Metropolitan tuberculosis control: the Rotterdam model

Rob van Hest, MD, PhD, Consultant Tuberculosis Control Physician/Epidemiologist

Tuberculosis Control Department, Municipal Public Health Service Rotterdam-Rijnmond

Presentation

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Rotterdam en omstreken

1. Introduction Metropolitan TB and homelessness

1. Control of TB in the Netherlands

1. Specific TB activities in Rotterdam

Presentation

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1. Introduction Metropolitan TB and homelessness

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Metropolitan TB in Europe

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Metropolitan TB in Rotterdam

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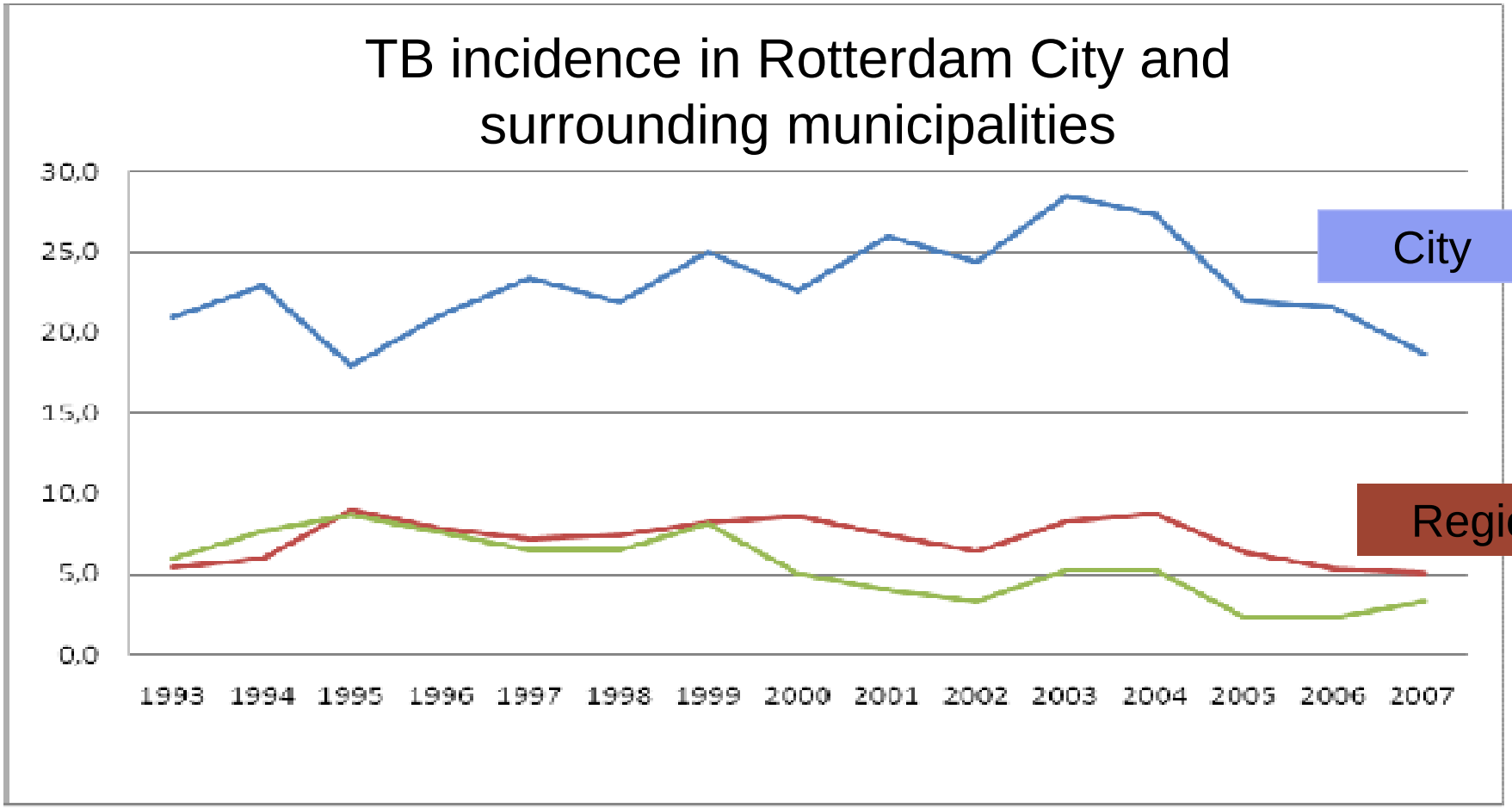

Metropolitan TB in England

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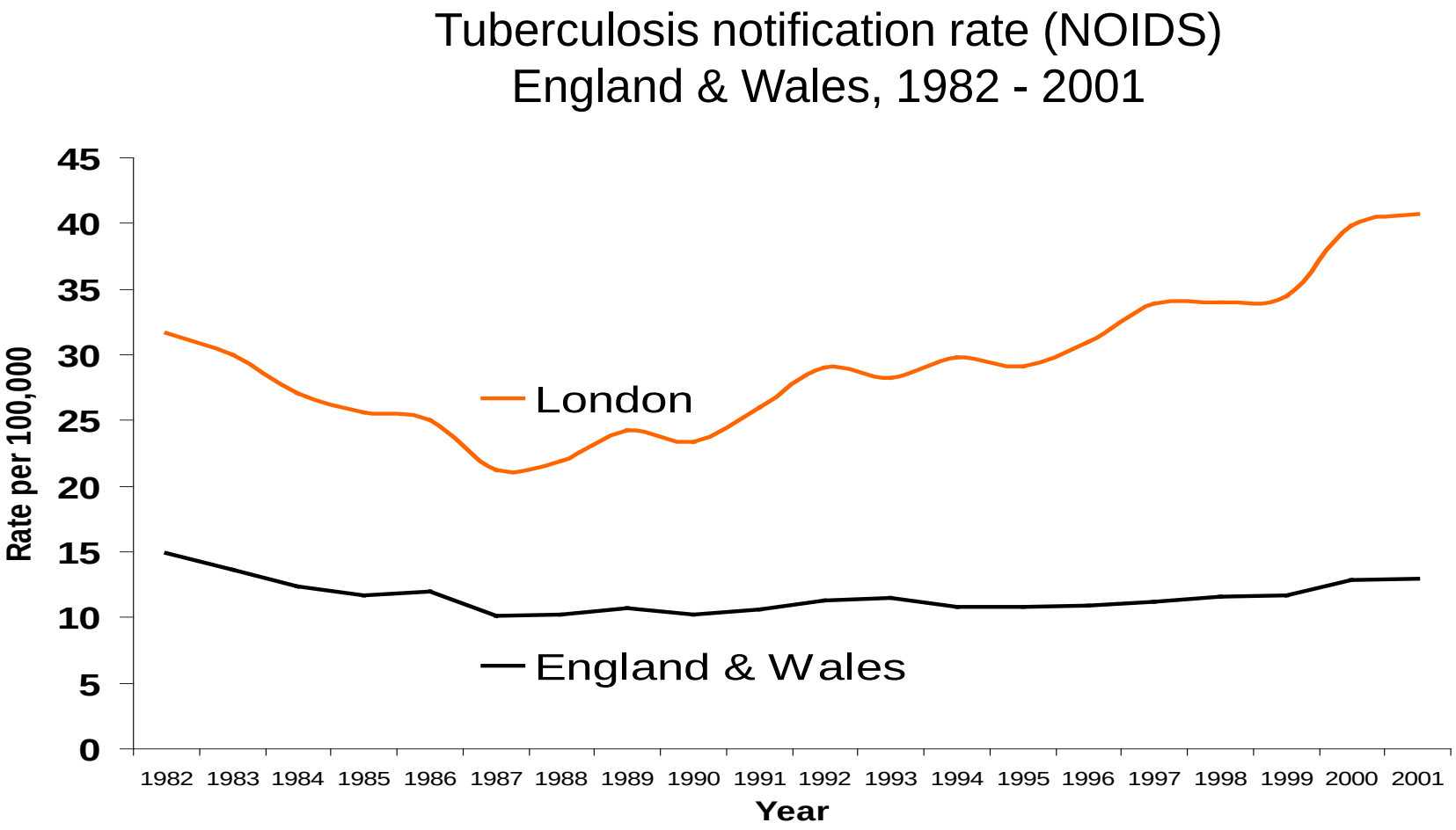

Tuberculosis rates in Western European Capitals 1995-2006

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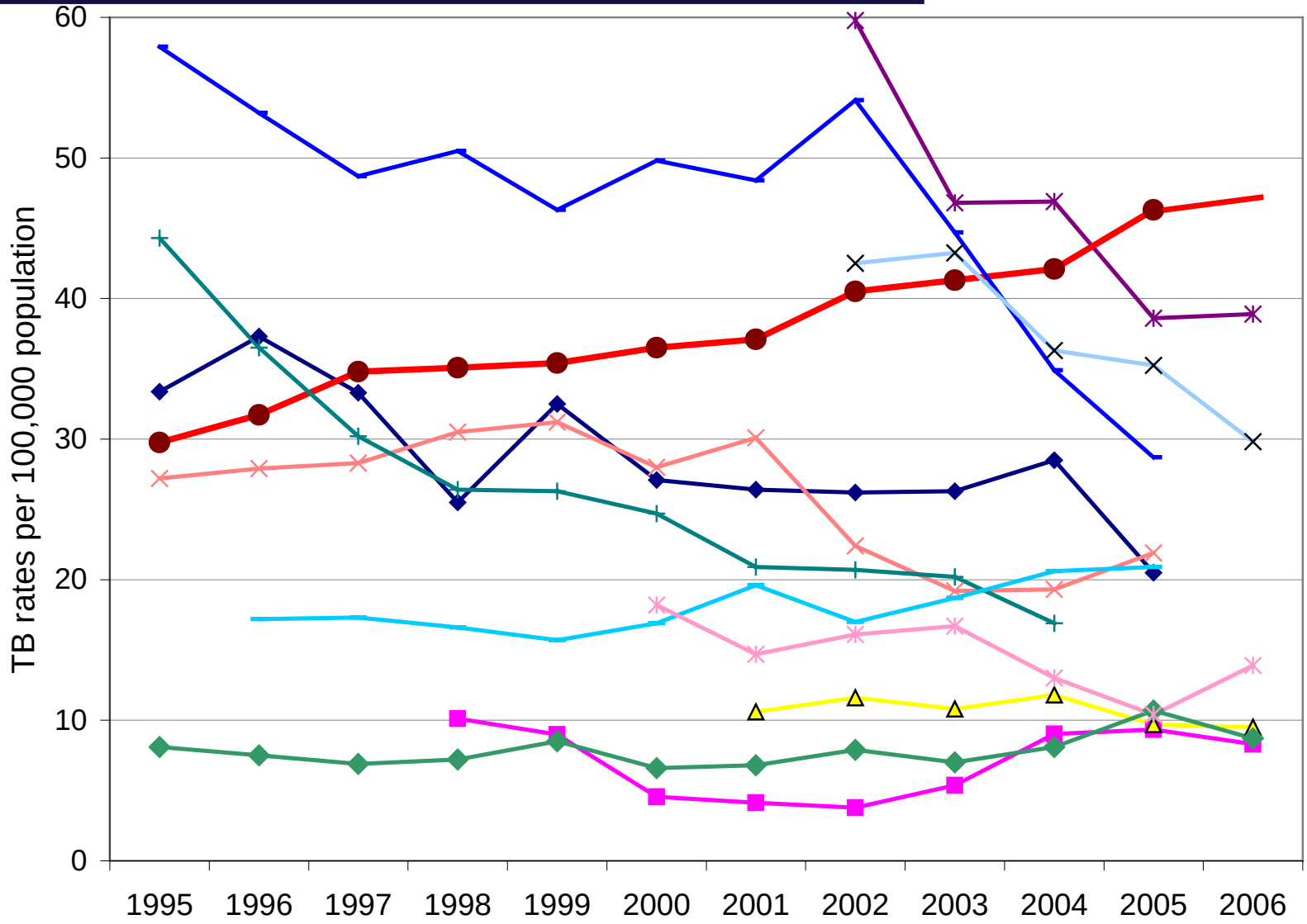

Produced by TB Alert - Source *EuroTB* Country Participants

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Metropolitan TB among homeless persons is a PAN-EUROPEAN problem

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Metropolitan TB among homeless persons needs a PAN-EUROPEAN solution!!

Tuberculose in Europe

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Tuberculosis and social exclusion

Developed countries need new strategies for controlling tuberculosis

In developed countries most patients with tuberculosis are not infectious, can readily access health services, and complete treatment successfully with minimal supervision from a health worker. As a result they make only limited demands on services and pose little public health risk. By contrast, many socially excluded patients are at risk of delayed presentation, poor adherence, and loss to follow-up. A recent persistent outbreak in London including over 220 drug resistant cases and disproportionately affecting homeless people, prisoners, and problem drug users clearly illustrates the urgent need to strengthen tuberculosis control among socially excluded groups.[1]

Mycobacterium tuberculosis can infect anyone but predominantly affects the poor. Globally, 98% of deaths from tuberculosis are in the poorest countries.[2]

BMJ 2006;333:57–8

Story A, Van Hest R, Hayward A. Tuberculosis and social exclusion. *BMJ* 2006; 333: 57-8.

Tuberculosis patients in London in 2001 per postcode

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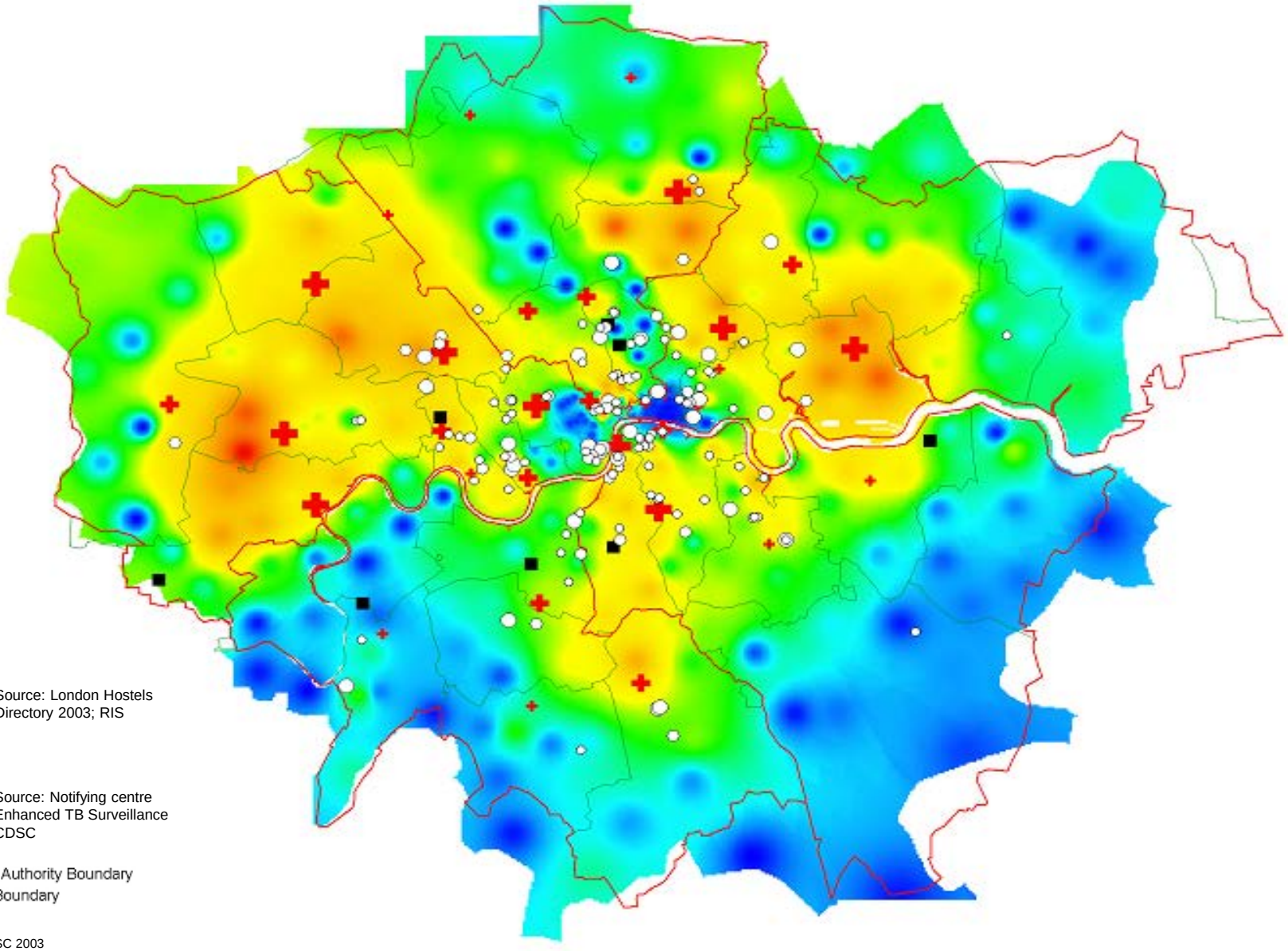

GIS mapping by Chris Lane CDSC 2003

Tuberculosis patients in London in 2001 per postcode

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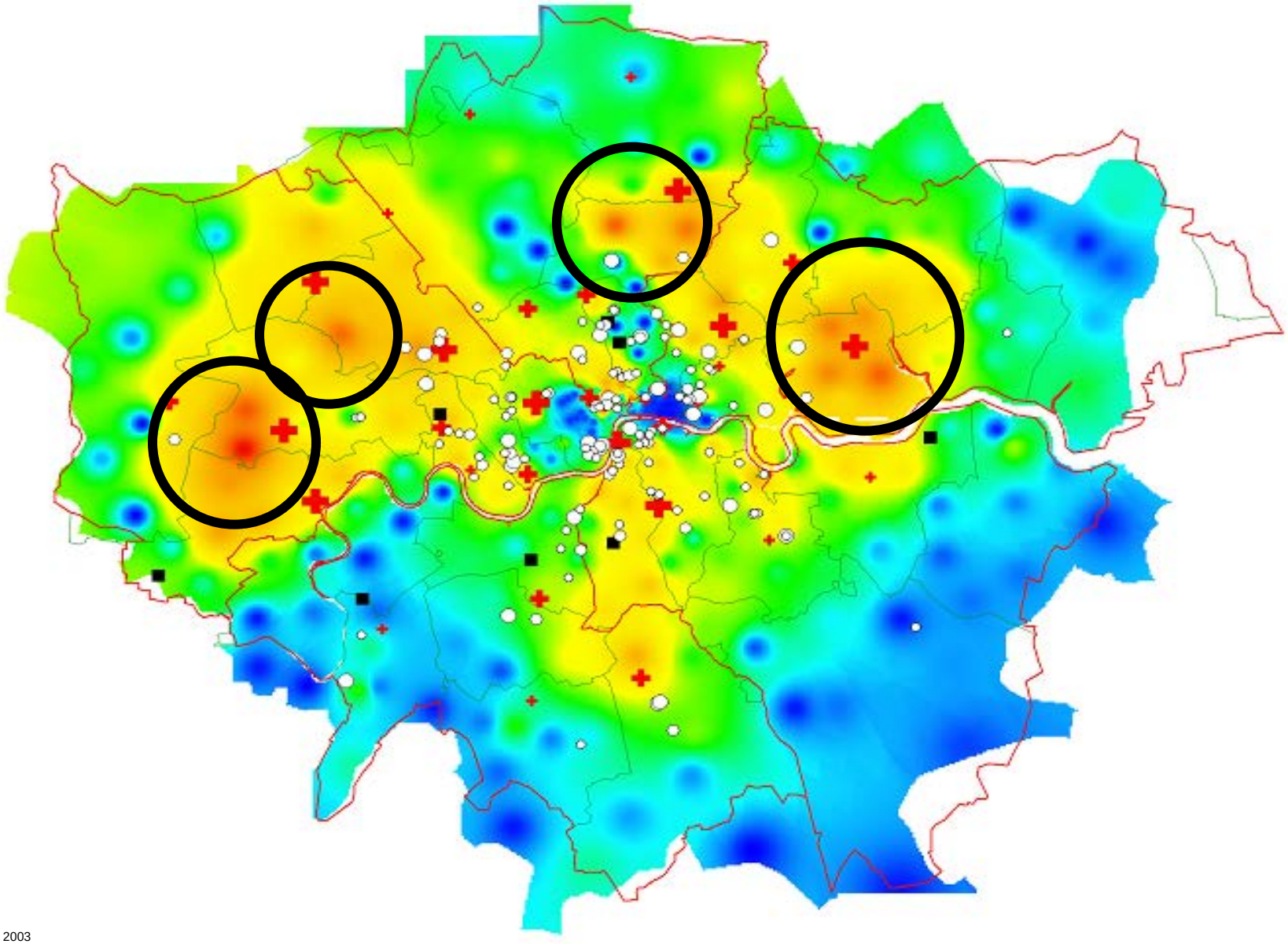

GIS mapping by Chris Lane CDSC 2003

Social index in London per postcode in 2000

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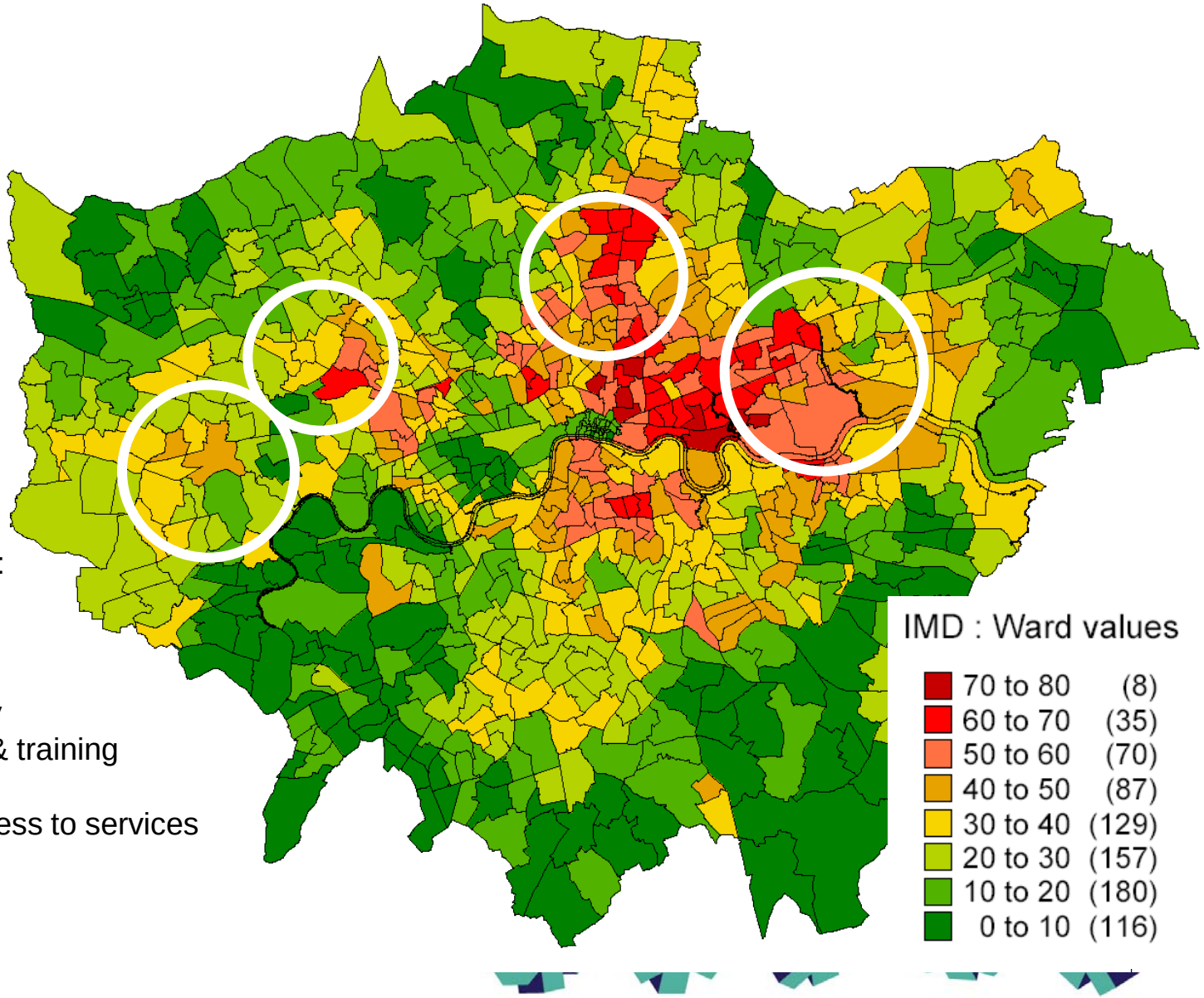
IMD contains 6 'domains':

- income
- employment
- health & disability
- education, skills & training
- housing
- geographical access to services



Socio-economic impact

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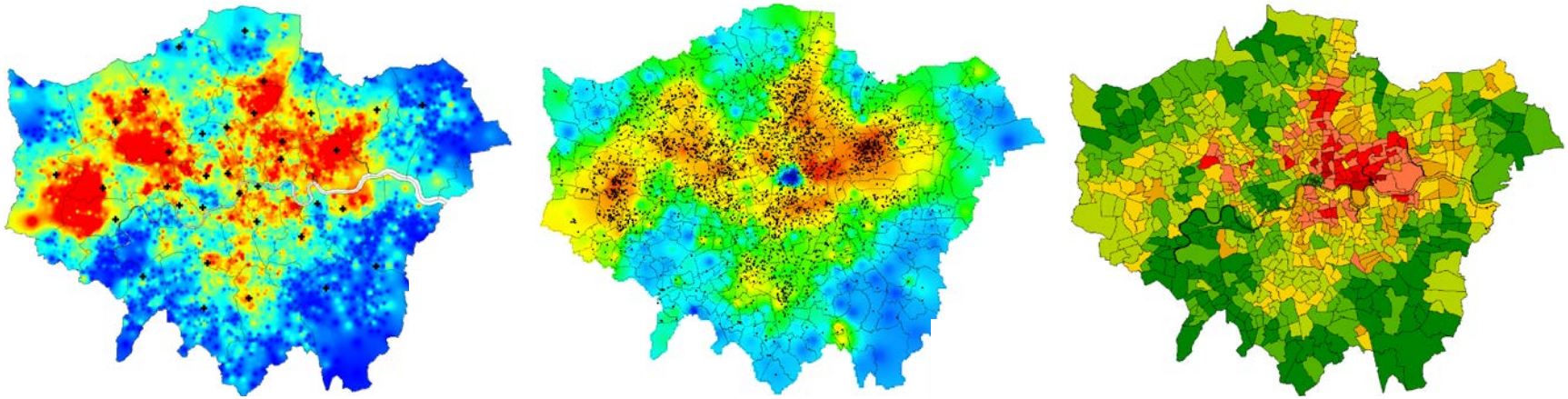

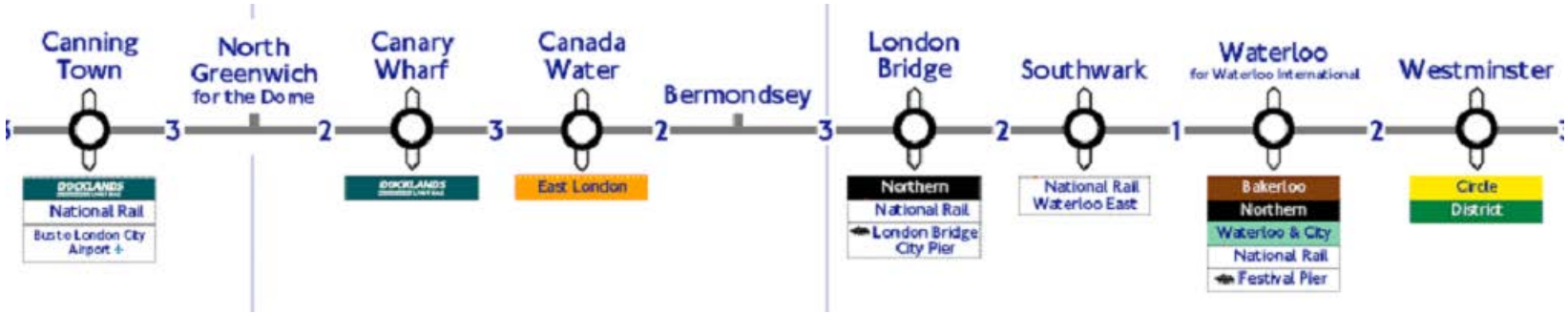

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Risk groups:

Immigrants (legal and illegal)

Asylum seekers

Prisoners

Seamen/Sailors

Alcohol and drug addicts

Homeless people

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In 2002 in Rotterdam 1 out of six TB patients was homeless or illicit drug user

De Vries G, Van Hest R, Richardus JH. Impact of mobile radiographic screening on tuberculosis among drug users and homeless persons. Am J Respir Crit Care Med 2007;176:201-7

In 2003 in London 1 out of six TB patients was homeless, illicit drug user or prisoner

Story A, Murad S, Roberts W, Verheyen M, Hayward AC. Tuberculosis in London: the importance of homelessness, problem drug use and prison. Thorax 2007;62:667-71.

Metropolitan TB and homelessness

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In 2003 in London 17% of all TB patients was homeless, illicit drug user or prisoner but they were responsible for 40% of the problems such as smear-positive drug-resistant TB, poor or non-compliance or loss to follow-up!!

Story A, Murad S, Roberts W, Verheyen M, Hayward AC. Tuberculosis in London: the importance of homelessness, problem drug use and prison. Thorax. 2007;62:667-71.

TB prevalence rates after screening among homeless persons (EU)

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Town	Year(s) of survey	Setting	Population screened (n)	Active TB (n/100 000)
London	1983-1987	St, Sh	2490	760
London	1983-1987	St, Sh	555	1100
London	1992	Sh	595	1500
London	1995	Sh, Ho	1907	500
Amsterdam	1997/1999	St, Sh	364	800
Rotterdam *	2002/2005	Str, Sh,Ho	3248	327
Edinburgh	1968	Ho	4269	1264
Edinburgh	1976	Ho	4687	896
Glasgow	1978	Sh, Ho	9132	1456
Barcelona	1997	Sh	447	1118
Budapest	1995/1996	Sh, Ho, public	2147	3633
St Petersburg	1991-1997			3000
Poznan		Sh	460	2174

TB prevalence rates after screening among homeless persons (USA)

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Town	Year(s) of survey	Setting	Population screened (n)	Active TB (n/100 000)
Birmingham, Alabama	1996/1997	Sh	127	3150
Boston	1984	Sh	586	512
New York	1992	AIDS hostel	106	15094
San Francisco	1996-1997			230
Sydney	1989-1993	Ho	3555	253

TB notification rates among homeless persons

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Town	Year	Active TB (n/100 000)
London	2003	788
Budapest	2002	676
Budapest	2004	726
Boston	1990	433
Denver	1995	510
New York	1999	77
New York	2001-2003	176
San Francisco	1992-1996	270

Metropolitan TB Control

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Metropolitan TB is mainly driven by certain risk groups such as recent immigrants, homeless persons, illicit drug users or prisoners

In the EU there are approximately 90,000 TB cases every year. When 40% of them live in large cities and in large cities 17% of the cases are homeless than there are +/- 6000 homeless persons with TB every year

Metropolitan TB Control

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TB Control (case-finding and case-holding) among homeless persons, illicit drug users, illegal immigrants and other TB risk groups cannot be controlled by the chest physicians in the hospitals alone but needs a targeted (public health) intervention through co-operation with a multidisciplinary team of doctors, nurses, social workers and assistants.

Presentation

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1. Introduction Metropolitan TB and homelessness

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1. Specific TB activities in Rotterdam

TB Control in The Netherlands

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Parallel system of TB control > 100 years

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TB control: hospitals

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TB control: Public Health TB Clinics

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> 100 years TB control

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EERSTE JAARVERSLAG

DER

Vereeniging tot bestrijding der Tuberculose,

TE ROTTERDAM.

(Goedgekeurd bij Koninklijk Besluit van 3 Juli 1903, No. 51).

Mei 1903—1904.

Tuberculosis 1903

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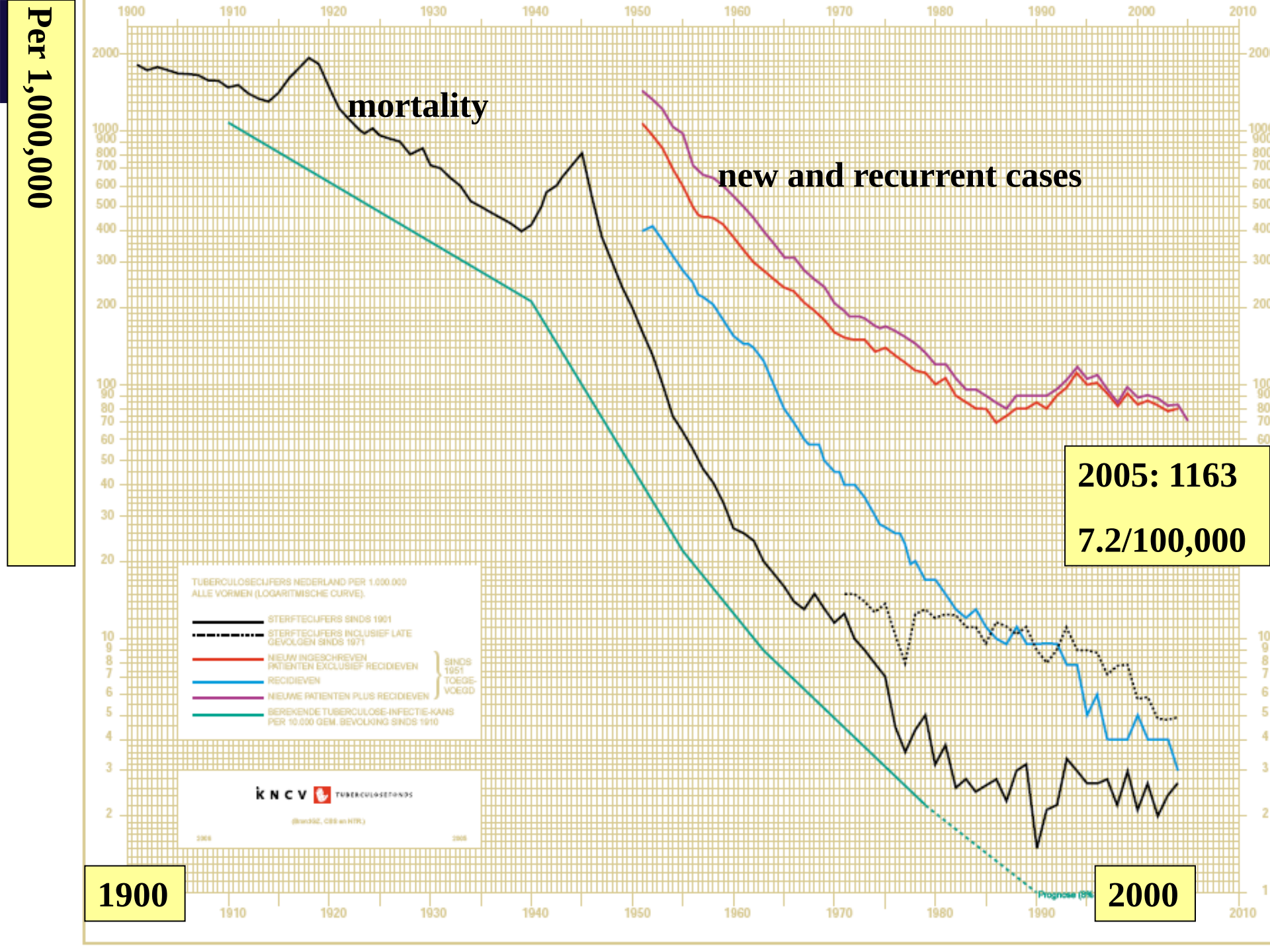
- In 1901 in the Netherlands 10,119 deaths as a result of tuberculosis were registered.

- Around 1903 the incidence of tuberculosis in Netherlands can be estimated at approximately 20,000 and 25,000 cases.


Per 1,000,000
mortality
new and recurrent cases
2005: 1163
7.2/100,000
1900
2000
TUBERCULOSECIJFERS NEDERLAND PER 1.000.000
ALLE VORMEN (LOGARITMISCHE CURVE).
STERFTECIJFERS SINDS 1901
STERFTECIJFERS INCLUSIEF LATE GEVOLGEN SINDS 1971
NIEUW INGESCHREVEN PATIENTEN EXCLUSIEF RECIDIEVEN
RECIDIEVEN
NIEUWE PATIENTEN PLUS RECIDIEVEN
SINDS 1951 TOEGEVOEGD
BEREKENDE TUBERCULOSE-INFECTIE-KANS PER 10.000 GEM. BEVOLKING SINDS 1910
KNCV TUBERCULOSEFONDS
Prognose

TB incidence in the Netherlands

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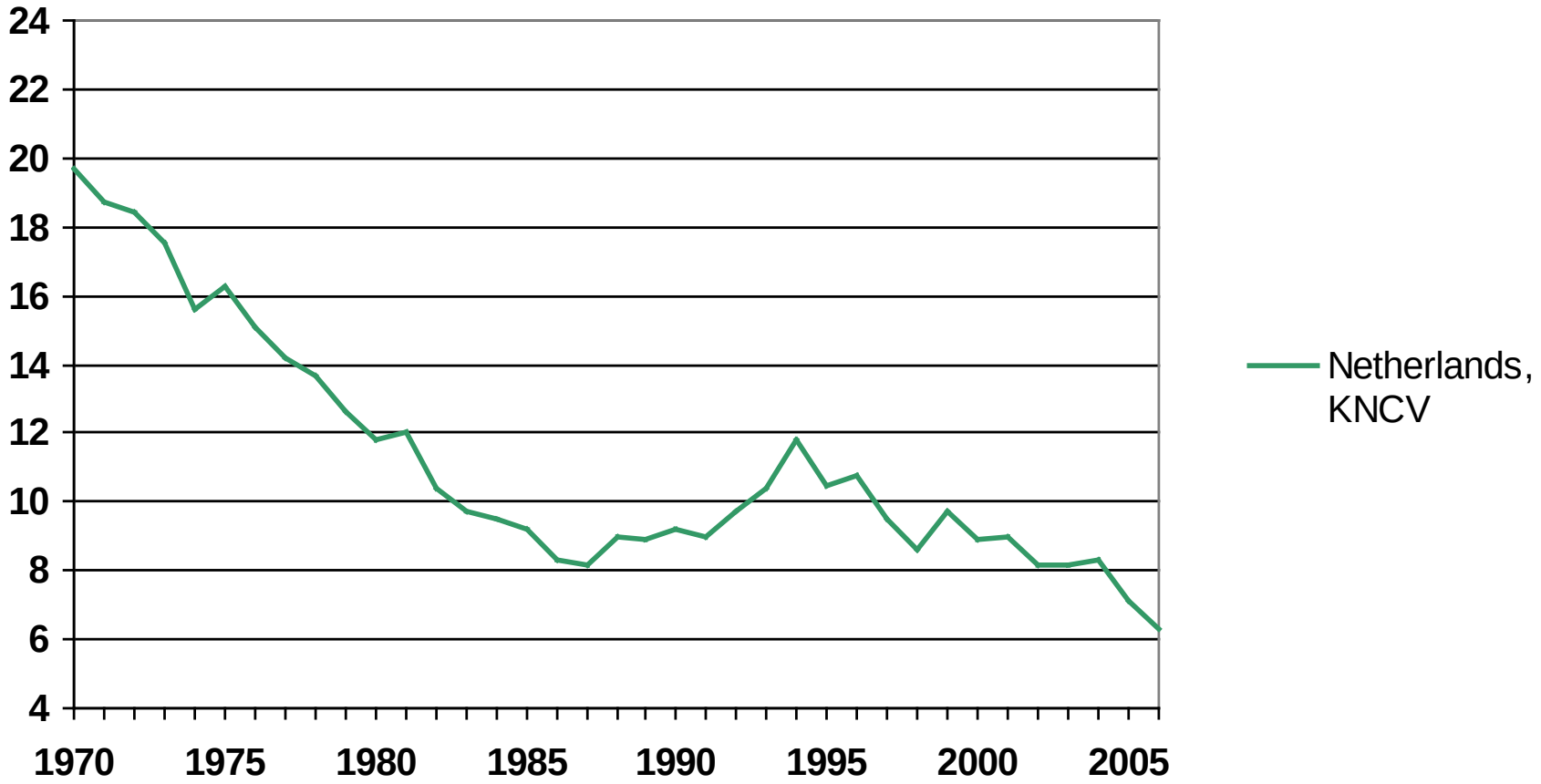
TB incidence rate per 100,000 in the Netherlands 1970 - 2006



Tuberculosis 2006

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- These days in the Netherlands tuberculosis is no longer a common disease, especially not among the autochthonous Dutch population

- Last decade on average 1300 patients per year:
  * 1999: 1535 patients
  * 2000: 1404 patients
  * 2001: 1436 patients
  * 2002: 1401 patients
  * 2003: 1321 patients
  * 2004: 1344 patients
  * 2005: 1163 patients
  * 2006: 1027 patients
  * 2007: 1011 patients

Source: Netherlands Tuberculosis Register

Metropolitan TB in the Netherlands (2003)

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	Inhabitants	TB cases	TB cases per 100,000
the Netherlands	16.200.000	1321	8,2
4 major cities:			
Amsterdam	737.000	194	26,3
Rotterdam	600.000	172	28,7
the Hague	464.000	98	21,1
Utrecht	265.000	28	10,6
4 major cities	13%	37%	23,8
the rest of the Netherlands	87%	63%	5,9

Source: Netherlands Tuberculosis Register 2003, KNCV Tuberculosis Foundation

TB trend in Rotterdam 1983 - 2005

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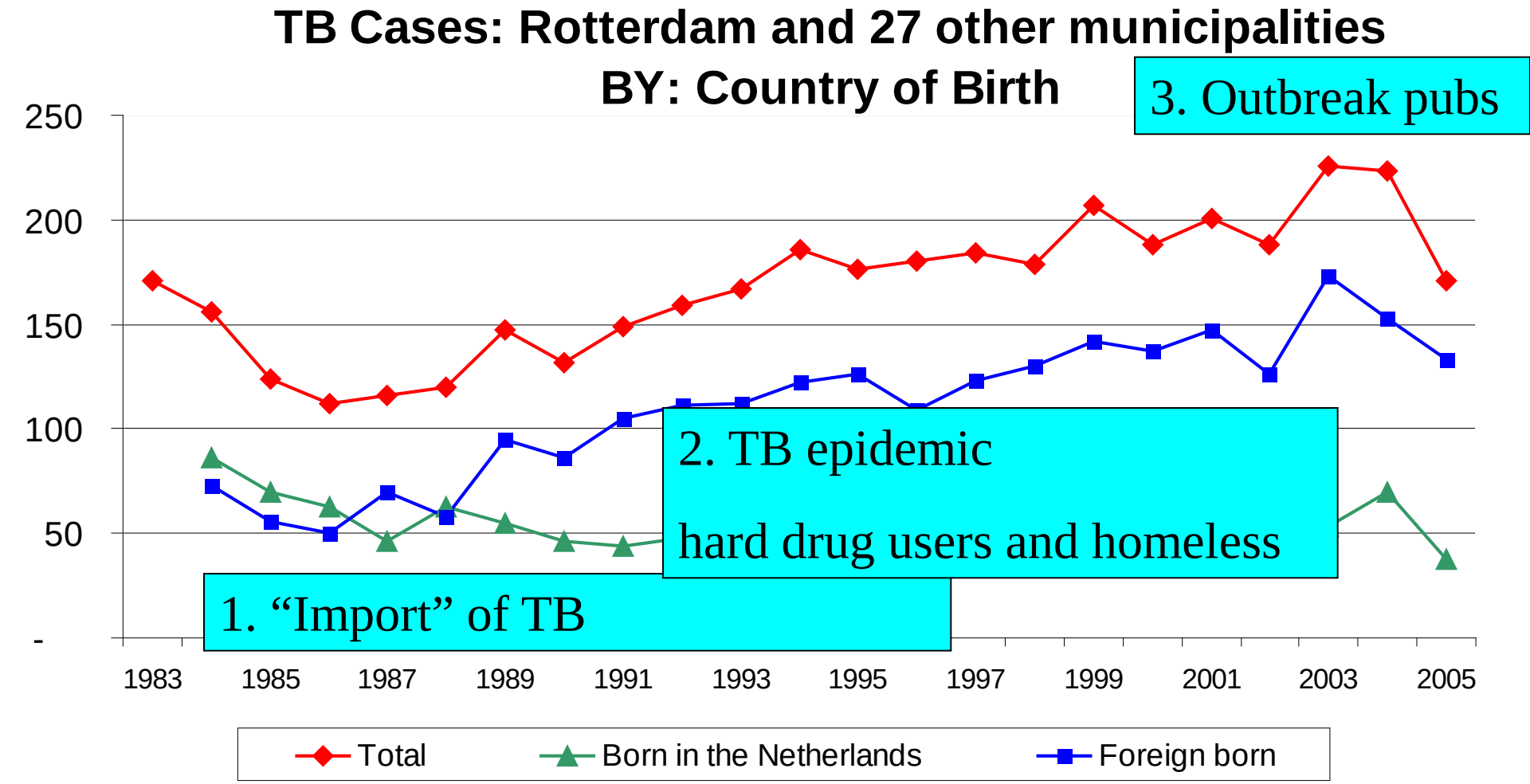

3. Outbreak pubs

2. TB epidemic

hard drug users and homeless

1. “Import” of TB

Tuberculosis

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Tuberculosis

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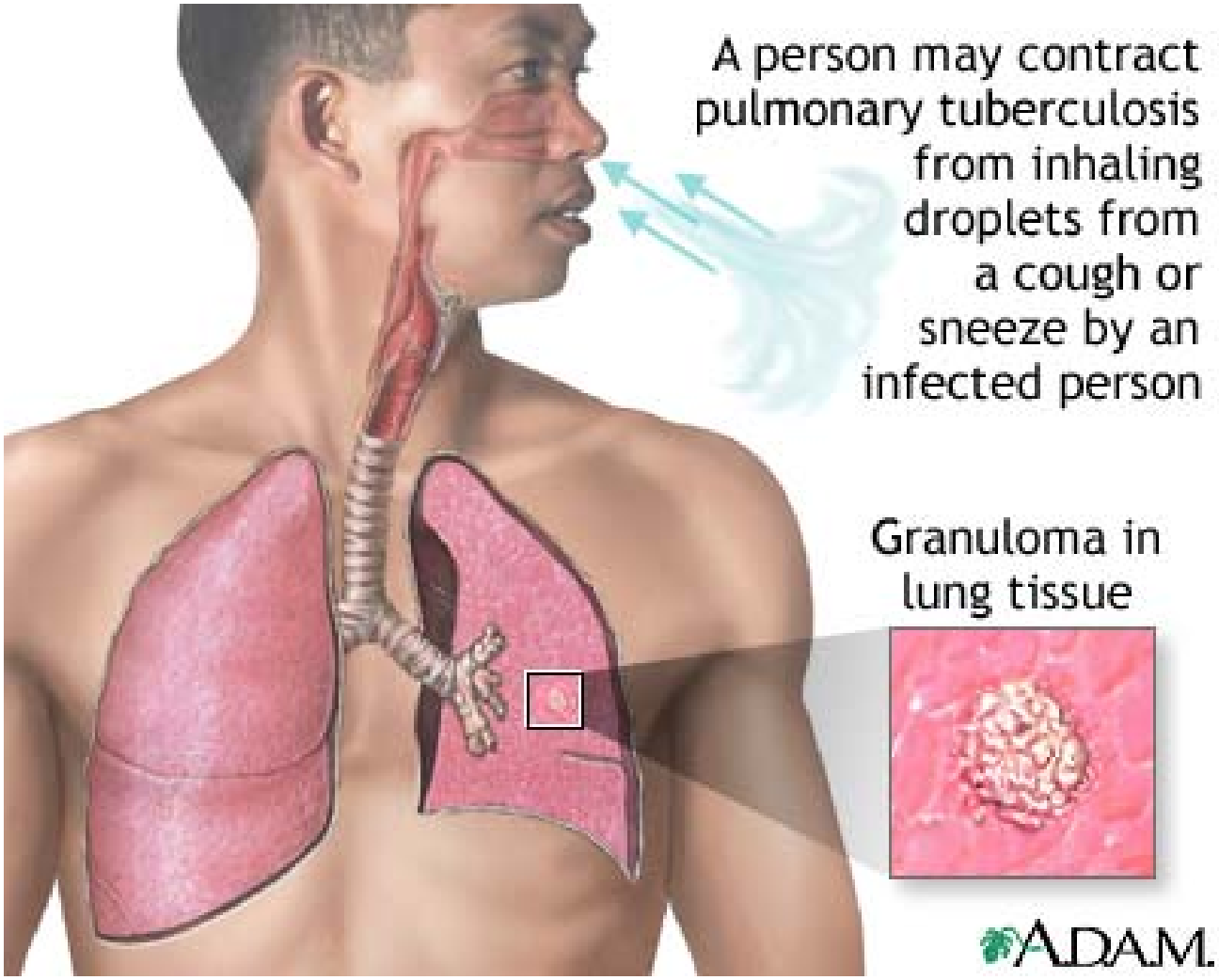

Chest X-rays

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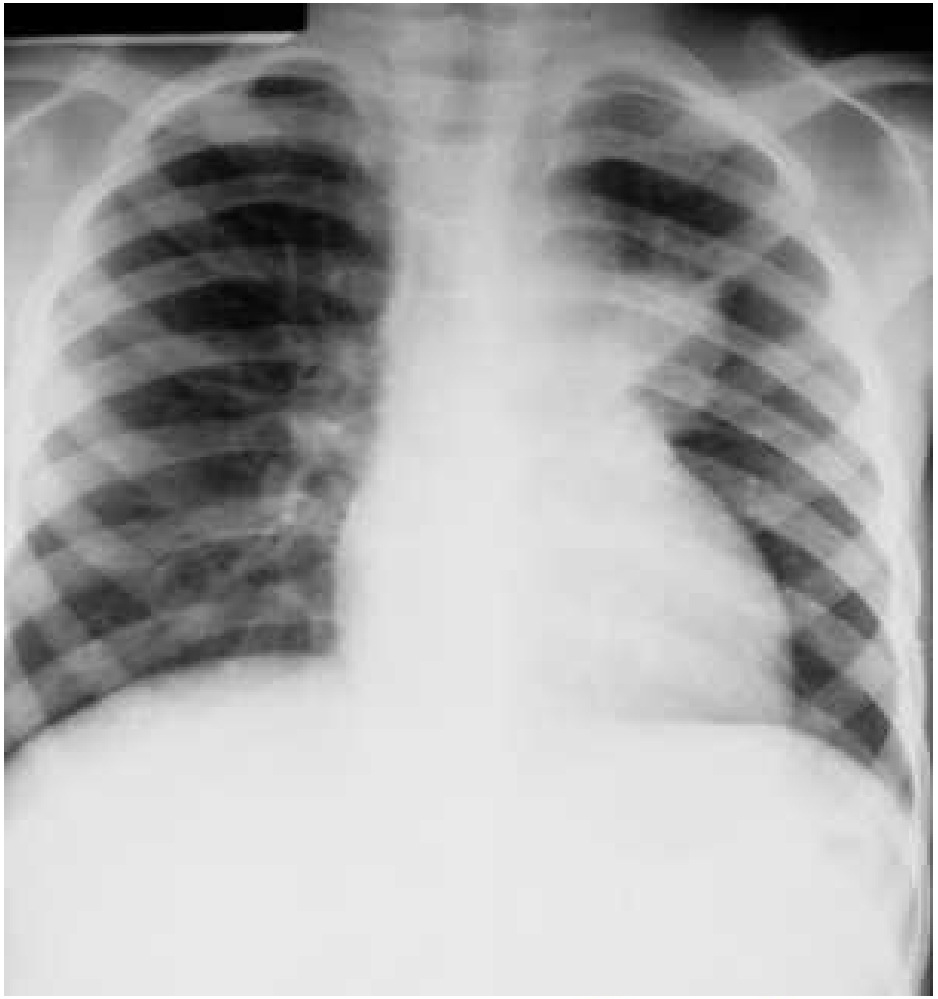
Primary (primo-) tuberculosis



Chest X-rays

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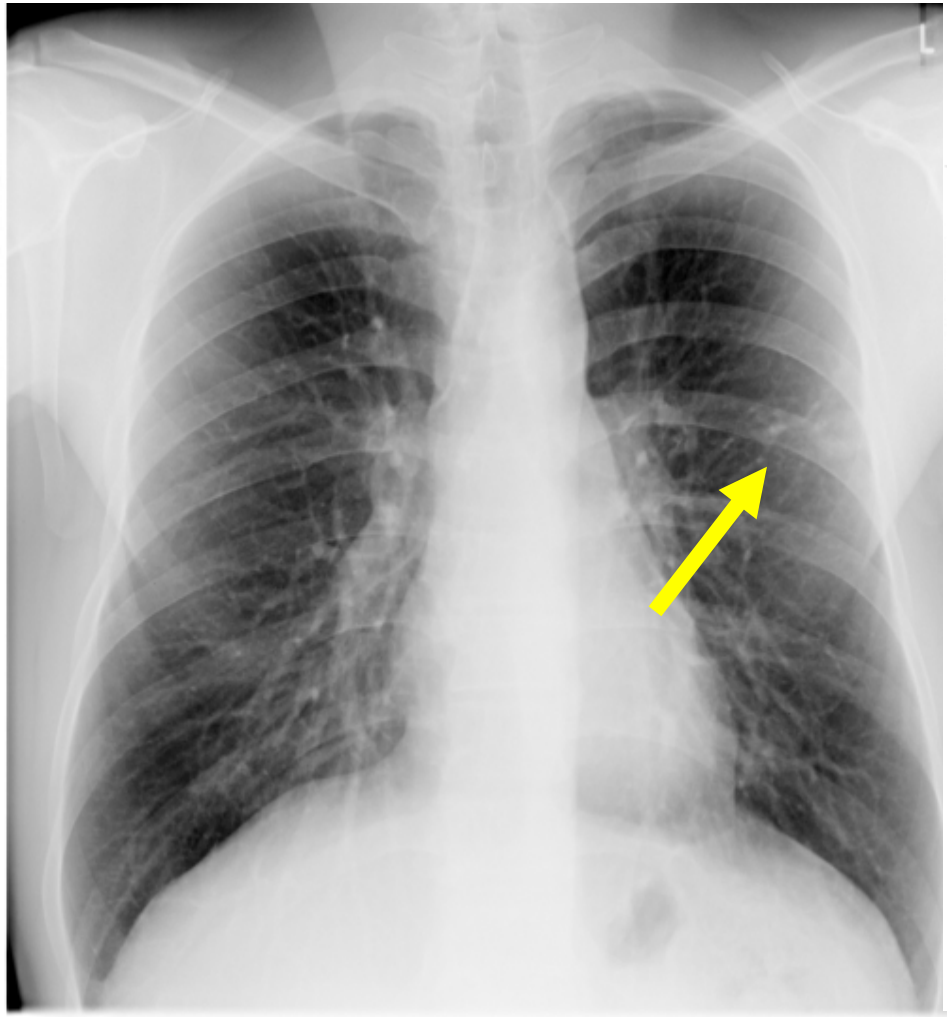
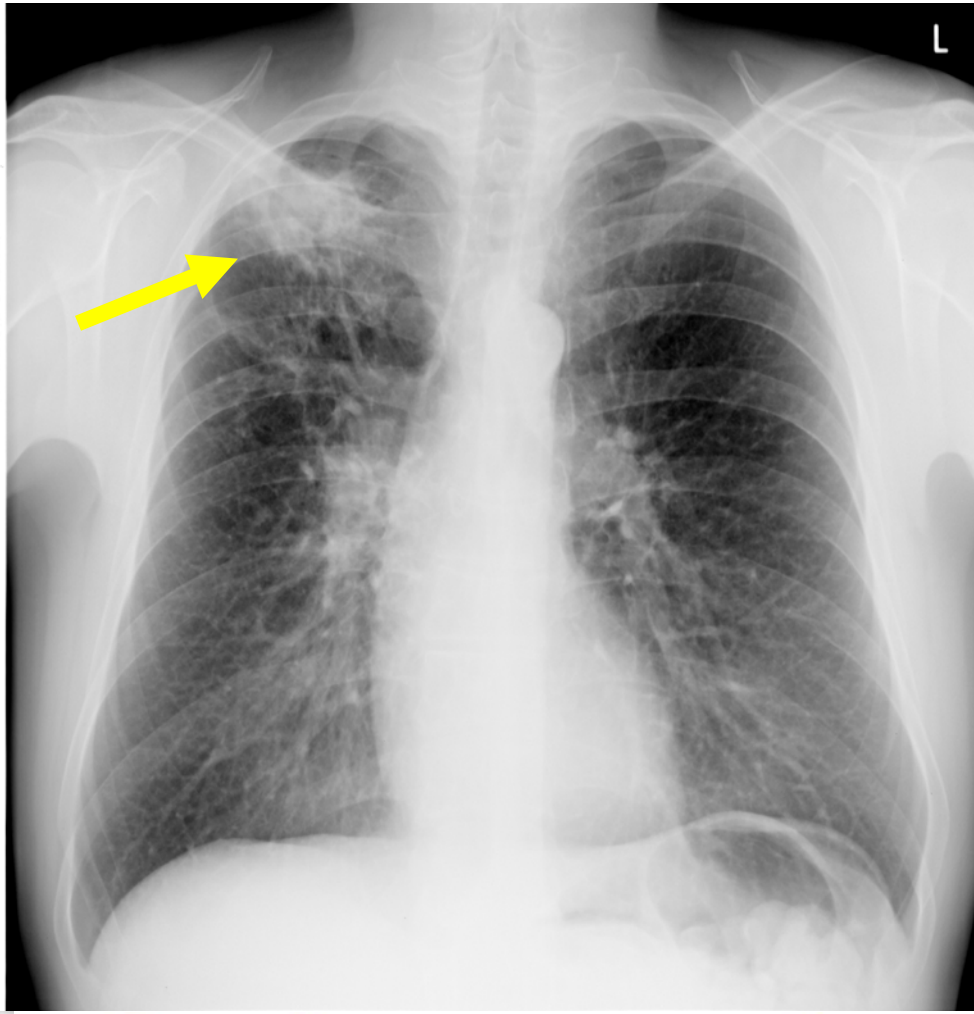
Smear-negative pulmonary tuberculosis





Chest X-rays

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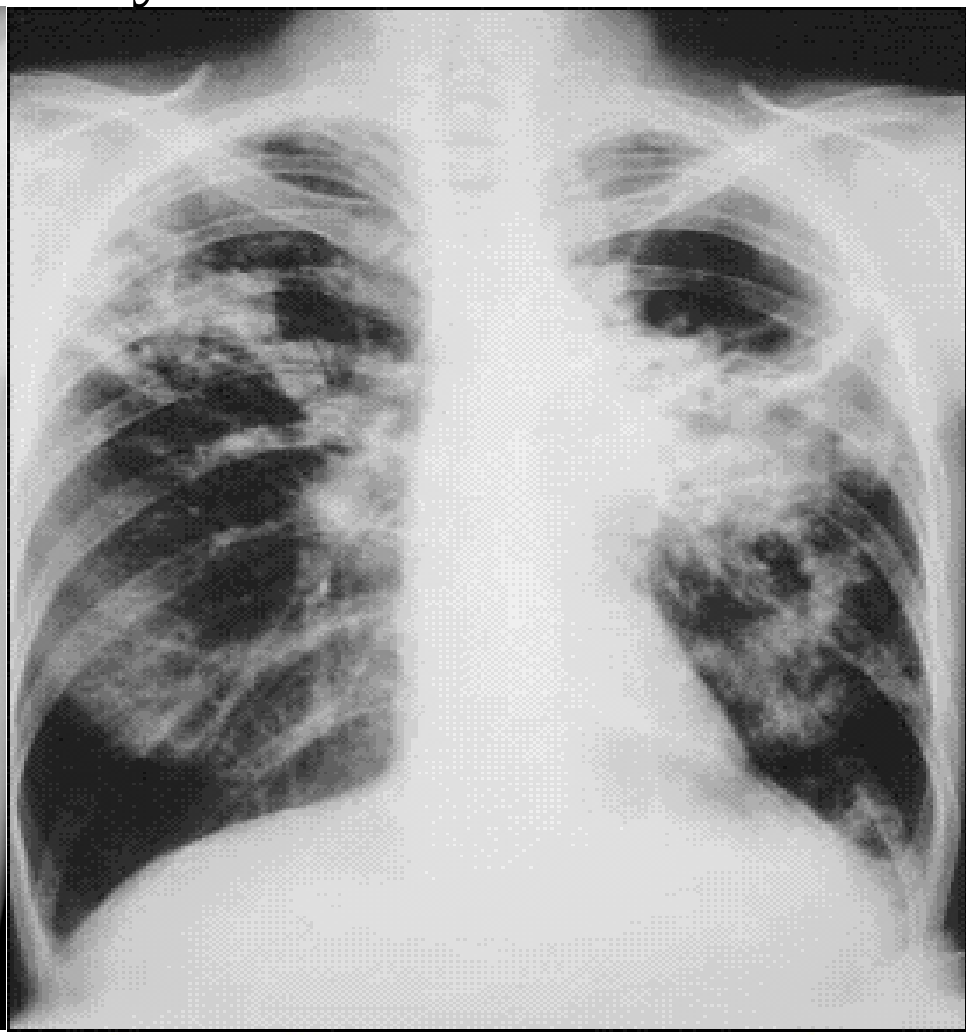
Smear-positive pulmonary tuberculosis



Tuberculosis

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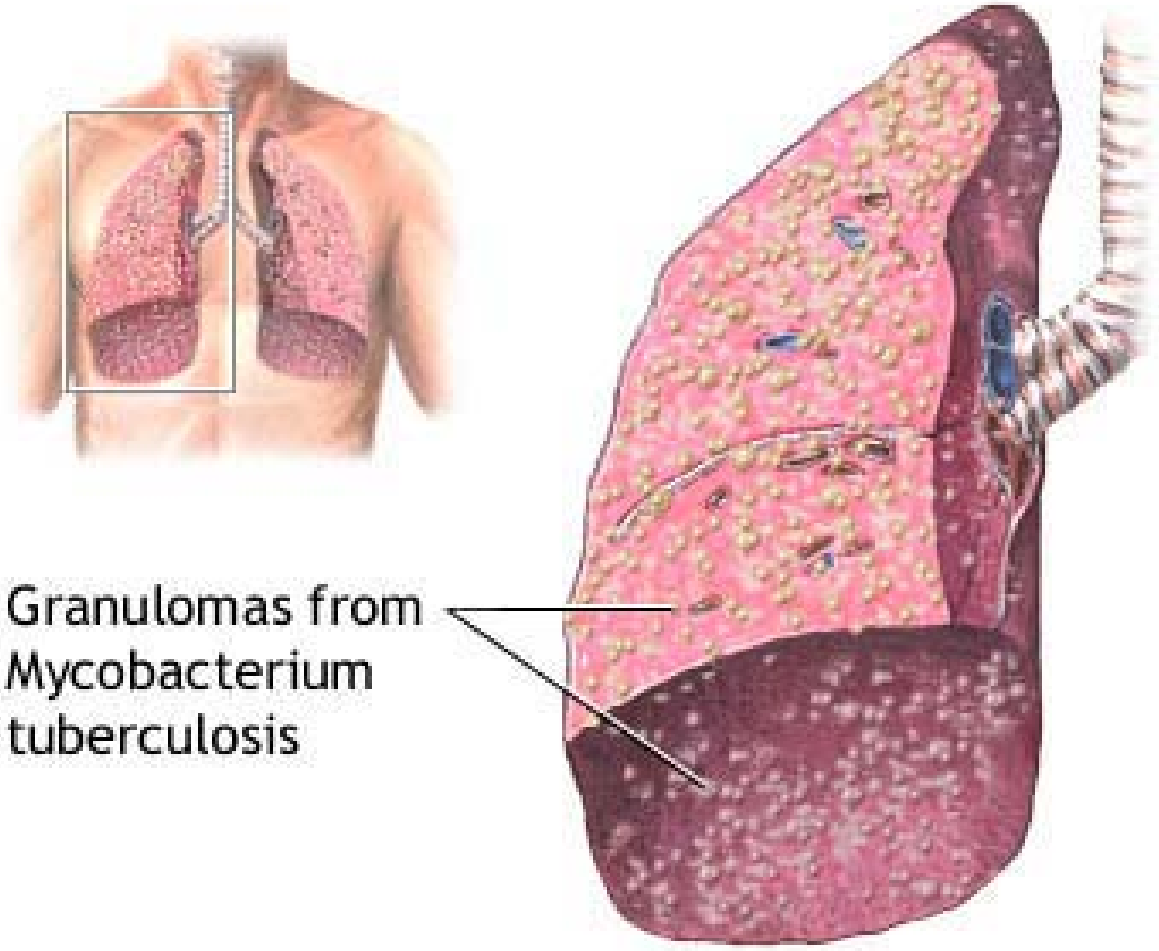

A.D.A.M.

Tuberculosis

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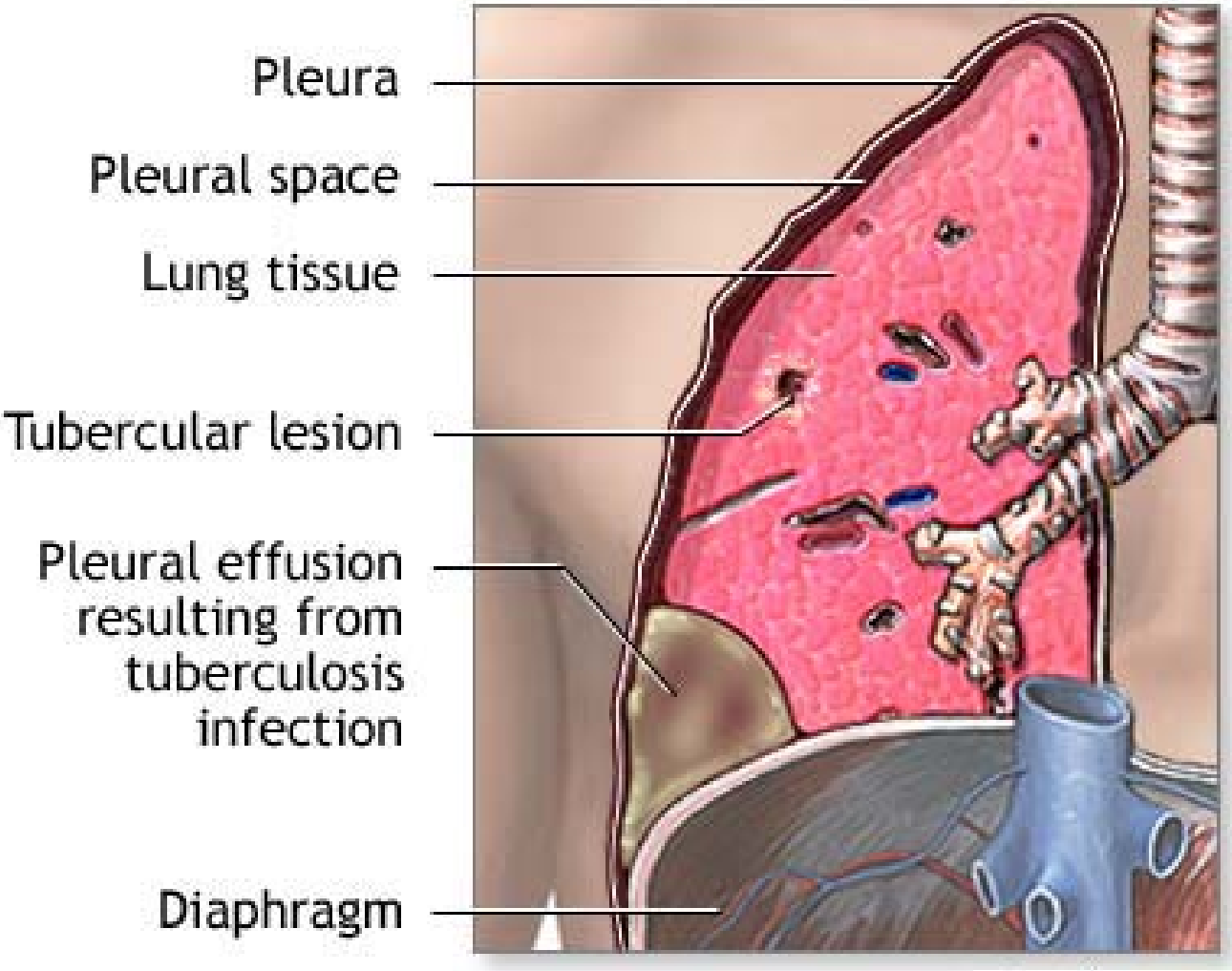

A.D.A.M.

> 100 years TB control

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TB Control Department Rotterdam

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One-stop-shop!!

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TB Control Department Rotterdam

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- 5 tuberculosis-physicians
- 5 TB nurses
- 15 practice assistants
- 30,000 visitors per year
- 20,000 chest X-rays per year
- 6,000 Mantoux tests per year
- Diagnosis or supervision of approx. 175 tuberculosis patients annually

One-stop-TB-shop!!

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Tuberculin skin test

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Interferon gamma release assays (IGRAs)

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Digital chest X-ray

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Digital chest X-ray

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Rotterdam en omstreken

Tuberculosis

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Rotterdam en omstreken

Tuberculosis

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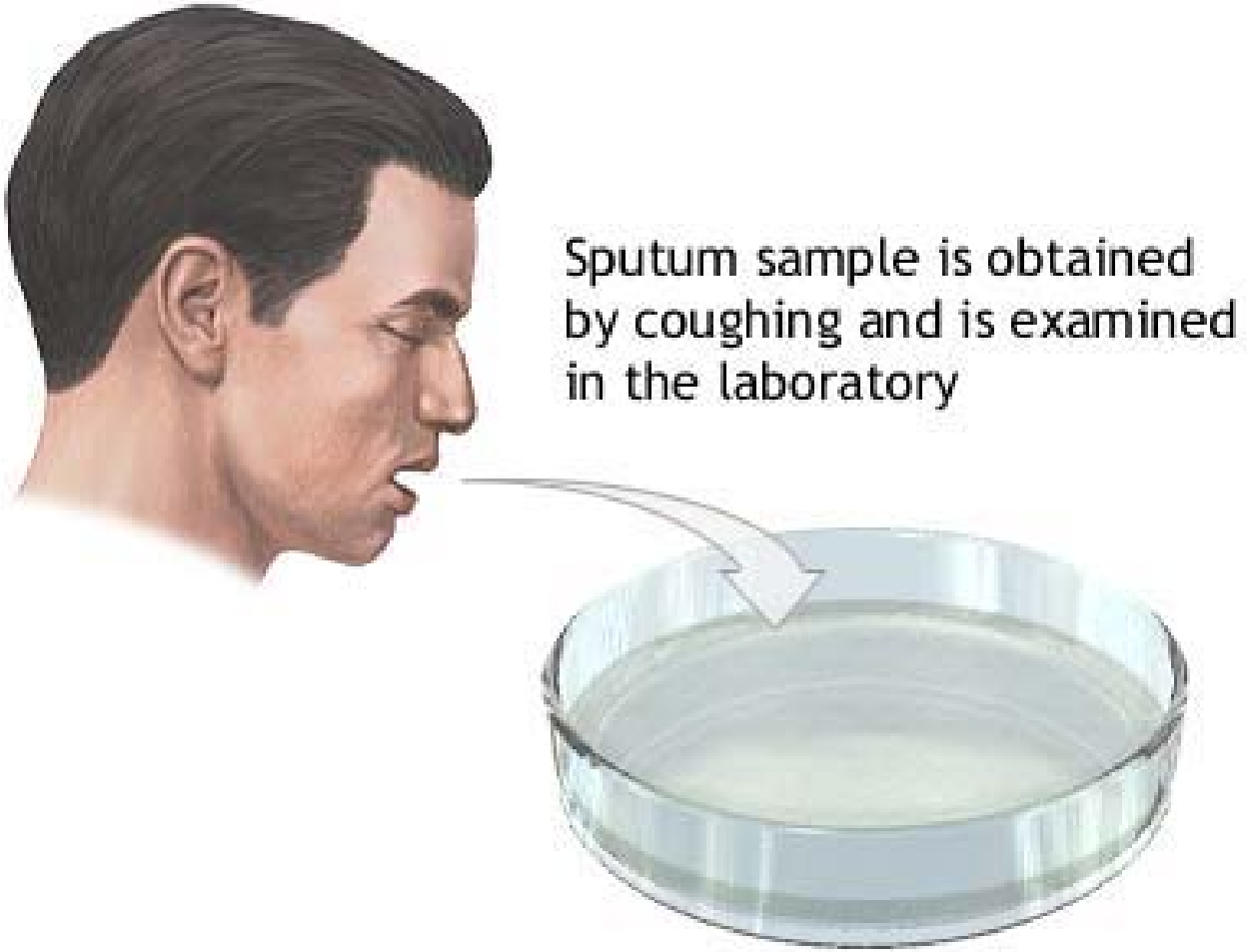

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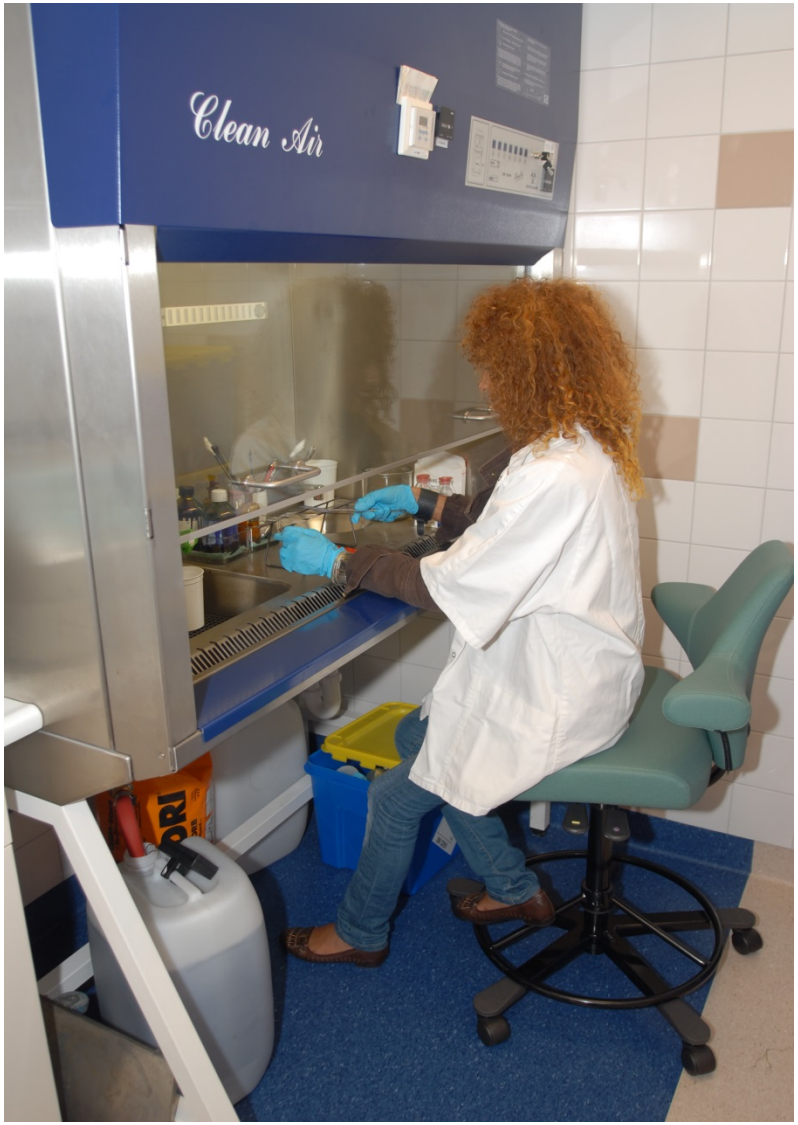
Clean Air

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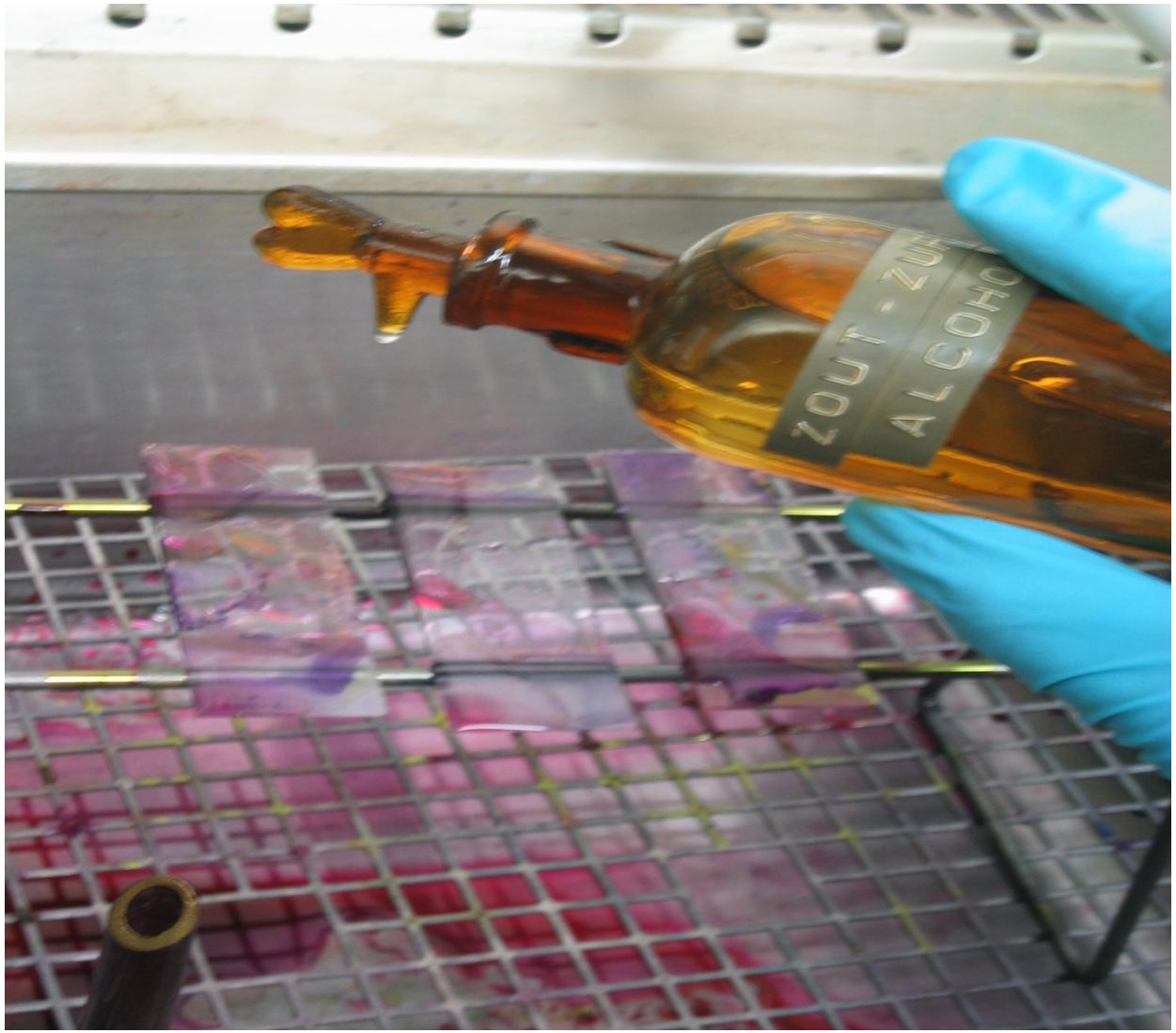

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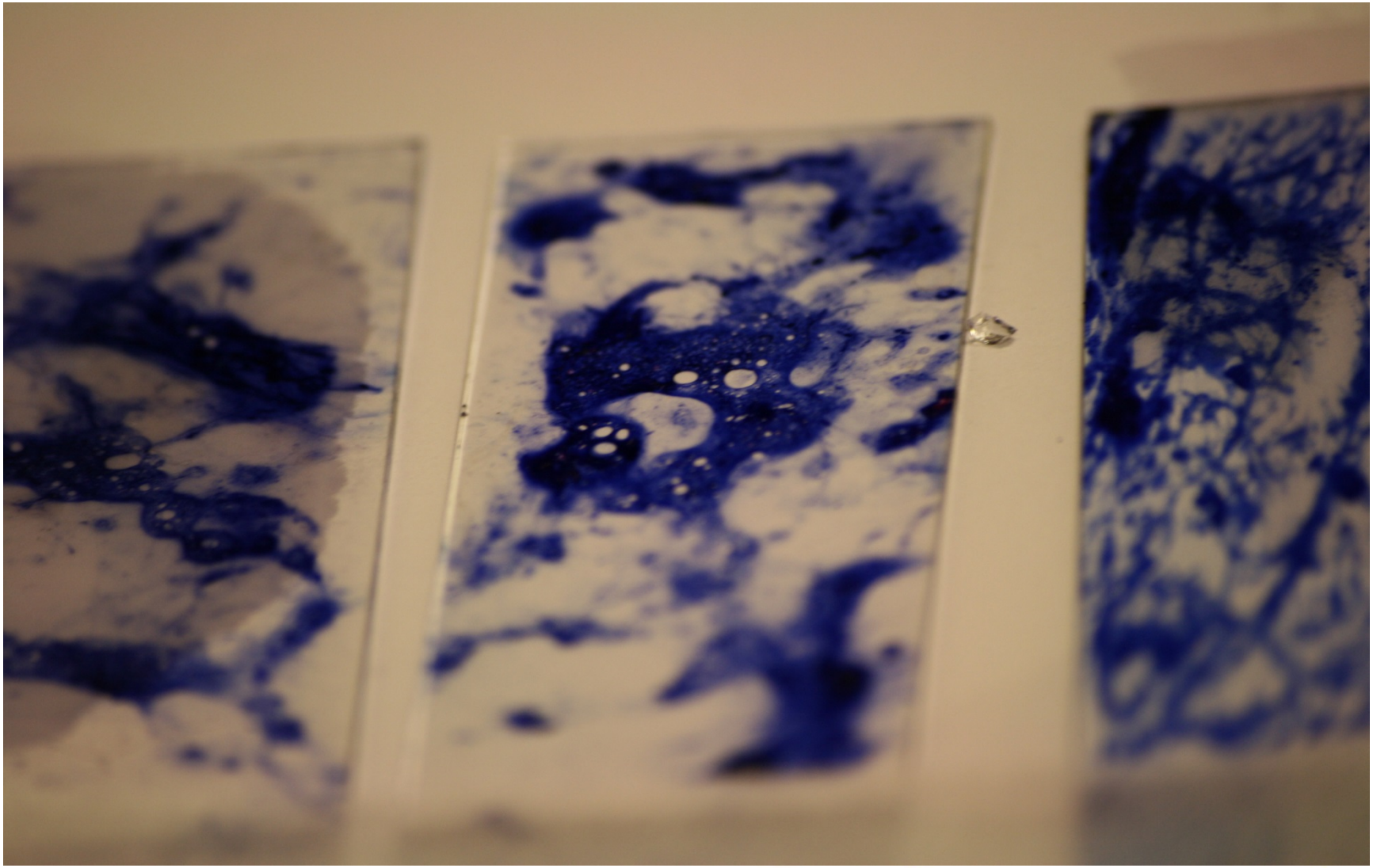

Microscopy

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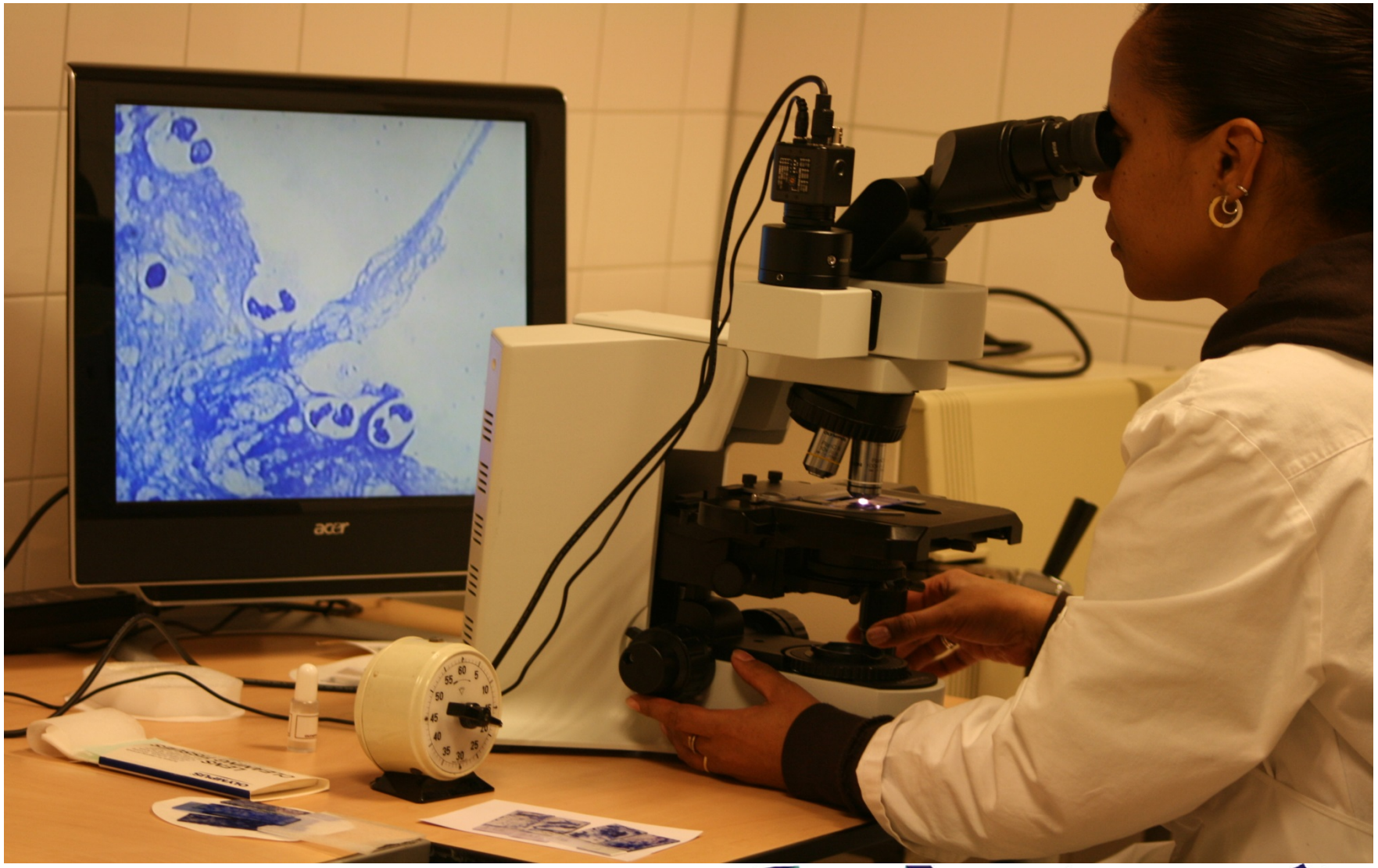

Microscopy

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Sputum examination

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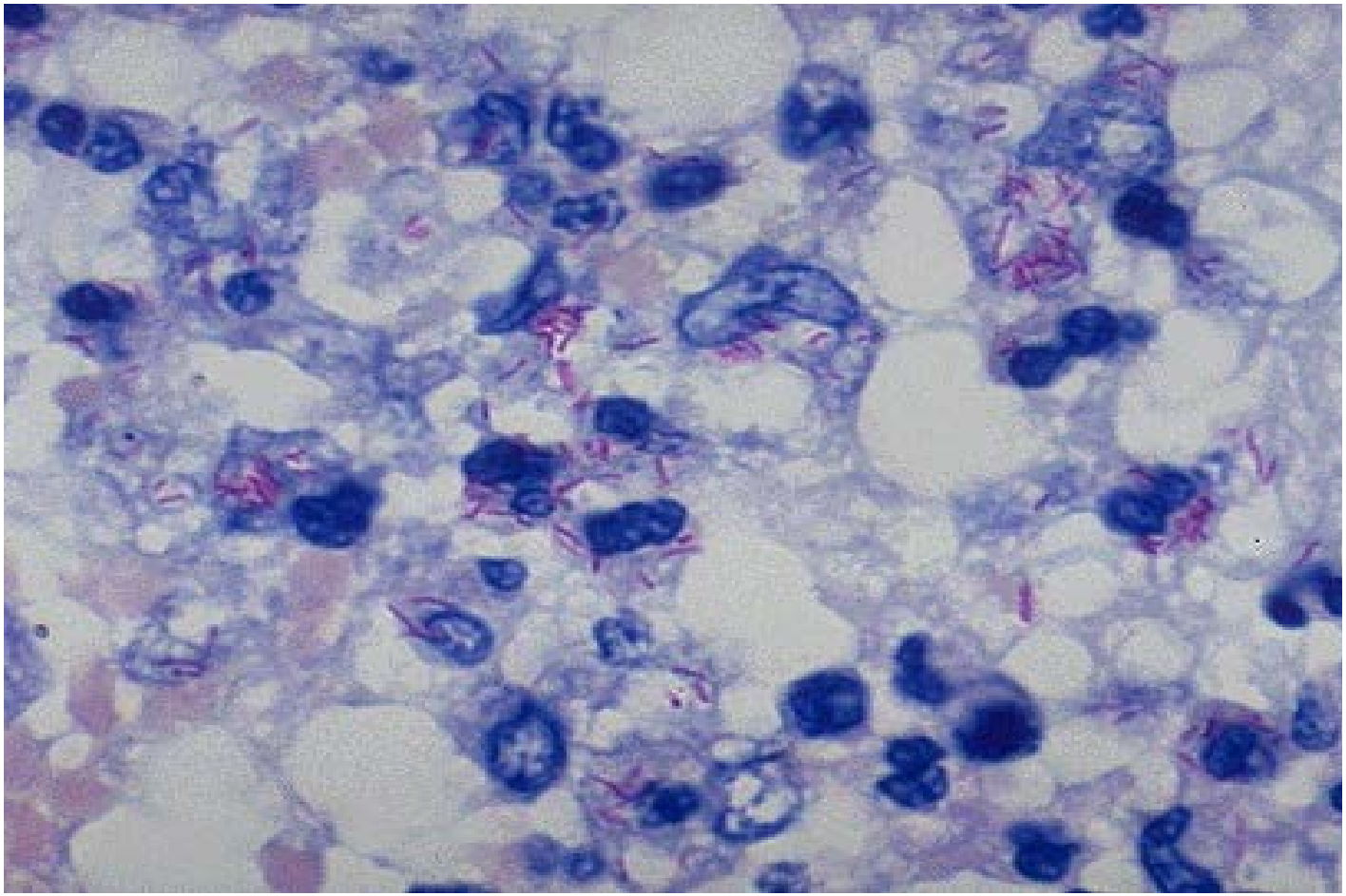
Direct microscopy after Ziehl-Neelsen staining



Isolation

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Isolation

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Clinical isolation –isolation at home

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Medication supervision is important

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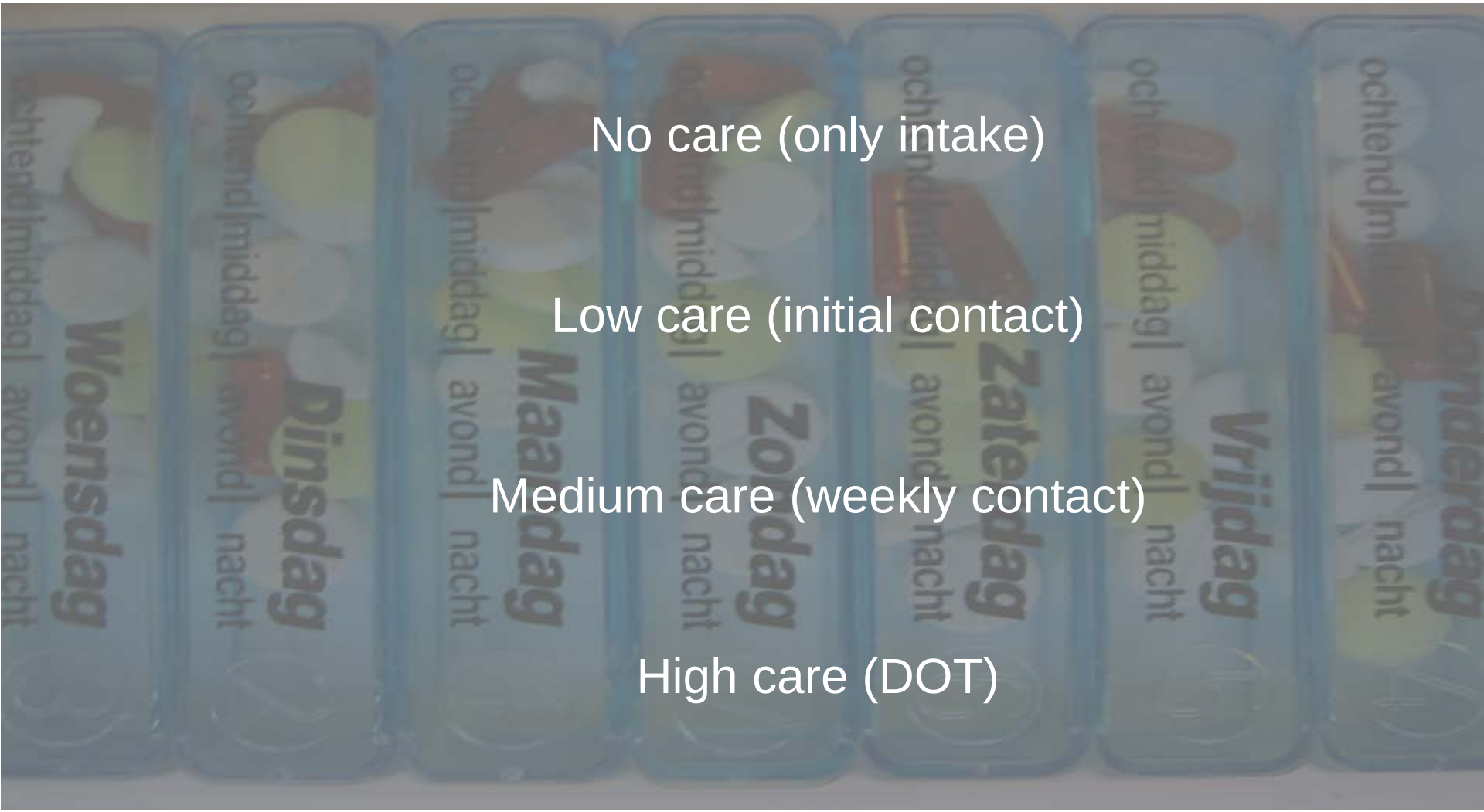

No care (only intake)

Low care (initial contact)

Medium care (weekly contact)

High care (DOT)

Week boxes

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Defaulters

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Self-Reported Reasons for Defaulting, N = 233

Reason	Number*	Percent*
I felt better	59	25%
The pills gave me side effects	36	16%
I didn't like taking pills every day	33	14%
I did not have time, too busy	29	13%
I didn't want to lose my job	25	11%
I didn't think it was important	25	11%
I had to look for a job/for money	25	11%
I thought I was taking pills for too long	23	10%
I gave up/I was depressed	21	9%
I forgot to come in for TB treatment	19	8%
The clinic was too far	19	8%
I was not getting any better	17	7%
I did not get enough support	15	6%
I could not afford transport to the clinic	15	6%

*Categories not mutually exclusive, percentages will add up to more than 100%

Maandag 1
ochtend | middag | avond | nacht

Dinsdag 2
ochtend | middag | avond | nacht

Woensdag 3
ochtend | middag | avond | nacht

Donderdag 4
ochtend | middag | avond | nacht

Vrijdag 5
ochtend | middag | avond | nacht

Feedback to social services

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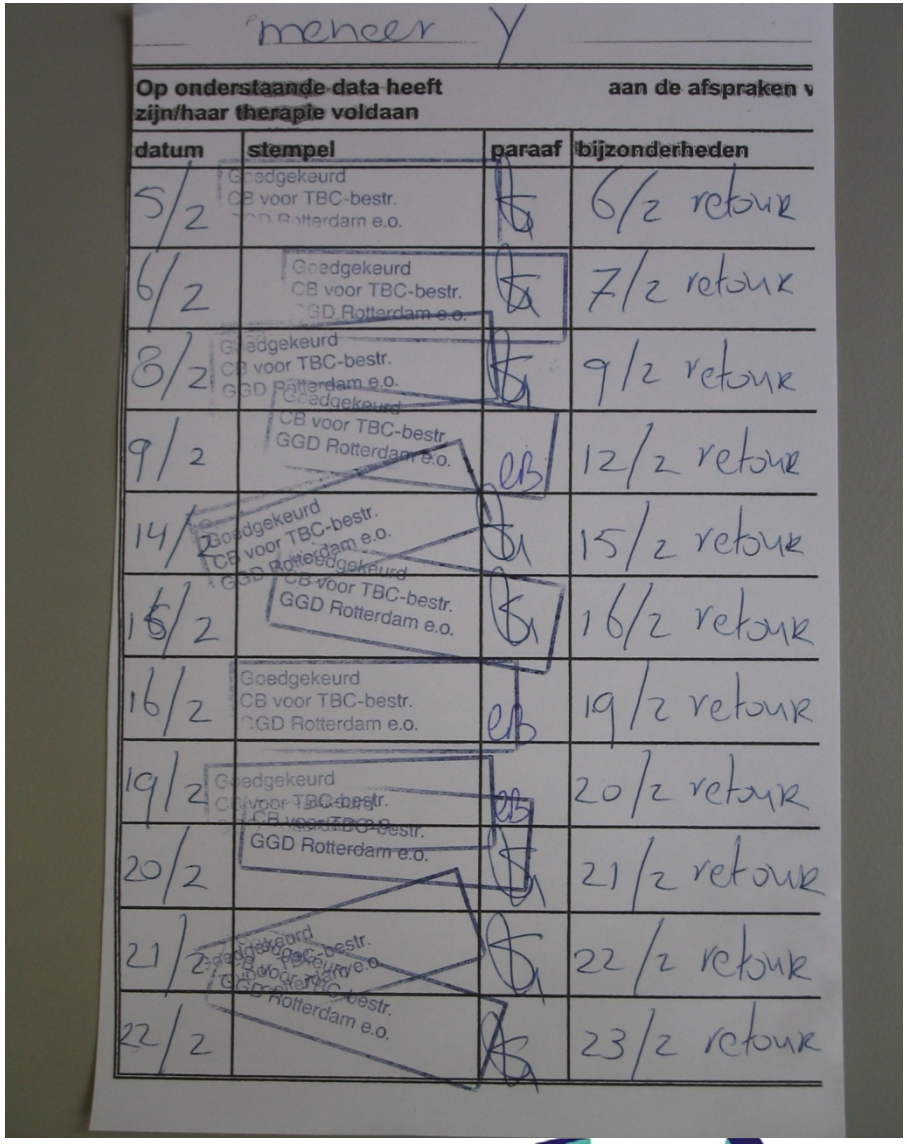

meneer Y

Op onderstaande data heeft zijn/haar therapie voldaan aan de afspraken v

datum	stempel	paraaf	bijzonderheden
5/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.		6/2 retour
6/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.		7/2 retour
8/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.		9/2 retour
9/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.	eb	12/2 retour
14/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.		15/2 retour
15/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.		16/2 retour
16/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.	eb	19/2 retour
19/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.	eb	20/2 retour
20/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.		21/2 retour
21/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.		22/2 retour
22/2	Goedgekeurd CB voor TBC-bestr. GGD Rotterdam e.o.		23/2 retour

Tertiary TB treatment centre

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Tertiary TB treatment centre

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Medically complicated patients

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Socially complicated patients

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UMCG-Beatrixoord


Spoedkar


Maatschappelijk werk


Besmettingsgevaar
Melden bij verpleging


TURI
PRODUCTION


13 2 1
thuis
gasten
Rabobank

Sputum cultures

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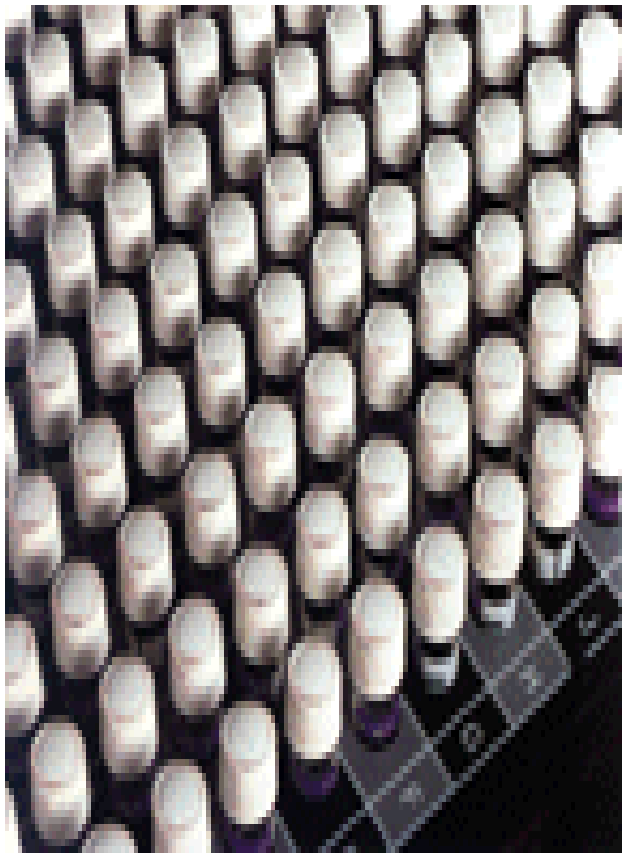
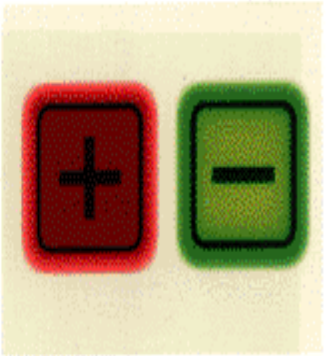
Cultures liquid media (Middlebrook, Bactec MGIT))



Step 1: Select workflow.

Step 2: Scan tube at instrument.

Step 3: Load where indicated by green LED.



Step 4: Remove positives and completed negatives as they occur.

Genotyping/DNA fingerprinting

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- Since 1993 all *M. tuberculosis* bacteria are fingerprinted (RFLP) by the National Institute of Public Health and the Environment in the Netherlands.
- If bacteria have the same DNA-pattern (cluster) it suggests recent transmission.

Cluster analysis

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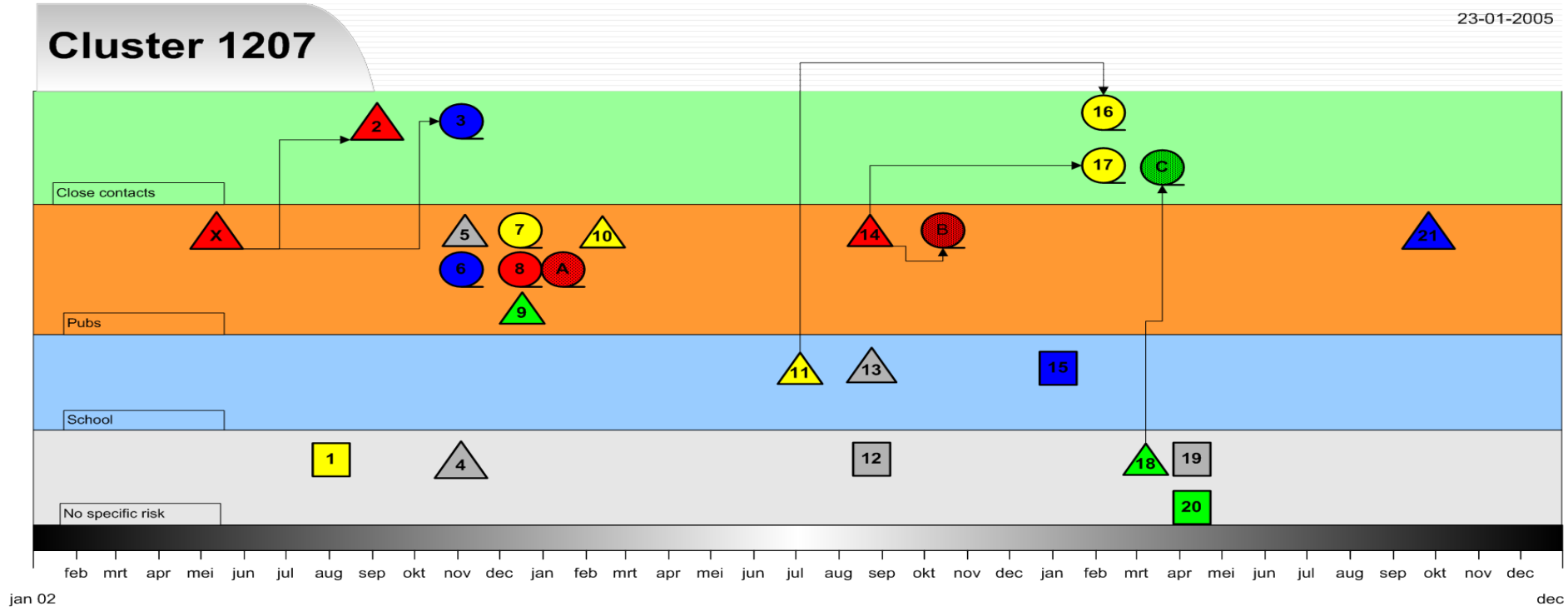

Tuberculosis, localisation

- Pulmonary tuberculosis, smear positive
- Pulmonary tuberculosis, smear negative
- Extrapulmonary tuberculosis

Ethnic background:

- Yugoslavian
- Surinam
- Moroccan
- Dutch (Netherlands)
- Other

Selective BCG vaccination

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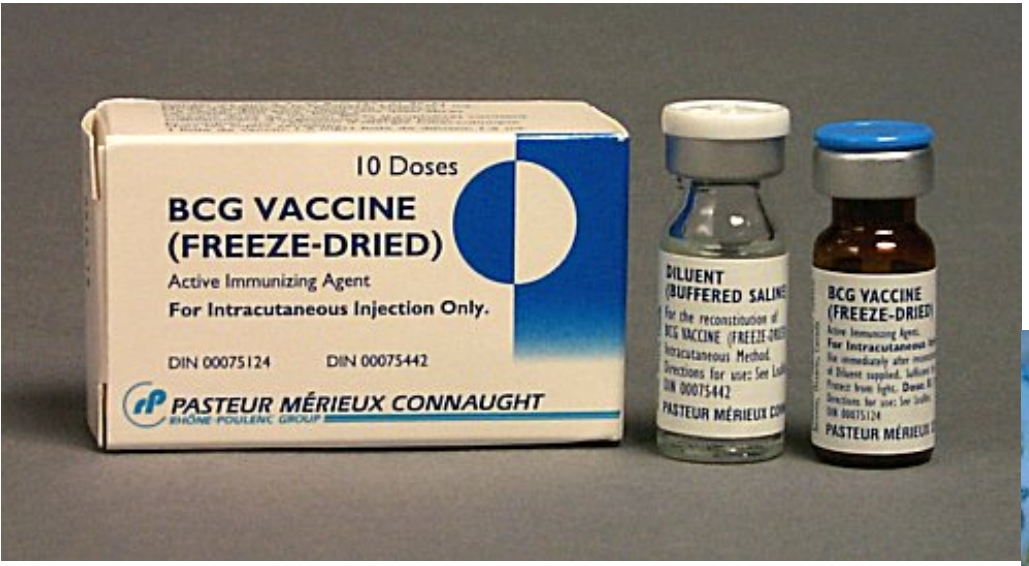

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Screening of risk groups:

Contacts

Immigrants

Asylum seekers

Prisoners

Seamen/Sailors

Alcohol and drug addicts

Homeless people

Contact tracing

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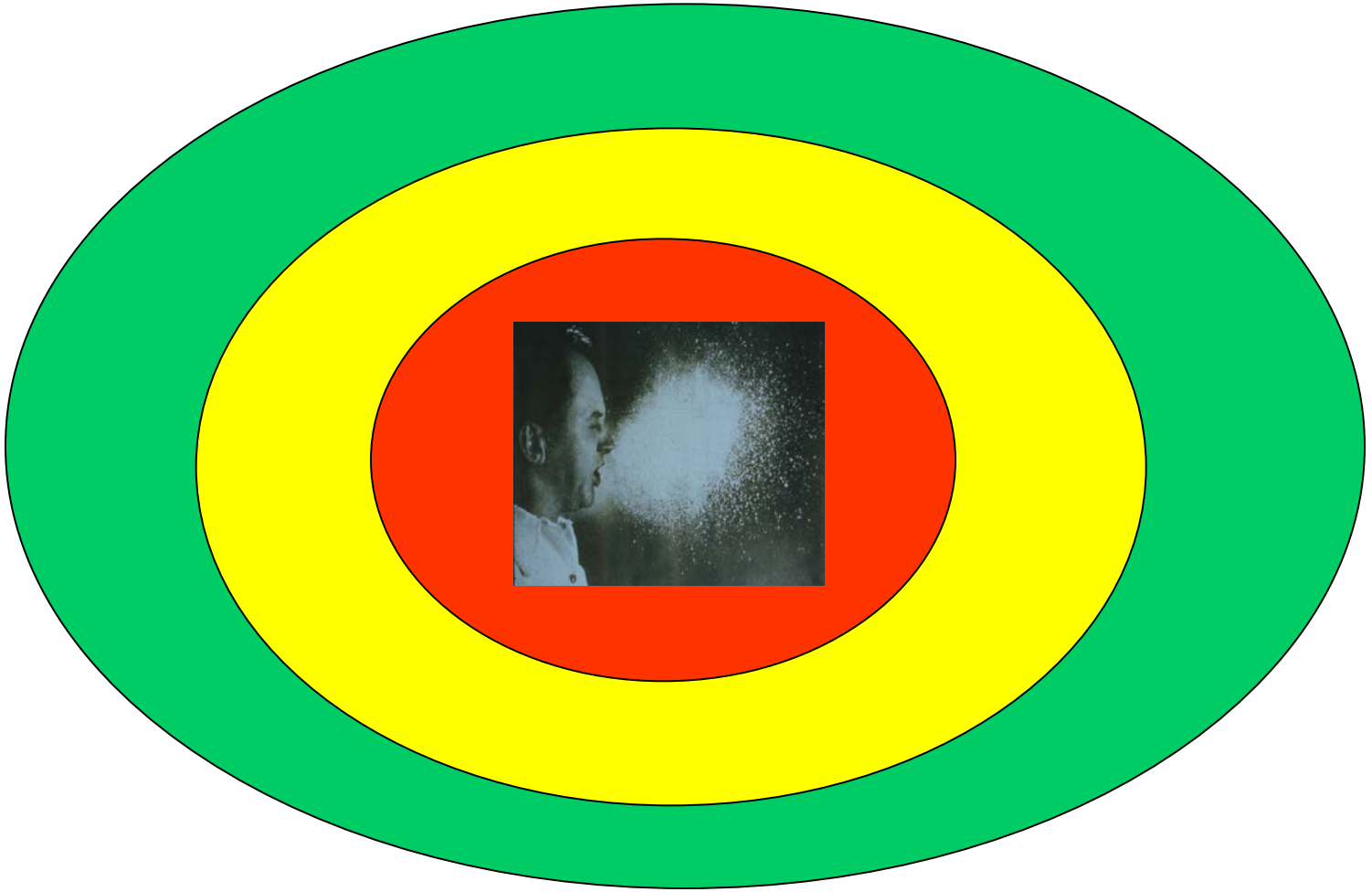

Contact tracing

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’Krijg ik er geen pleister op?’

De Mantoux-prik die 1500 leerlingen en personeelsleden van het ROC Zadkine gisteren kregen deed sommigen pijn. Ze zuchtten en steunden erop los.
Foto Jaap Rozema/ Rotterdams Dagblad

Door Hanneke van Houwelingen

Rotterdam — Mouwen opstropen, linkeronderarm uitsteken en een prikje. Deze handeling werd gisteren 1500 keer uitgevoerd bij leerlingen en personeelsleden van het ROC Zadkine aan de Benthemstraat. Met de zogenoemde Mantoux-prik werden zij getest op tuberculose. Maandag moeten ze allemaal terugkomen voor controle.

Wanneer iemand besmet blijkt te zijn, moet die zes maanden preventief medicijnen slikken. Een biertje is dan niet toegestaan. Een verontwaardigde leerling: „Dat is waardeloos met Oud en Nieuw. Nou, dan wacht ik wel even met medicijnen slikken tot na de jaarswisseling.”
„Niet wrijven, niet drukken,” geeft een van de doktersassistenten als advies aan de jongeren, die hij net heeft voorzien van de prik. Wanneer een deelnemer aan het tbc-onderzoek, uitgevoerd door

controleerd op mogelijke besmetting. De jongen werd behandeld zodat hij de ziekte niet meer kon overdragen op andere personen. In september werd echter weer tbc vastgesteld bij een leerling op de ICT-schoolafdeling. Na onderzoek bleek het om dezelfde bacterie te gaan als de eerst besmette jongen.
Vandaar het grootschalig onderzoek van de GGD Rotterdam op de ROC Zadkine, waarbij in totaal 2300 leerlingen van de welzijnsopleidingen, de ICT-afdeling en alle personeelsleden werden getest.

Oproepkaart

Honderden leerlingen staan in lange rijen te wachten op de spuit. Ook ex-leerlingen die vorig jaar zijn afgestudeerd, hebben een oproepkaart ontvangen. De administratie nam meer tijd in beslag dan de prik.
Een wachtend meisje is bang voor de uitslag: „Vorige week kregen we een brief in de bus over de tbc-test. Ik had nog niet gehoord van

bij een te late ontdekking ook dood kan gaan aan de ziekte, word ik wel zenuwachtig voor de uitslag.”
Voor achthonderd allochtone leerlingen, die al ingeënt waren tegen de ziekte, staat de mobiele röntgen-unit klaar. In een busje worden er longfoto’s van hen gemaakt. De kleren mogen aanblijven, maar de hoofddoekjes en kettingen moeten even opzij worden geschoven. Een arts zal in het weekeinde de foto’s bekijken; geen bericht, betekent goed bericht voor deze leerlingen.
De mensen die een spuit krijgen, kunnen al heel snel zelf een besmetting constateren. Normaal gesproken trekt het kleine bultje na inspuiting van de vloeistof na een paar uurtjes weg, maar het kan ook opzwellen en na drie tot vijf dagen een flinke bult worden. Dan is er sprake van een besmetting.
Een brede, stoer uitziende jongen is ervan overtuigd dat hij niet besmet is. Hij wil dat het kleine

Contact tracing

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Immigrant screening

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Immigrant screening

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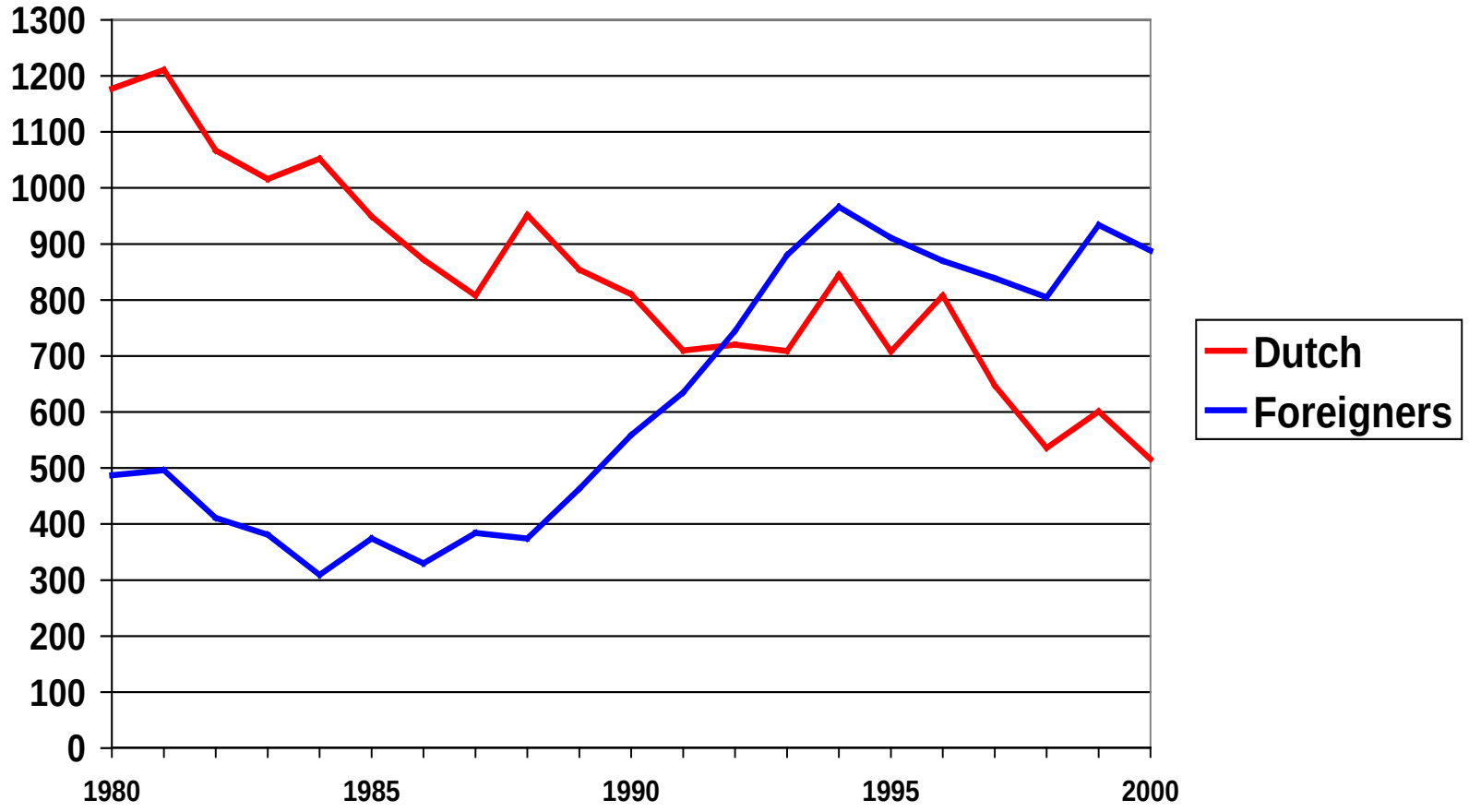
TB incidence for Dutch and foreigners in the Netherlands 1980-2000



Asylum seekers screening

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Prison screening

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Seamen screening

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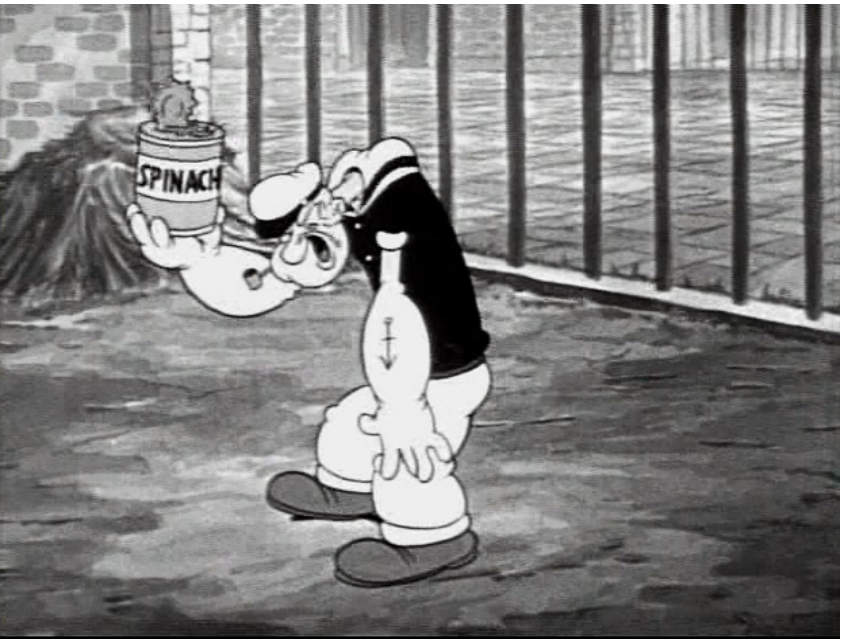

Rotterdam has second largest port in the world

Not public health but occupational health

Notification

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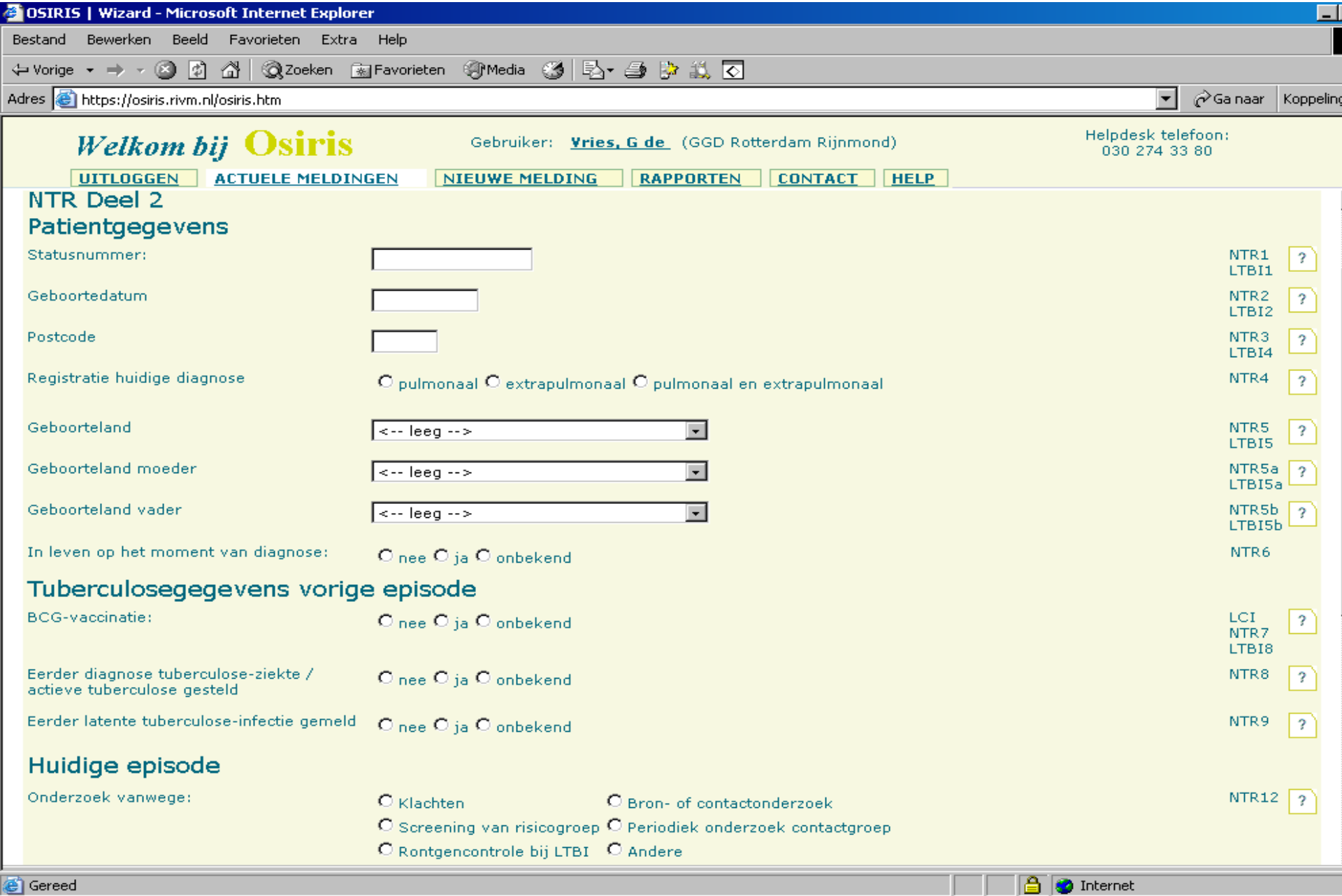

Presentation

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1. Introduction Metropolitan TB and homelessness

1. Control of TB in the Netherlands

1. Specific TB activities in Rotterdam

Screening of homeless persons and illicit drug users

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Screening of homeless persons and illicit drug users

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Story A, Van Hest R, Hayward A. *Tuberculosis and social exclusion*. BMJ 2006;333:57-58.

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From contact investigation to tuberculosis screening of drug addicts and homeless persons in Rotterdam.

Gerard de Vries and Rob van Hest.

European Journal of Public Health 2006;16:133-136

Increasing numbers and proportions

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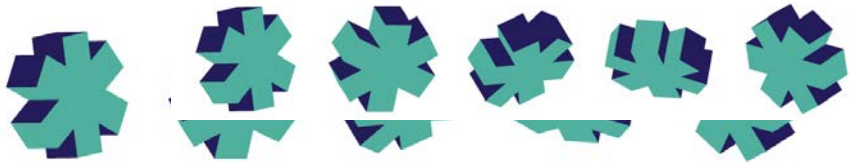
From contact investigation to tuberculosis screening of drug addicts and homeless persons in Rotterdam.

Early 2001 there were indications that TB was increasingly becoming a problem among drug addicts and homeless persons in Rotterdam:

In 1998 TB in **12** drug addicts or homeless persons (9.3%)

In 1999 TB in **20** drug addicts or homeless persons (13.5%)

In 2001 TB in **23** drug addicts or homeless persons (14.7%)



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From contact investigation to tuberculosis screening of drug addicts and homeless persons in Rotterdam.

DNA fingerprinting of the mycobacterial cultures showed that a specific cluster had developed in Rotterdam with a substantial number of patients being drug addicted or homeless.

According to the quarterly reports of the National Institute of Public Health and the Environment (RIVM), this was the fastest growing and largest TB cluster in the Netherlands.

DNA Fingerprinting

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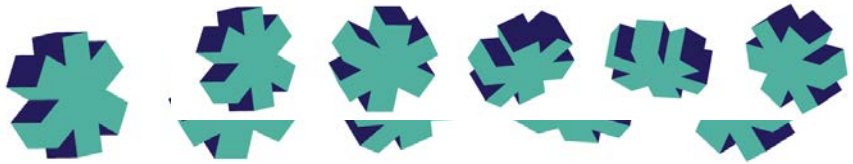
From contact investigation to tuberculosis screening of drug addicts and homeless persons in Rotterdam.

The mycobacterial RFLP pattern of the index case was unique i.e. not previously found in the Netherlands.

None of the **six** secondary TB cases had the same DNA fingerprint as the index patient.

Three DNA fingerprints among the **six** secondary TB cases



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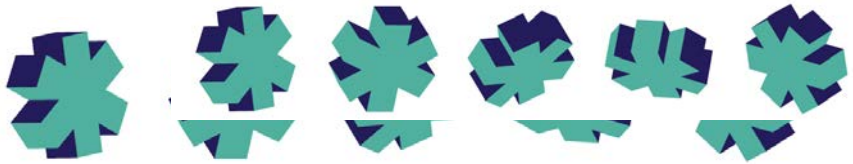
From contact investigation to tuberculosis screening of drug addicts and homeless persons in Rotterdam.

Early 2001 there were indications that TB was increasingly becoming a problem among drug addicts and homeless persons in Rotterdam:

18 staff members of institutions for illicit drug users and homeless persons were infected and needed preventive treatment during the extended contact investigation



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From contact investigation to tuberculosis screening of drug addicts and homeless persons in Rotterdam.

Is contact-tracing effective?

Or is targeted mobile digital X-ray screening a more appropriate intervention?

Mobile digital X-ray screening of homeless persons and illicit drug users

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Mobile digital screening

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Mobile digital screening

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Screening of illicit drug users and homeless persons

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Rotterdam June 2002

276 homeless drug users screened in one day

Mobile X-ray Unit

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Mobile X-ray Unit

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Homeless persons and illicit drug users screening

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Homeless persons and illicit drug users screening

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Mobile screening

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Homeless persons and illicit drug users screening

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Careless care-avoiders

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Careless care-avoiders

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Careless care-avoiders

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Careless care-avoiders

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Estimating the coverage of tuberculosis screening among drug users and homeless persons with truncated models.

Rob van Hest, Gerard de Vries, Filip Smit and Jan Hendrik Richardus.

Epidemiol Infect 2008;136:628-35.

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For a good coverage of TB screening among urban risk groups a good cooperation and commitment of the staff of the various services is indispensable!!!

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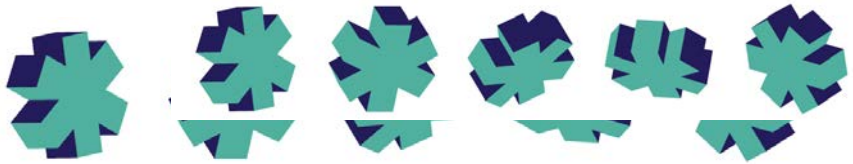
Rotterdam en omstreken

Estimating the coverage of tuberculosis screening among drug users and homeless persons with truncated models.

Rob van Hest, Gerard de Vries, Filip Smit and Jan Hendrik Richardus.

Epidemiol Infect 2008;136:628-35.

At least 63% - 75%



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Impact of mobile radiographic screening on tuberculosis among drug users and homeless pesrons.

Gerard de Vries, Rob van Hest and Jan Hendrik Richardus.

De Vries G, Van Hest R, Richardus JH. Impact of mobile radiographic screening on tuberculosis among drug users and homeless persons. Am J Resp Crit Care Med 2007; 176: 201-7

Rotterdam 1993 - 2005

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A total of 206 TB cases among illicit drug users and homeless persons in Rotterdam representing 11.4% of the total tuberculosis case-load of 1,807 TB patients

Rotterdam 1993 - 2007

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		n	%
1993	125	16	12.8
1994	137	10	7.3
1995	107	8	7.5
1996	125	13	10.4
1997	138	12	8.7
1998	129	12	9.3
1999	148	20	13.5
2000	135	14	10.4
2001	156	23	14.7
2002	146	24	16.4
2003	171	25	14.6
2004	164	18	11.0
2005	130	11	8.5
Total	1,811	206	11.4

Rotterdam 1993 - 2005

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Rotterdam en omstreken

Demographic and disease-related characteristics of illicit drug users and homeless persons with TB and cases without this risk profile

Illicit drug users and homeless persons with TB:

- were more often aged between 40-59 years
- were more often born in the Netherlands
- were more often HIV-coinfected

Rotterdam 1993 - 2005

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Rotterdam en omstreken

Demographic and disease-related characteristics of illicit drug users and homeless persons with TB and cases without this risk profile

Illicit drug users and homeless persons with TB:

- had more often pulmonary disease
- had more often positive sputum or bronchoalveolar fluid smears for acid-fast bacilli
- had more frequently clustered *M. tuberculosis* strains

Rotterdam 1993 - 2005

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Rotterdam en omstreken

Demographic and disease-related characteristics of illicit drug users and homeless persons with TB and cases without this risk profile

Illicit drug users and homeless persons with TB:

- were more often identified through active case-finding,

  such as contact investigation and screening.

Rotterdam 1993 - 2005

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Rotterdam en omstreken

Initial hospitalization was required in two-third of the TB cases among illicit drug users and homeless persons, due to the high proportion of infectious cases.

Rotterdam 1993 - 2005

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Rotterdam en omstreken

Fourteen patients (7%) were mandatory detained in a designated hospital for a mean period of 10 weeks (3-26 weeks) due to non-compliance with isolation

Screening results

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Rotterdam en omstreken

During the three years and eight months of the screening program, 8,559 chest X-rays were taken of 3,248 individuals

Screening results

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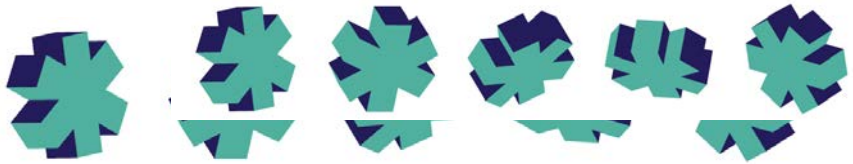
- Screening result 2002: 11/1545 (712/100,000)
- Screening result 2003: 10/2633 (380/100,000)
- Screening result 2004: 1/2300 (43/100,000)
- Screening result 2005: 6/1354 (369/100,000)

- In a period of three years screening (mid 2002 - mid 2005) 28 cases among hard drug users / homeless persons were identified: (incidence rate 327/100,000 screened persons)



TB trend among illicit drug users and homeless persons in Rotterdam

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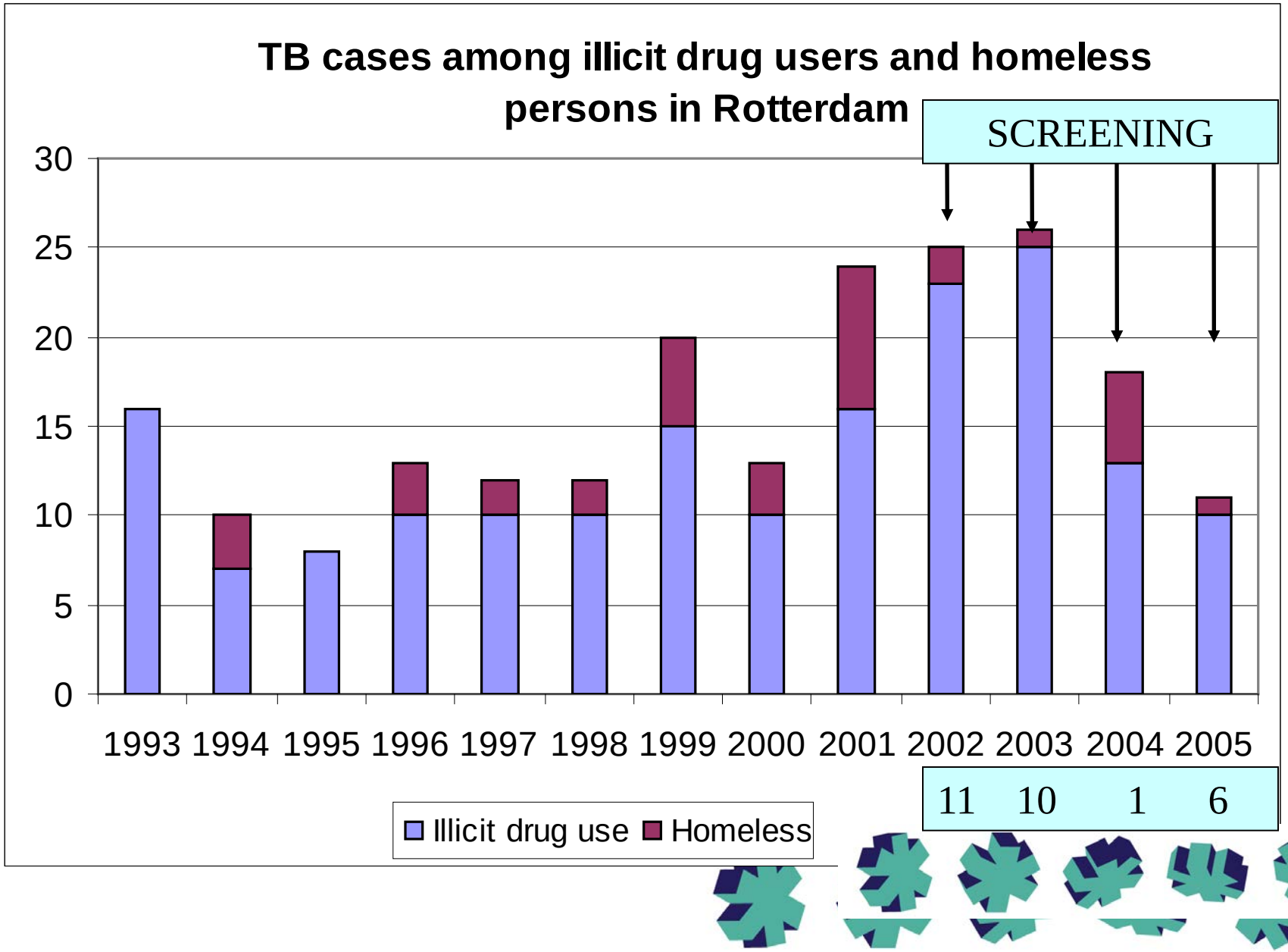
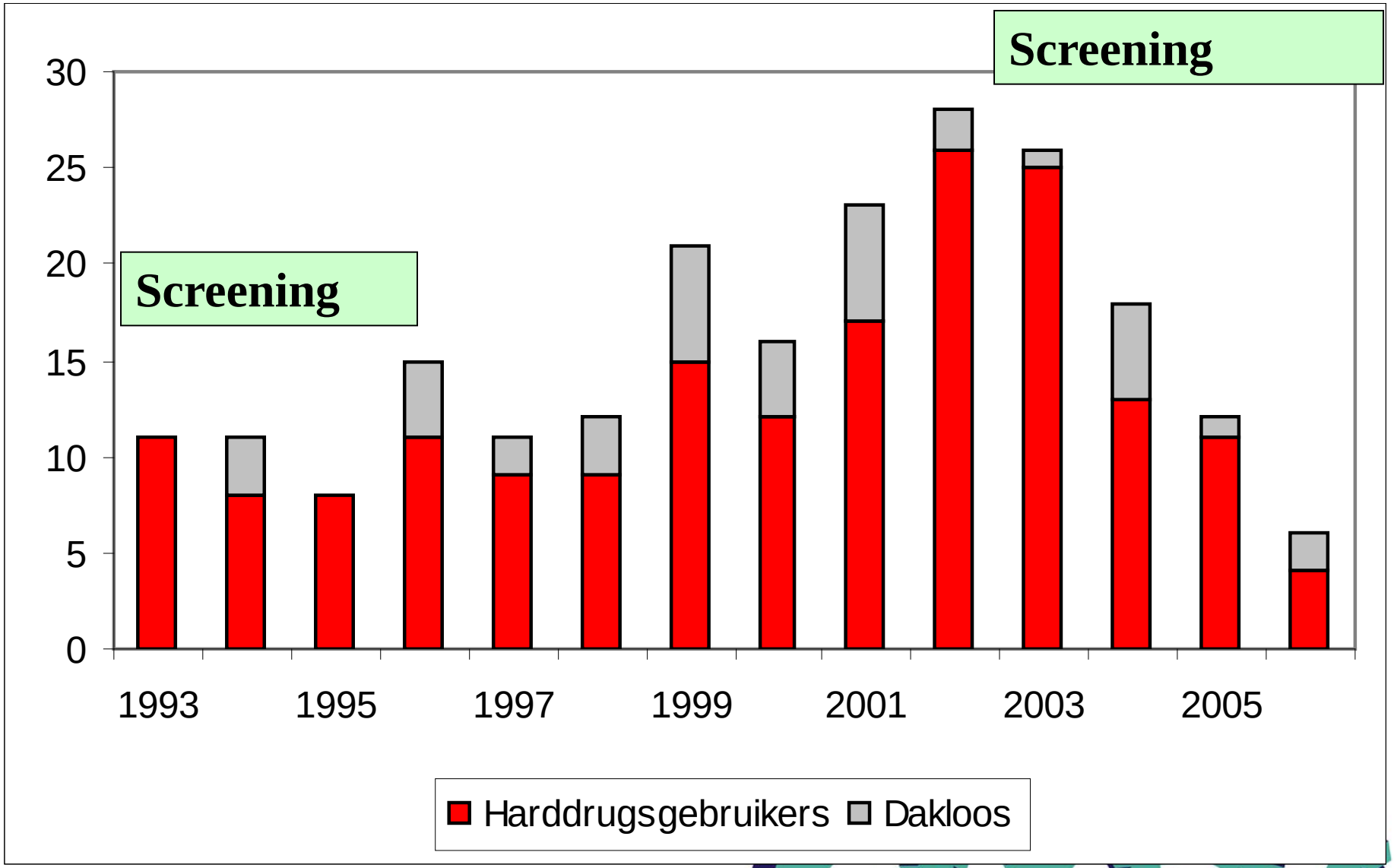
Rotterdam en omstreken



TB trend among illicit drug users and homeless persons in Rotterdam

GGD
Rotterdam en omstreken



Rotterdam cluster

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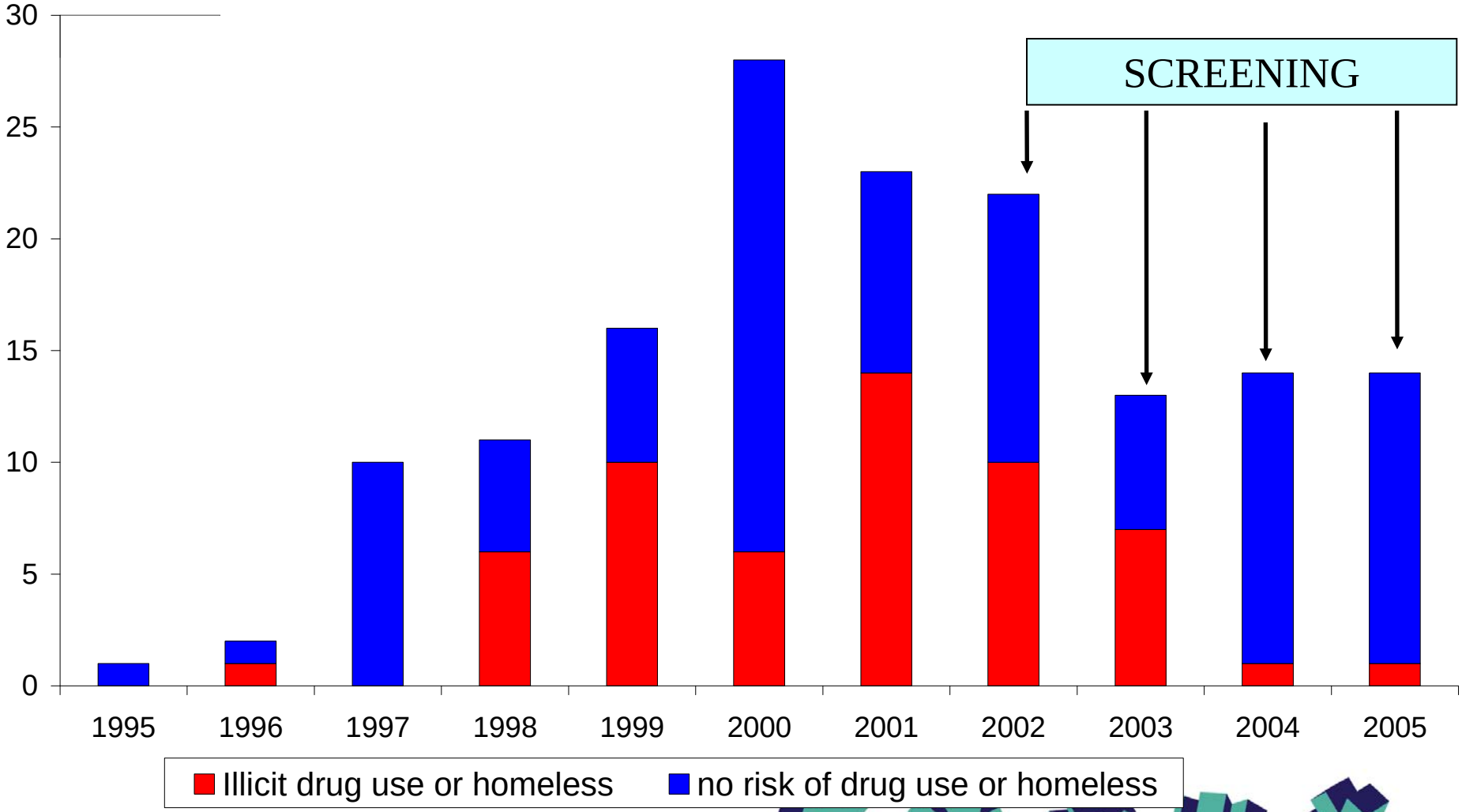
Cluster 510, by risk group (drug use or homeless)



Transmission

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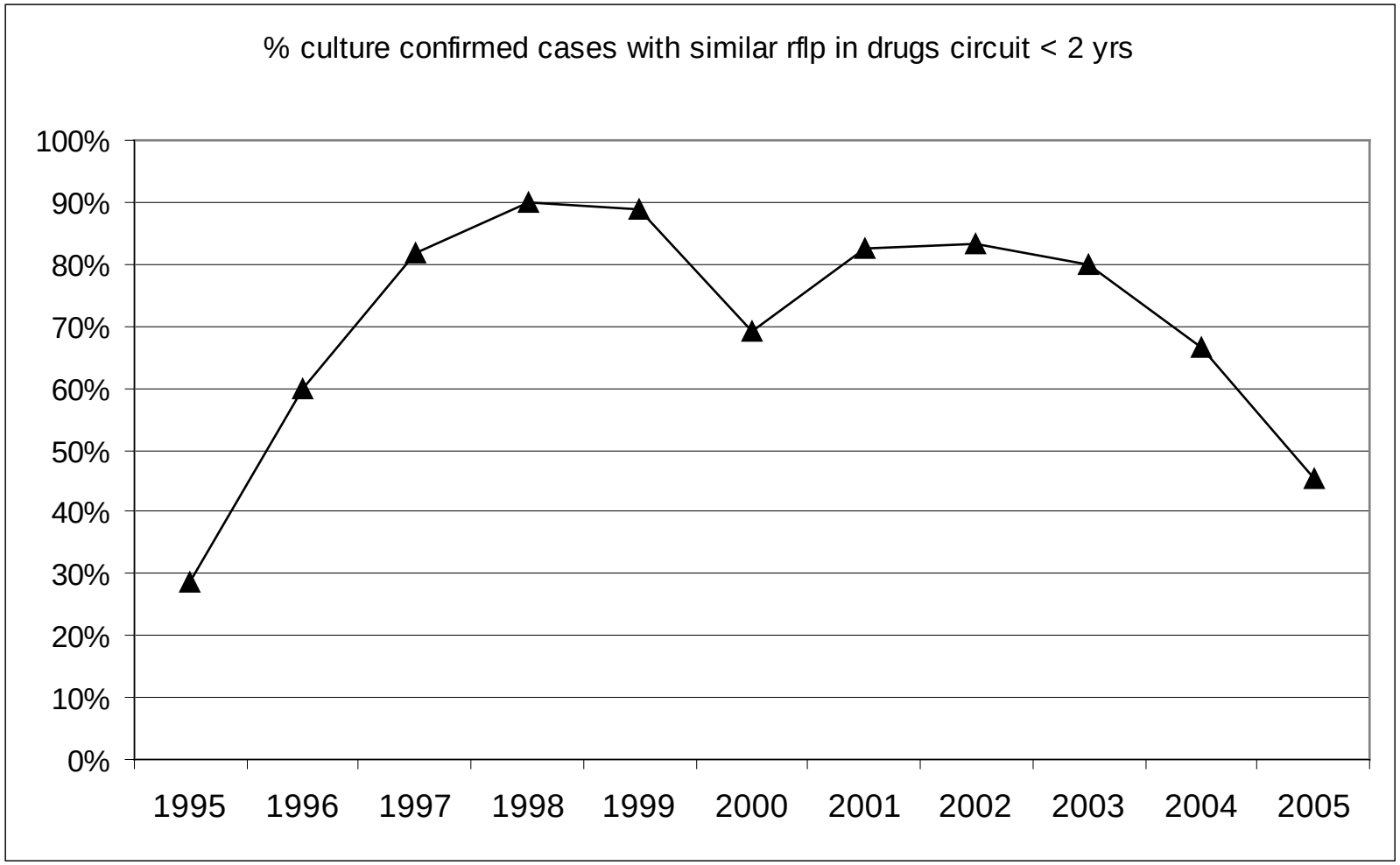

Treatment results

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25 out of the 28 cases (89,2%) identified through the mobile radiographic screening program completed treatment.

Conclusion

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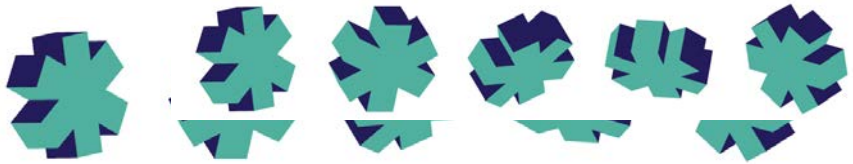
- There is a marked difference between TB in cities (Metropolitan TB) and TB in rural areas (both in numbers and in the characteristics of the patients).
- Cities have a disproportional number of immigrants and other risk groups such as illicit drug users and homeless persons.
- The crowding in a city and in certain places (e.g. pubs, shelters) enhances the spread of TB.



Conclusion

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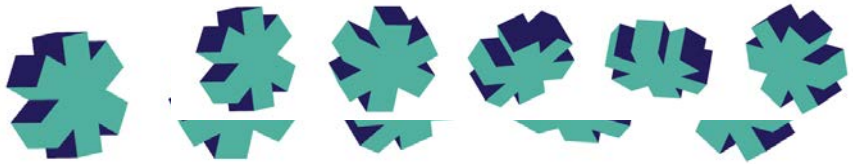
Rotterdam en omstreken

- A combination of appropriate and targeted interventions (DOT, MXU) are needed to address these aspects of Metropolitan TB.
- After the introduction of the targeted mobile digital X-ray TB screening programme among illicit drug users and homeless persons in Rotterdam (1) the number of TB cases, (2) their proportion of the total case-load and (3) the recent transmission indicator all reduced to pre-outbreak levels!!

Conclusion

GGD
Rotterdam en omstreken

- DNA fingerprinting is an indispensable tool to identify new risk groups and monitor the impact of interventions.
- The screening programme should be continued to prevent another resurgence of tuberculosis among illicit drug users and homeless persons in Rotterdam!!!!



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Metropolitan TB among homeless persons is a PAN-EUROPEAN problem

Metropolitan TB among homeless persons in Europe

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- **EU funded research or inventory**
- **More uniform approach and targeted interventions throughout EU**

Metropolitan TB among homeless mobile project in London

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Metropolitan TB among homeless mobile project in London

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