◆ Laboratories from 26 hospitals in Spain
- ◆ October to December 2000
- ◆ standardized survey questionnaire to evaluate
  - workers
  - workload
  - training
  - information and safety practices

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## Assessment of biological risk in mycobacteriology laboratories (2)

Vaquero et al. *Int J Lung Dis* 2003;7:879-885

### Personnel (n = 80)

- 15 nursing staff
- 29 laboratory technicians (m:w = 1:3)
- 30 medical staff
- 75% worked in the same job für > 5 yrs, 50% of them had previously worked in a clinical analysis laboratory

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## Assessment of biological risk in mycobacteriology laboratories (3)

Vaquero et al. *Int J Lung Dis* 2003;7:879-885

- Collection of specimens (for > 1h/d): 44%
- Pretreatment of specimens:
  - Lab assistants 83.3%
  - Nursing staff 53.3%
  - Medical staff 3.3%
  - Lab technicians 86.2%
- Less than 20% of people handled the radiometric BACTEC 460 System

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## Assessment of biological risk in mycobacteriology laboratories (4)

Vaquero et al. *Int J Lung Dis* 2003;7:879-885

### Microbiological waste disposal

- together with normal waste 1.25%
- directly in the sink 6.25%
- durable containers 57%
- incineration bags 50%
- autoclave bags 24%

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## Assessment of biological risk in mycobacteriology laboratories (5)

Vaquero et al. *Int J Lung Dis* 2003;7:879-885

### Training

- on biological hazards and occupat. safety measures and procedures 80%
- awareness of potential health hazards 96%
- regular information 50%
- written instructions in case of an incident 56%
- accident/incident in the past years (most common needle punctures, cuts, inhalation, burns, splashes) 45%
- work-related illness 16%

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## Assessment of biological risk in mycobacteriology laboratories (6)

Vaquero et al. *Int J Lung Dis* 2003;7:879-885

### Safety practices

- separate area 93.8%
- restricted access 53.8%
- filtered air 60.0%
- area with negative pressure 37.8%
- specimens in a safe place 85.0%

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## Assessment of biological risk in mycobacteriology laboratories (7)

Vaquero et al. *Int J Lung Dis* 2003;7:879-885

### Protective equipment

- coats with elastic cuffs 67.5%
- surgical masks 43.5%
- biosafety masks 61.3%
- gloves 93.8%
- 53% leave the lab in their working clothes
- contaminated lab clothing: 36% of staff separate it, 26% decontaminate it, 56% send it directly to the laundry...

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## Risk of TB infection in a laboratory

Research labs           60%  
Clinical labs            17%

*(London School of Hygiene & Tropical  
Medicine 1991)*

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## Tuberculosis acquired in laboratories and necropsy rooms (1)

*Collins and Grange. Comm Dis Publ Health 1999;2:161-167*

- ◆ Meta-analysis of the literature: only a few reports, last one in 1982
- ◆ Acquisition of pulmonary TB via
  - aerosols and skin lesions (cuts, abrasions)
  - contaminated specimen containers
  - unfixed smears
  - examination procedures

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## Tuberculosis acquired in laboratories and necropsy rooms (2)

*Collins and Grange. Comm Dis Publ Health 1999;2:161-167*

- ◆ Lab staff is estimated to be between 100 and 200 x more likely than the general public to develop TB.
- ◆ Training in good laboratory practice is the most important aspect of staff protection, especially in resource-poor countries.

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## TB as an occupational hazard for HCW in Estonia (1)

*Krüüner et al. Int J Tuberc Lung Dis 2001;5:170-176*

1994-1998

67 HCW

- 23 physicians
- 23 nurses
- 7 lab techs
- 12 assistant nurses
- 2 cleaners

were diagnosed as having active TB

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## Estonia



### TB incidence

1953:  
417/100,000  
1992:  
25.8/100,000  
1998: 56/100,000  
MDR 14%

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## TB as an occupational hazard for HCW in Estonia (1)

*Krüüner et al. Int J Tuberc Lung Dis 2001;5:170-176*

Incidence among

- HCW 91/100,000, i.e. 1.5 to 3 x higher than in the general population
- HCW in a chest hospital 30-90 x higher! (highest among physicians)
- in 49 HCW confirmed by culture, in 23 (49%) DR, of whom 18 (38%) MDR-TB

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# Information from selected laboratories

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## Max Salfinger, Florida / USA IMM Zurich, NY State Dept. of Health




**Zurich**  
BACTEC 460  
2-5 (after needle punctures)/20 yrs

**Albany, NY**  
2 needle punctures/  
15 yrs

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## Meltem Uzun, Istanbul Faculty of Medicine / TR



BSC II  
Since 1986 no infections with *M. tuberculosis*

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## Sofia Samper, Zaragoza / E



- Hospital Universitario M. Servet
- Since 1974 P2 lab, soon a P2+ lab
- Research Lab, Group of Genetis of Mycobacteria, University of Zaragoza

'... not any known case of TB among workers in both laboratories.'


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## Sabine Rüsç-Gerdes, Borstel / D

'No cases in the past 10 yrs (1 needle puncture approx. 12-15 yrs ago, treated for 6 mo.)


- P3 lab
- nearly no use of syringes.'



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## Nalin Rastogi, IP, Guadeloupe / F



'Since 1993:

- P2+ facility with BSC class 1 (100% exhaust through filters)
- no known transmission of TB to lab personnel'

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**Enrico Tortoli, U. of Firenze / I**

- ' P2, P3 laboratories planned
- last incident 32 yrs ago., treated
- more recently 2 QFN conversions, prophylaxis'

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**Vera Katalinic-Jankovic, Zagreb / HR**

- '- 14 labs (smear / culture), 4 of them sm, cul and DST
- all P2 including the National Reference Laboratory (NRL)
- In the past 60 years: 63 infections among 42 lab technicians, 17 coworkers, 4 MD and microbiologists (→ approx. 1 case / yr.)
- NRL: last case in 1985, 2 cases in other labs (2003, 2006).'



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**IMM Luzern**

Let us keep the fingers crossed!

No case since 2003 (P2+ till 2006), now P3



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**Malcolm Yates, HPA, London / UK**

- '30 yrs not one single case
- WHY?
- very proactive in lab safety
- Class I cabinet, no P3 in the beginning'

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**Malcolm Yates, HPA, London / UK**

- '...after all, if your technique is bad then all regulations in place will not stop you catching TB.
- The trouble now is that with all the regulations and paperwork.... many workers believe that they are immune and forget that paperwork does not protect them.'

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**Risk in Labs — Conclusions (1)**

- Infections do occur (via aerosols and skin)
- Numerous reports on laboratory safety (do's and don't's)
- Hardly any figures about infection rates among lab personnel
- Risk among lab personnel appears to be 100 to 200 x higher than in the normal population
- Disappearance of BACTEC 460 technology may have a dramatic impact on safety

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## Risk in Labs — Conclusions (2)

- ◆ Technical equipment (P3...) is certainly an important aspect, however does not prevent from acquiring infections
- ◆ **TRAINING! AWARENESS!**



Manuel Casal, Cordoba  
Sofia Samper, Zaragoza  
Malcolm Yates, London  
Annika Krüüner, Tartu  
Max Salfinger, Florida  
Nalin Rastogi, Guadeloupe  
Vera Katalinic-Jankovic, Zagreb  
Enrico Tortoli, Firenze  
Sabine Rüsç-Gerdes, Borstel  
Meltem Uzun, Istanbul  
Herbert Hächler, IMM Luzern