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NUHS National University Health System

Tuberculosis: a disease and social lens

Richard Coker

- ✓ **To understand the global epidemiology of tuberculosis over the past 5 years**
- ✓ **To understand the social drivers and public health responses to tuberculosis**
- ✓ **To understand why public health is political, and how an understanding of the social aspects of tuberculosis offer wider insights into political responses to many of the most marginalised populations (2 case studies: Russia; NYC)**

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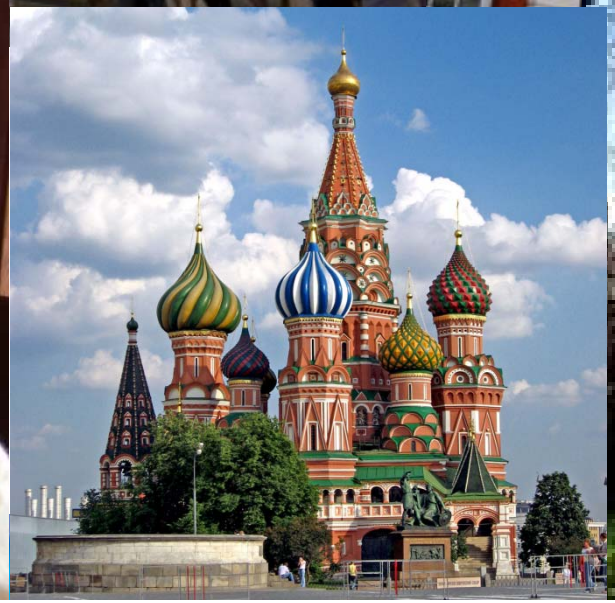

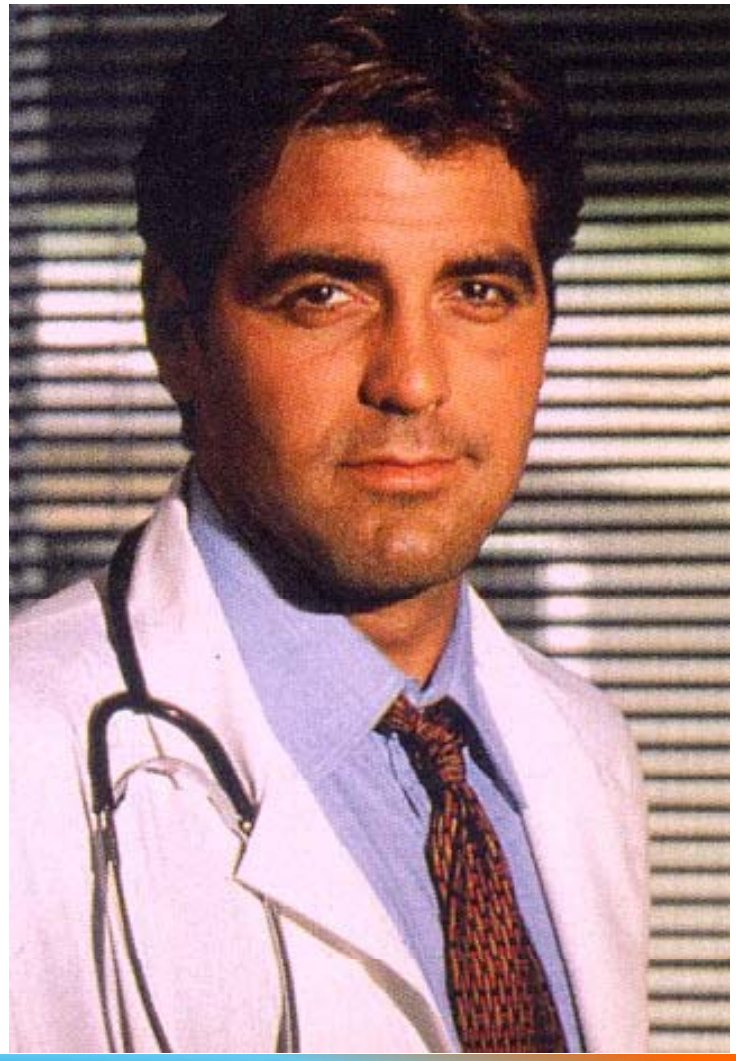

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Communicable Disease Report

Outbreak of hospital acquired multidrug resistant tuberculosis

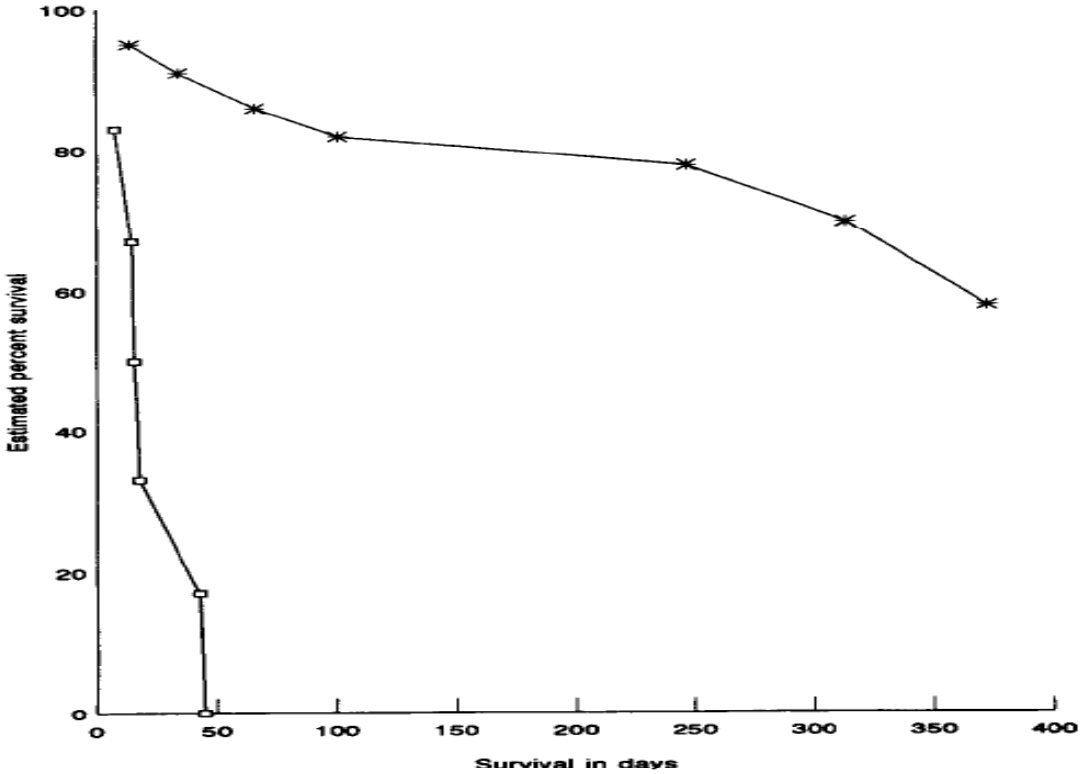

Figure 1. Estimated percent survival for those patients with multidrug-resistant tuberculosis who did (*) and did not (□) receive appropriate therapy for at least 2 consecutive weeks.

The Global Burden of TB -2009

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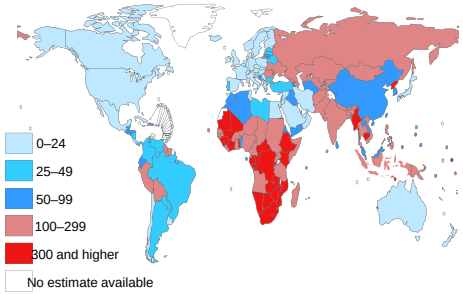


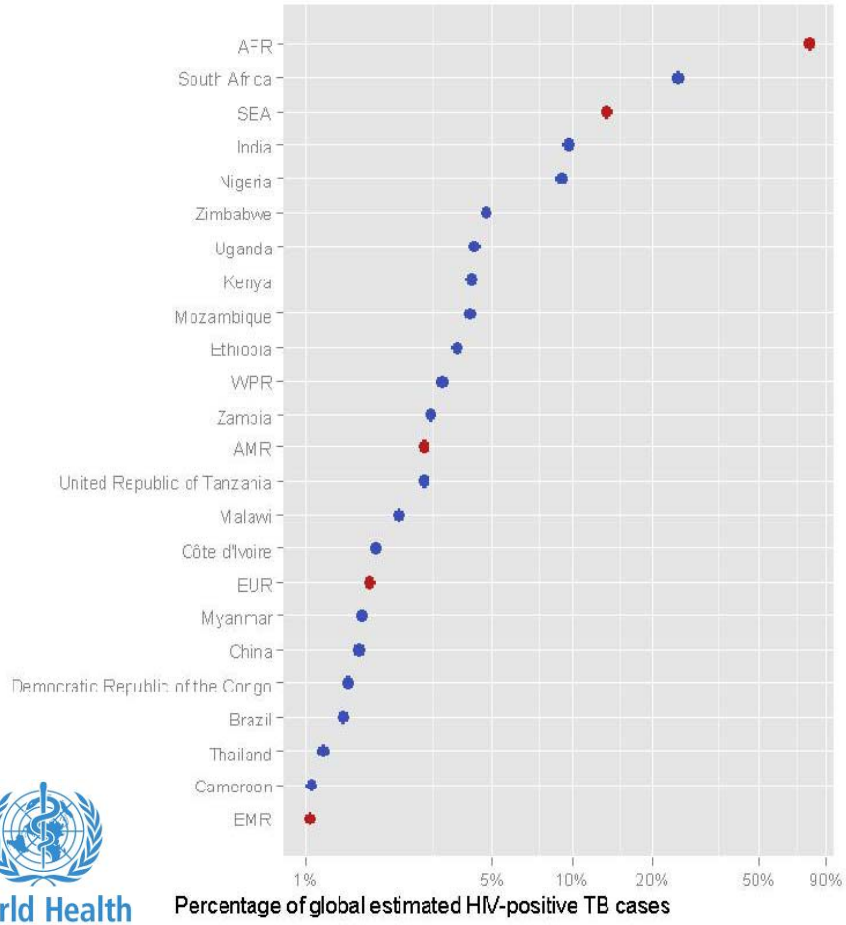
	Estimated number of cases	Estimated number of deaths
All forms of TB	9.4 million (range: 8.9–9.9 million)	1.7 million* (range: 1.5–2.0 million)
HIV-associated TB	1.1 million (12%) (range: 1.0–1.2 million)	380,000 (range: 320,000–450,000)
Multidrug-resistant TB (MDR-TB)	440,000 (range: 390,000–510,000)	about 150,000

**including deaths among PLHIV*

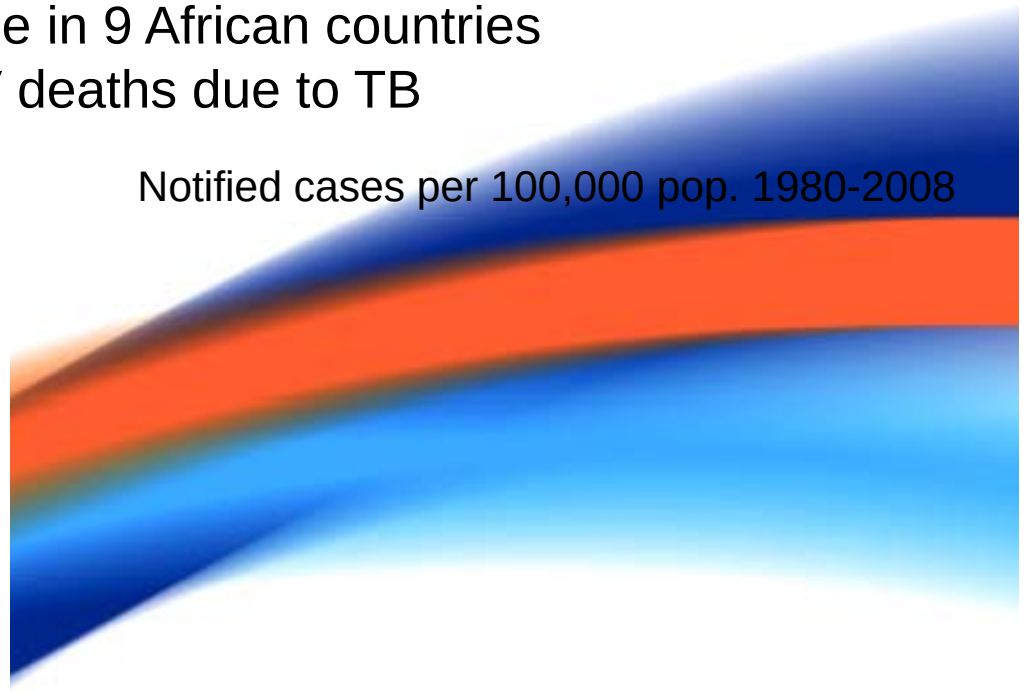
World Health Organization

Impact of HIV on TB in Africa

- 79% of all TB/HIV cases world-wide are in Africa
- 50% of all TB/HIV cases world-wide in 9 African countries
- 23% of the estimated 2 million HIV deaths due to TB

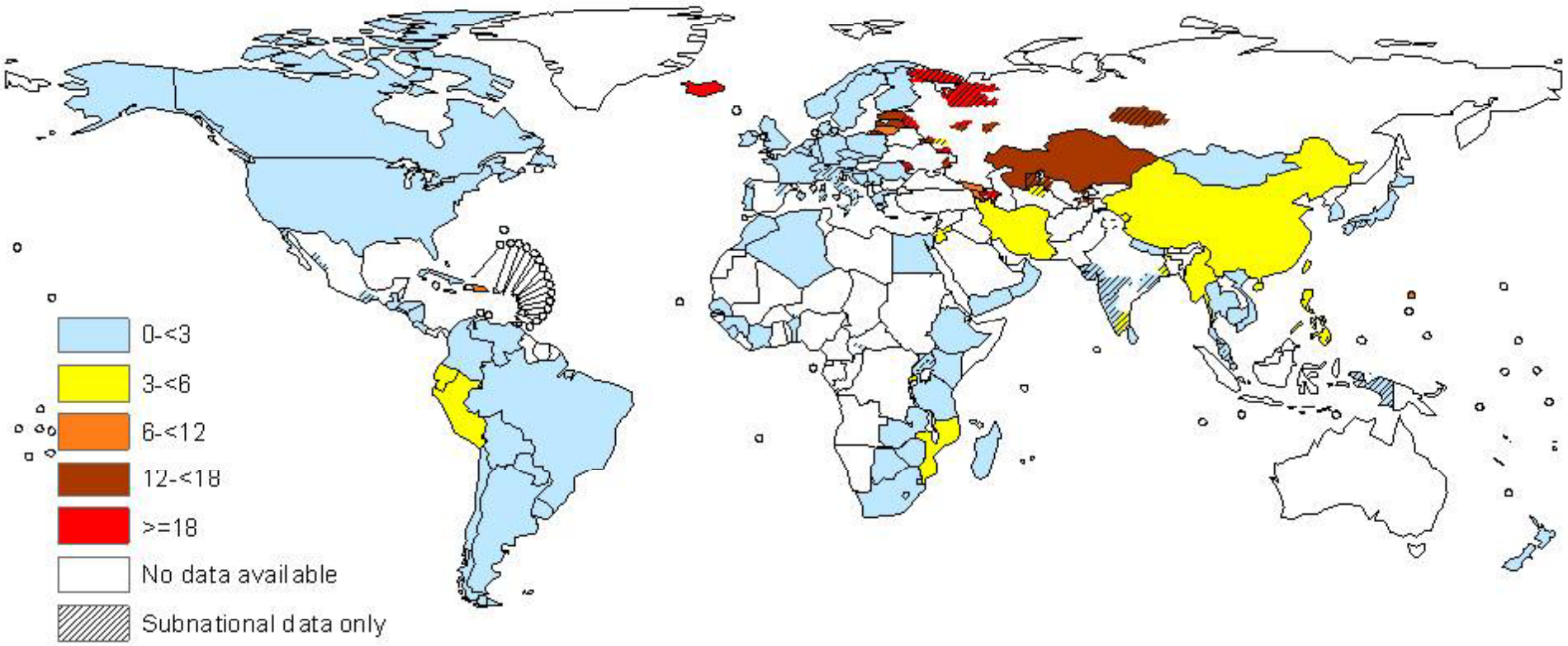


Notified cases per 100,000 pop. 1980-2008



World Health Organization

% MDR-TB among new TB cases, 1994-2009



Australia, Democratic Republic of the Congo, Fiji, Guam, New Caledonia, Solomon Islands and Qatar reported data on combined new and previously treated cases.

World Health Organization

The global response: Stop TB Strategy & Global Plan

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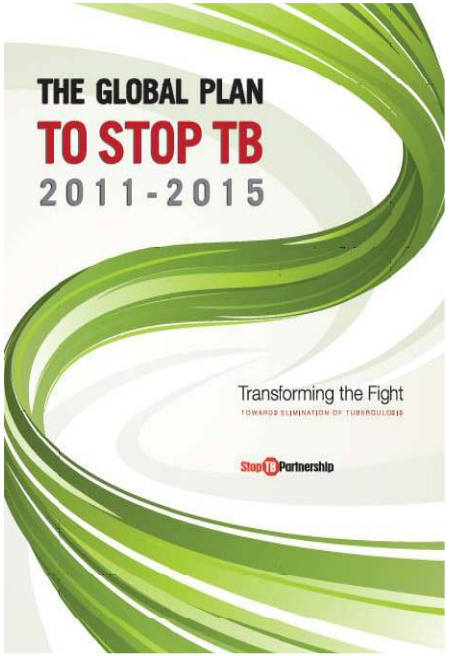
1. Pursue high-quality DOTS expansion
2. Address TB-HIV, MDR-TB, and needs of the poor and vulnerable
3. Contribute to health system strengthening
4. Engage all care providers
5. Empower people with TB and communities
6. Enable and promote research

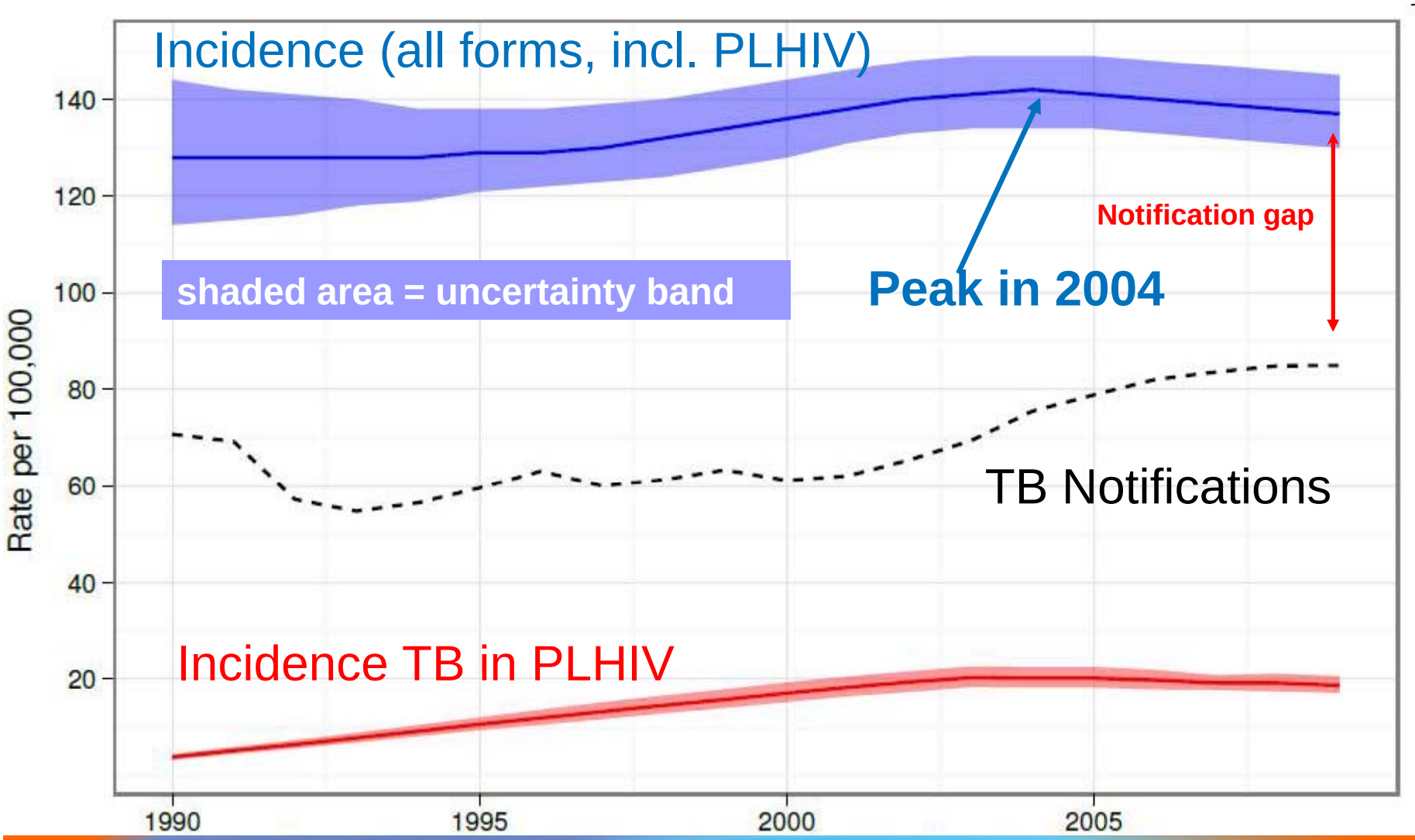
To save lives, prevent suffering, protect the vulnerable, & promote human rights



Achievements thus far

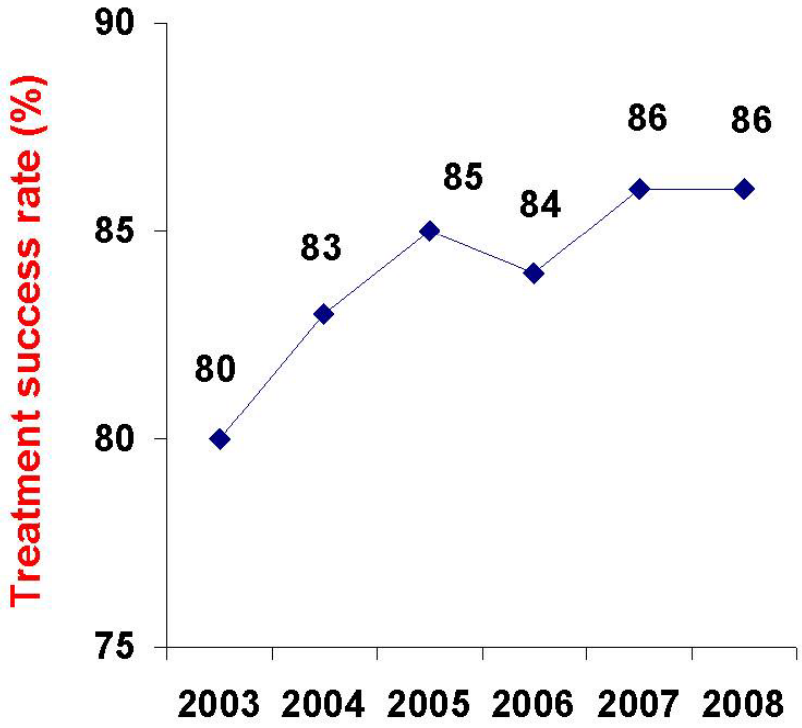
- 41 million patients cured, 1995-2009
- 6 million deaths averted compared to 1995 care standards
- Mortality reduced by 35% since 1990
- Cure rates >85%, care for TB/HIV improving
- 50% mortality targets on track globally
- 2015 MDG target on track: global TB incidence peaked in 2004
- But…. TB incidence declining too slowly, case detection stagnating, and MDR-TB care only now starting scale-up

Incidence rates falling globally after peak in 2004, but only at <1%/year

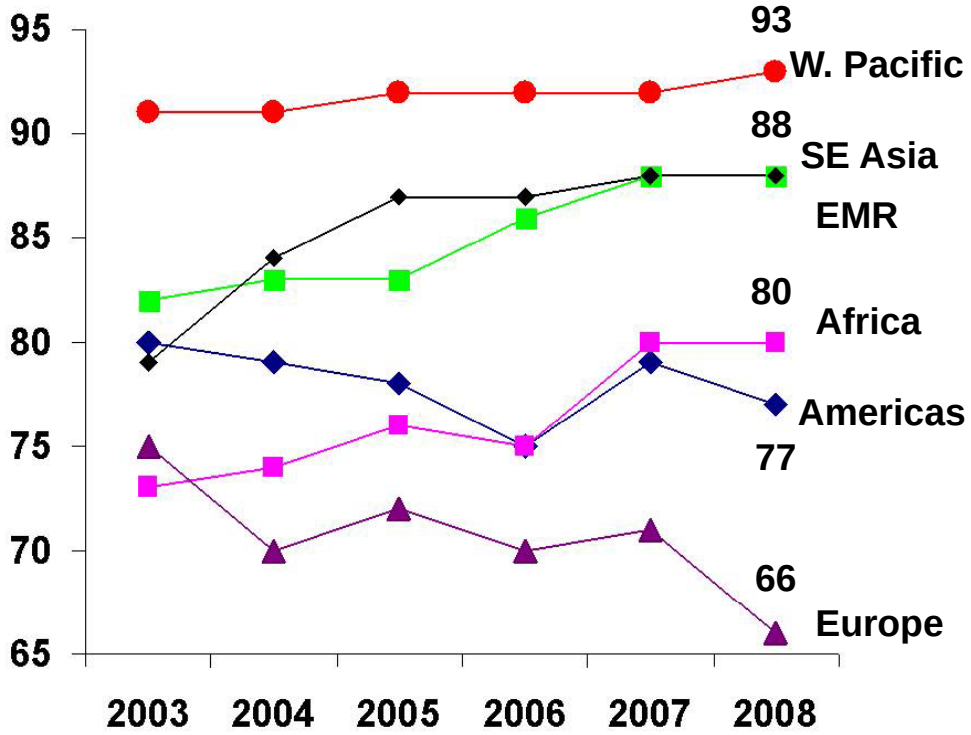


Treatment success 86% globally

Global



WHO Regions



Progress in most regions, but Europe lagging behind

Funding for TB control increasing

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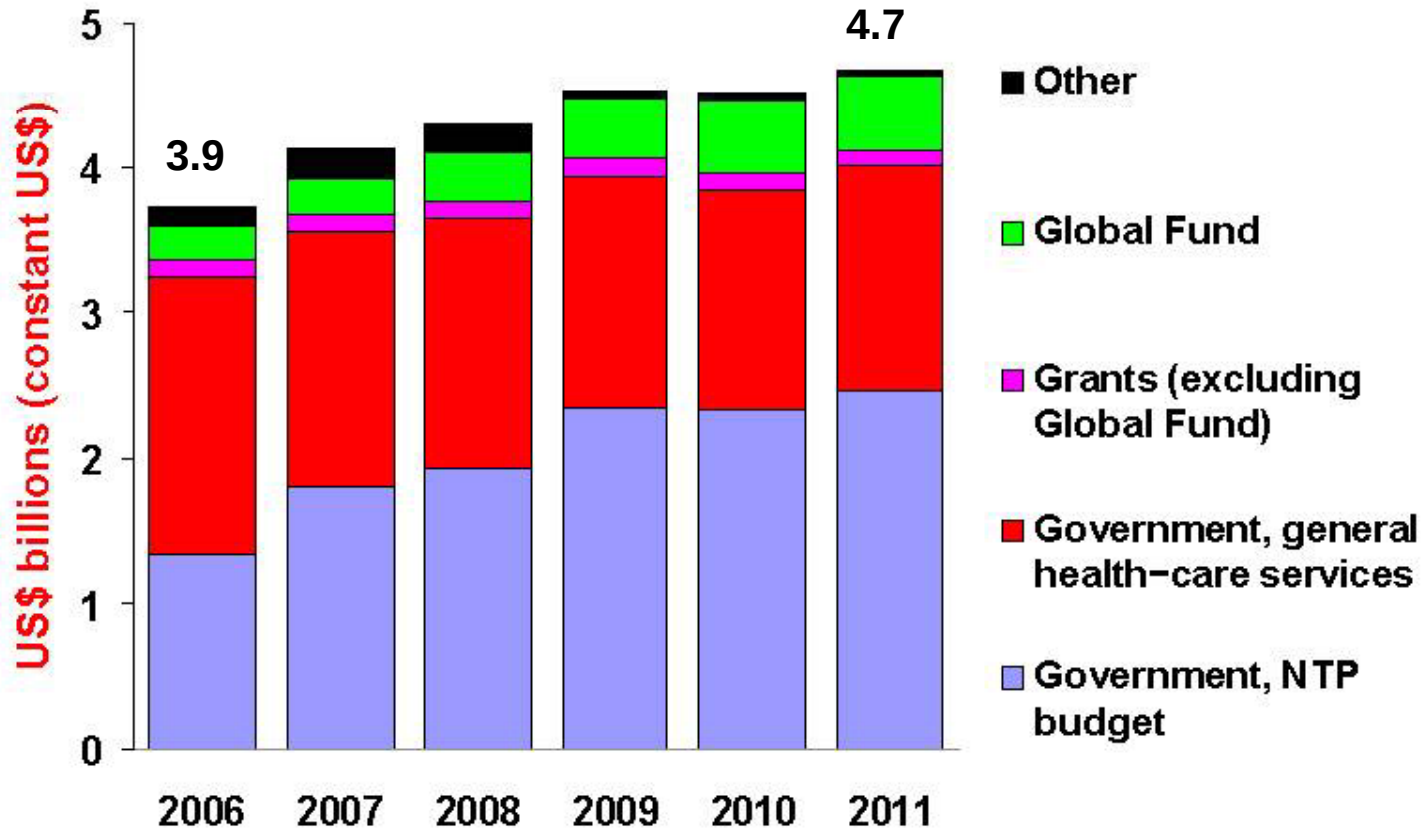
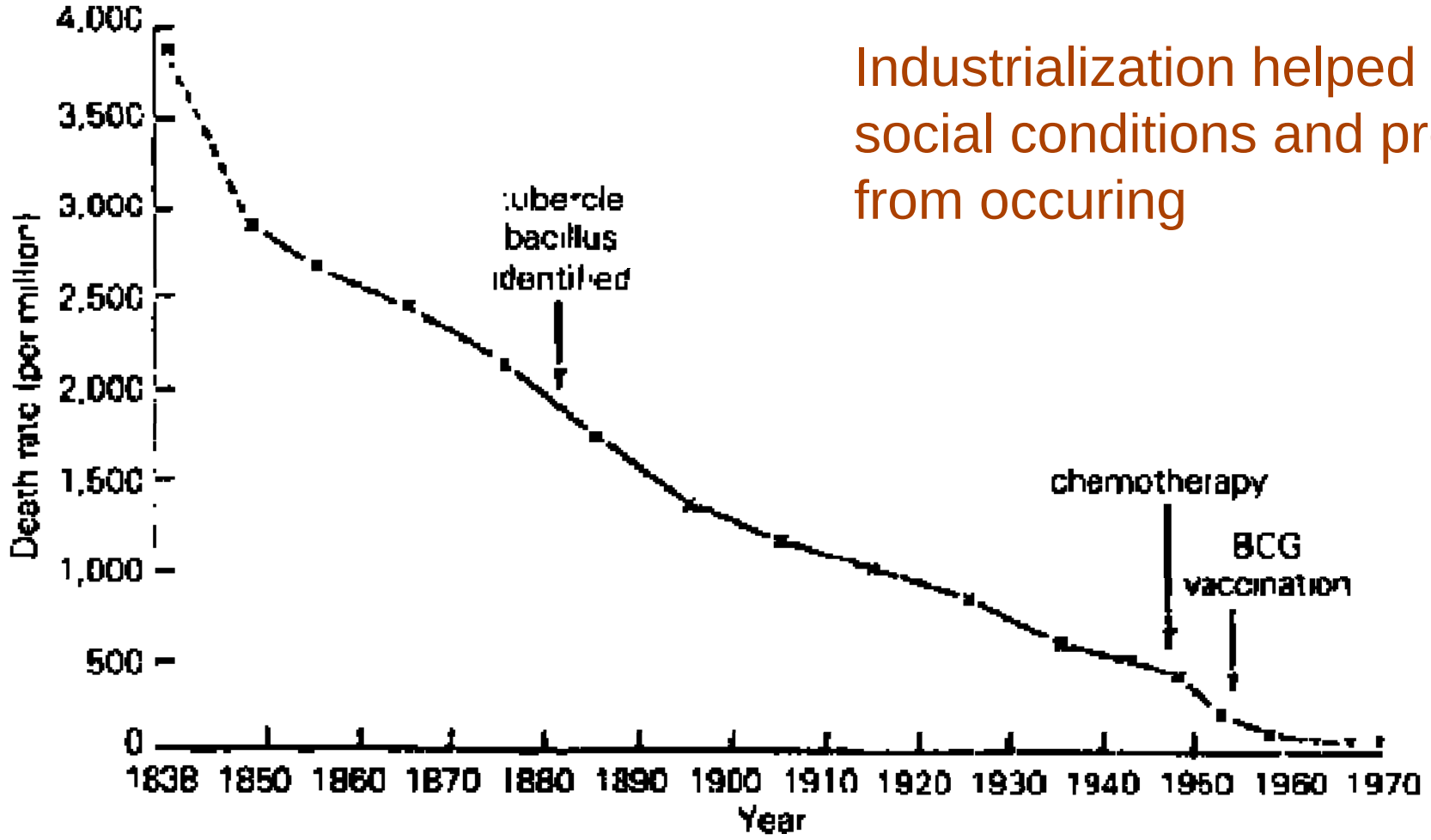


What are the challenges if we seriously target "elimination"?

1. Funding not secure
2. Only 61% of all estimated cases reported
3. TB/HIV major impact in Africa
4. MDR-TB burden serious in former USSR and China

1. XDR-TB
2. Weak health policies, systems and services
3. Non-state practitioners un-engaged

Industrialization helped improved social conditions and prevents TB from occuring



Population attributable fraction – Selected Risk Factors & Determinants

	Relative risk for active TB disease	Weighted prevalence (22 HBCs)	Population Attributable Fraction in Adults
HIV infection	20.6/26.7*	1.1%	**19%**
Malnutrition	3.2**	16.5%	**27%**
Diabetes	3.1	3.4%	**6%**
Alcohol use (>40g / d)	2.9	7.9%	**13%**
Active smoking	2.6	18.2%	**23%**
Indoor Air Pollution	1.5	71.1%	**26%**

Sources: Lönnroth K, Raviglione M. Global Epidemiology of Tuberculosis: Prospects for Control. Semin Respir Crit Care Med 2008; 29: 481-491. *Updated data in GTR 2009. RR=26.7 used for countries with HIV <1%. **Updated data from Lönnroth et al. A consistent log-linear relationship between tuberculosis incidence and body-mass index.

History

- ✓ **TB emerged as a major cause of morbidity and mortality during 17th century feudal Europe with growth of crowded cities and widespread poverty**
- ✓ **Peaked in late 18th century causing 25% of all deaths, the "White Plague"**
- ✓ **Robert Koch discovered *Mycobacterium tuberculosis* and proved it was the cause of TB in 1882, later developing diagnostic tests**
  - ★ ***"If the number of victims which a disease claims is the measure of its significance, then all diseases, particularly the most dreaded infectious diseases, such as Bubonic Plague, Asiatic Cholera, et cetera, must rank far behind Tuberculosis."***

    –Robert Koch, 1882

Dubos

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“Tuberculosis is a social disease, and presents problems that transcend the conventional medical approach…its understanding demands that the impact of social and economic factors on the individual be considered as much as the mechanisms by which tubercle bacilli cause damage to the human body.”

The White Plague

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- ✓ **Dramatic decrease in TB mortality in the 20th century:**
  - ★ **A consequence of control measures or improved standard of living?**
  - ★ **A "luxury of prosperous communities"?**

The White Plague

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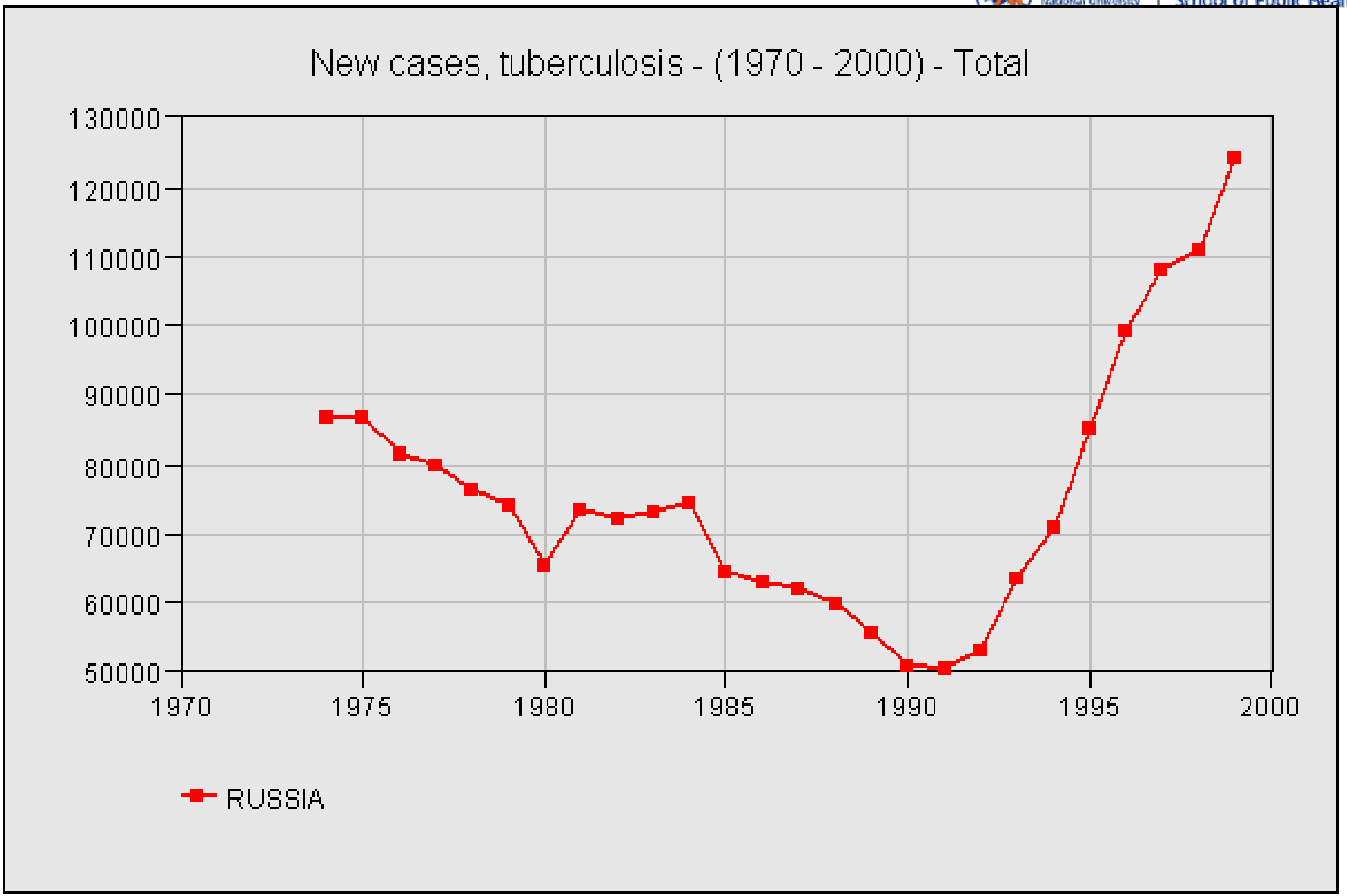
"Public health is purchasable. Within natural limitations, any community can determine its own death rate."

Hermann Biggs

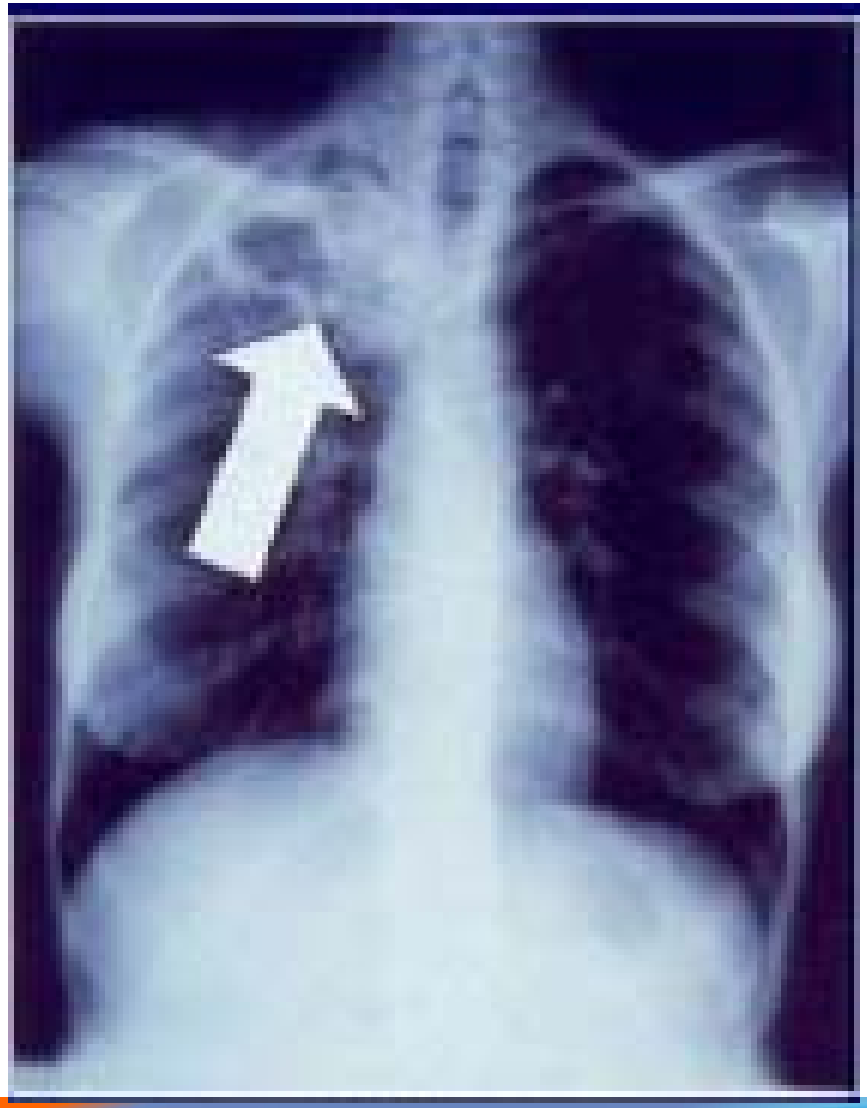
RUSSIA


IMAL H

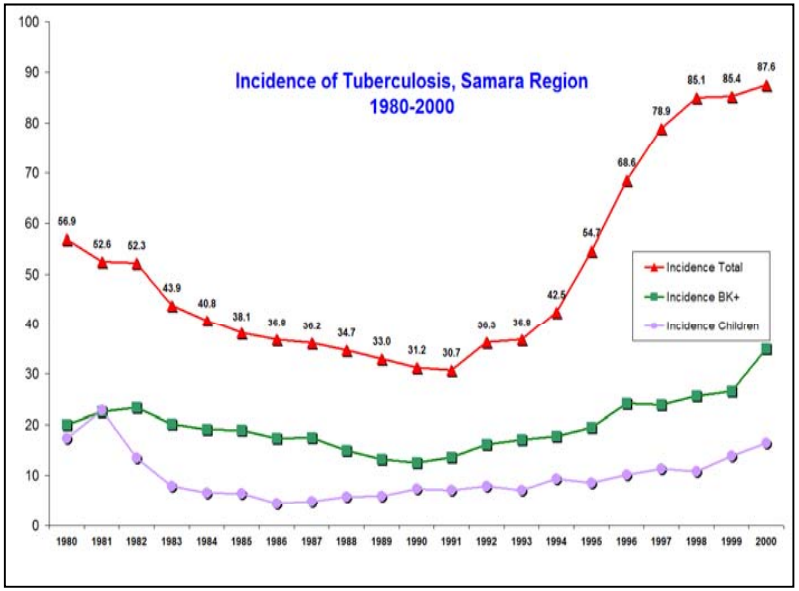

New cases, tuberculosis - (1970 - 2000) - Total
130000
120000
110000
100000
90000
80000
70000
60000
50000
1970
1975
1980
1985
1990
1995
2000
RUSSIA

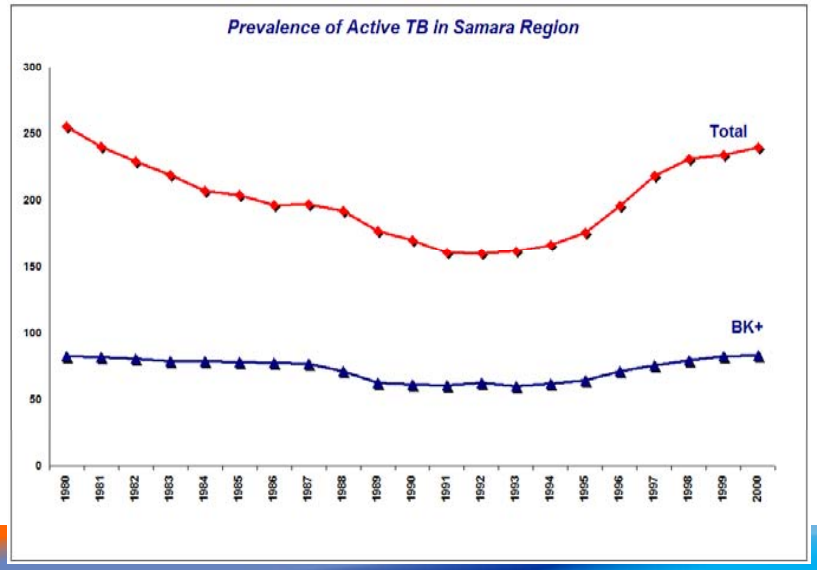

Saint-Petersburg
Moscow


Togliatti
Zhigulevsk
Samara
Pokhvistnevo
Kinel
Chapaevsk
Samarskaya oblast
Ulyanovskaya oblast
Orenburgskaya oblast
Kazakhstan



Source: regional TB register





- ✓ **The region of Samara**
  - **New cases ~2,500 annually**
  - **Pulmonary TB – 92%**
  - **More than 50% - smear negative**
  - **From the newly detected pulmonary cases 15-20% will die within four years**
    - **>500 death annually**
  - **High proportion of MDR TB among new notification and in the prevalent cases**

✓Drug resistant TB

New cases	**Prison and civilian (N-948)**	**Prison (N-184)**	**Civil (N-764)**	**OR (95%CI)**	**RR (95%CI)**
Inh*	236 (24.9%)	90 (48.9%)	146 (19.1%)	3.6 (2.5-5.1)	2.6 (2.0-3.2)
Rif*	192 (20.3%)	71 (38.6%)	121 (15.8%)	3.0 (2.1-4.2)	2.4 (1.9-3.1)
MDR TB*	164 (17.3%)	69 (37.5%)	95 (12.4%)	3.8 (2.6-5.5)	3.0 (2.3-3.9)
S*	215 (22.7%)	91 (49.5%)	124 (16.2%)	4.5 (3.2-6.4)	3.0 (2.5-3.8)
E*	115 (12.1%)	44 (23.9%)	71 (9.3%)	2.7 (1.8-4.2)	2.6 (1.8-3.6)
Relapses	**Prison and civilian (N- 94)**	**Prison (N-18)**	**Civil (N-76)**	**OR (95%CI)**	**RR (95%CI)**
Inh*	38 (40.4%)	16 (88.9%)	22 (28.9%)	16.4 (3.5-77.6)	3.1 (2.1-4.5)
Rif*	38 (40.4%)	15 (83.3%)	23 (30.3%)	10.0 (2.5-36.5)	2.8 (1.9-4.10
MDR TB*	32 (34.0%)	15 (83.3%)	17 (22.4%)	14.7 (3.8-57.1)	3.7 (2.3-5.9)
S*	34 (36.2%)	16 (88.9%)	18 (23.7%)	21.8 (4.5-104.3)	3.8 (2.4-5.8)
E*	23 (24.5%)	12 (66.7%)	11 (14.5%)	10.2 (3.1-32.9)	4.6 (2.4-8.7)

Balabanova Y, Drobniewski F, Fedorin I, Zakharova S, Nikolayevskyy V, Atun R, Coker R. The Directly Observed Therapy Short-Course (DOTS) strategy in Samara Oblast, Russian Federation.. Resp Res 2006; 7: 44-

Risk factors for TB

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- ✓ **Case control study (334 cases and controls)**
  - ★ **Univariate odds ratios**
    - **Accumulated wealth (16.70)**
    - **Financial insecurity (5.67)**
    - **Unpasteurised milk (3.58) [PAR 18%]**
    - **Diabetes (2.66)**
    - **Relative with TB (2.94)**
    - **Unemployed (6.10) [PAR 28%]**
    - **Overcrowded (2.99)**
    - **Illicit drug use (8.74)**
    - **SIZO Hx (5.70) [PAR 2%]**
    - **Prison (12.50) [PAR 0.8%]**

Coker R, McKee M, Atun R, Dimitrova B, Dodonova E, Kuznetsov S, Drobniewski F. Risk factors for pulmonary tuberculosis in Russia: case-control study. BMJ 2006; 332: 85-7.

Coker RJ, Dimitrova B, Drobniewski F, Samyshkin Y, Balabanova Y, Kuznetsov S, Fedorin I, Melentsiev A, Marchenko G, Zakharova S, Atun R. Tuberculosis control in Samara Oblast, Russia: institutional and regulatory

environment. IJTLD 2003; 10: 920-32.

Staffing and beds

- ✓ 850 inpatient beds
- ✓ 80 children's TB beds
- ✓ 60 (of 1690) psychiatric beds dedicated to TB
- ✓ 354 TB nurses
- ✓ approx. 200 TB doctors

Incidence of TB among HCWs by setting in Samara Oblast

Setting	Incidence of TB per 100,000 person years (95% confidence interval)	Incidence rate ratio (95% confidence interval)
Health care workers in GHS	68.8 (55.4 to 85.4)	reference
TB health care workers	741.6 (413.3 to 1330.8)	10.8 (6.0 to 19.4)
By category of TB facility:		
TB outpatient	*317.0 (162.6 to 618.0)*	*4.6 (2.3 to 9.3)*
TB outpatient & inpatient	*823.4 (570.2 to 1188.9)*	*12.0 (7.8 to 17.7)*
TB inpatient	*1216.7 (845.7 to 1750.5)*	*17.7 (11.6 to 27.0)*

Dimitrova B, Hutchings A, Atun R, Drobniewski F, Marchenko G, Zakharova S, Fedorin I, Coker RJ. Increased risk of tuberculosis among health care workers in Samara Oblast, Russia: analysis of notification data. IJTLD 2005; 9: 43-8.

Health System Organisation and financing

- ✓ TB control system is fragmented into four vertical systems:
  - (a) screening services based on X-Ray fluorography;
  - (b) penitentiary tuberculosis control system;
  - (c) hospital based services and;
  - (d) PHC based services.
- ✓ Hospitals and ambulatory care services financed separately-no links

Tarrifs and DRGs

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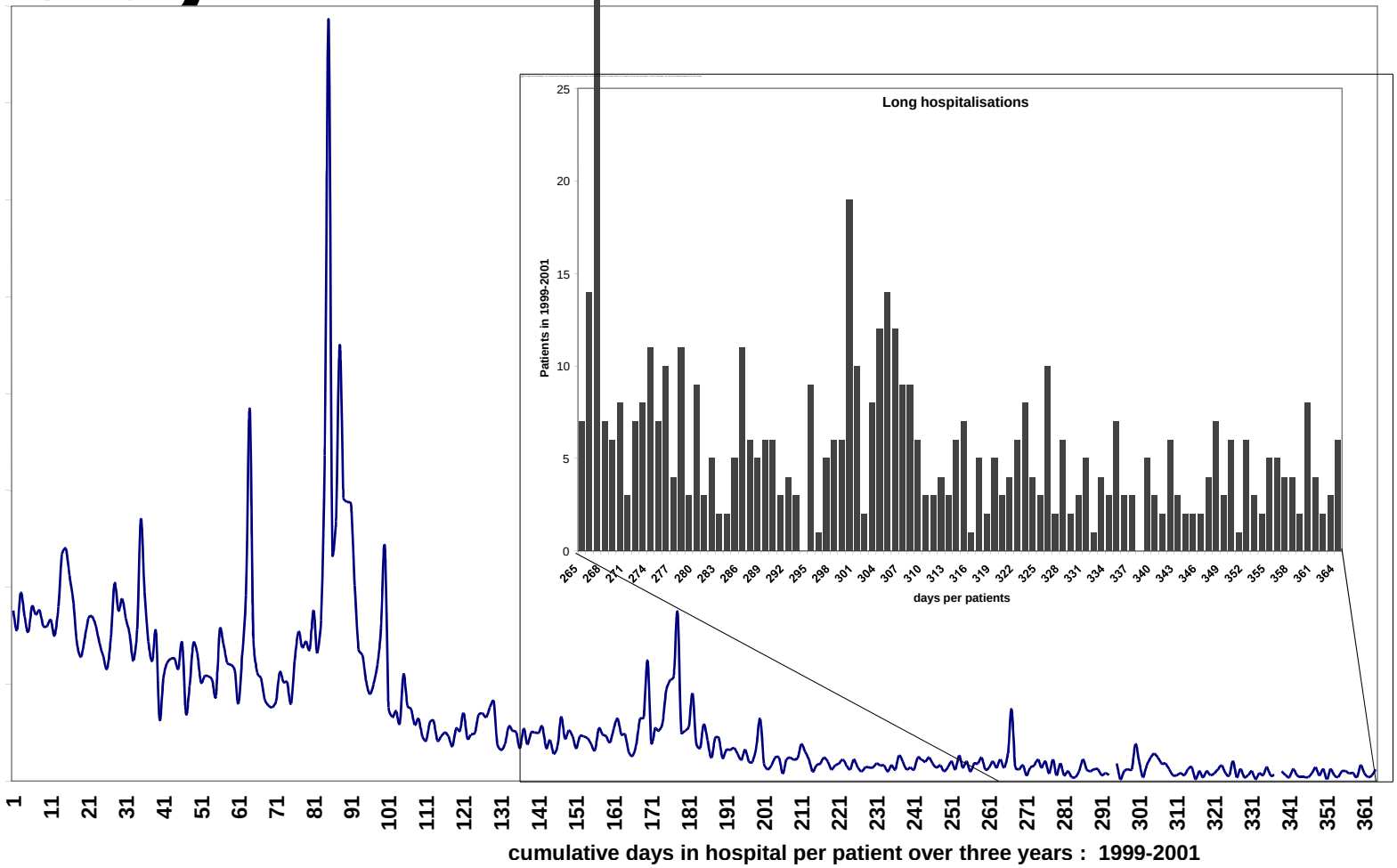
Table 3 Tariffs associated with diagnosis-related groups

DRG	Pulmonary tuberculosis in-patient care in TB hospitals	ALOS	DRG rate	Rate per day, RR*
120216	Uncomplicated pulmonary TB	85	6 987	82.2
120217	Pulmonary TB, disseminated forms	89	8 150	91.57
120217	TB patients who did not receive a full course of treatment	25	2 406	96.24
120218	Extra-pulmonary TB	35	3 490	99.71
120219	Pulmonary TB and other pulmonary pathology, medical treatment, including with co-morbidity and examined for TB	16.9	3 231	191.2
120219	Pulmonary TB and other pulmonary pathology, medical treatment, course not completed	5.9	1 128	191.2
120220	Differential diagnosis patients with acute pulmonary pathology, spontaneous pneumothorax and pulmonary bleeding	33.9	6 481	191.2
120221	Primarily diagnosed pulmonary TB with localised and disseminated pathologies; chronic TB in exacerbation phase treated with intensive methods	76.3	14 588	191.2
120222	Pulmonary surgery for TB and other pulmonary pathology with the size of resection at least one lung segment	50.8	10 361	204.0
120223	Pulmonary surgery for TB and other pulmonary pathology, with severe co-morbidity and large size of resection; also palliative surgery and bronchiectatic disease	90	20 742	230.5
120224	Pleural empyema, TB pleurisy	118.6	24 189	204.0

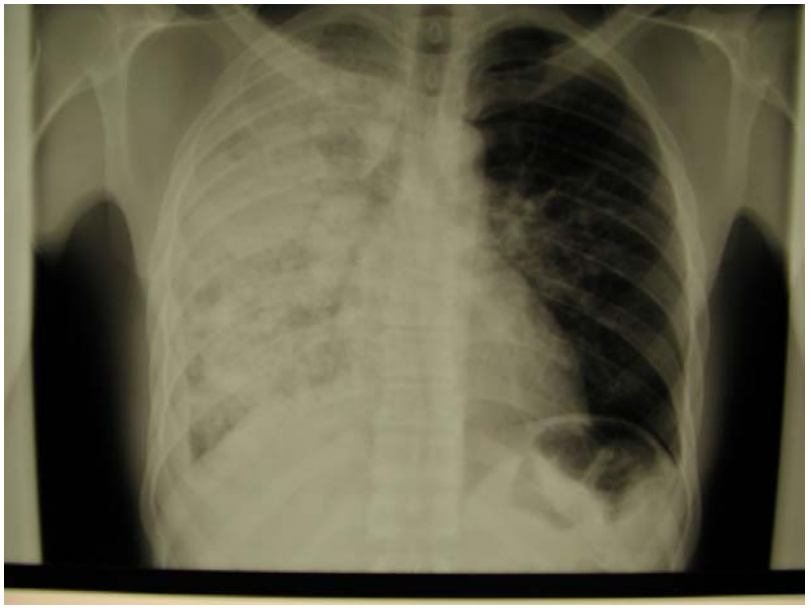
Source: Health Insurance Fund payment rates, Samara Oblast Tuberculosis Dispensary.
* At time of analysis RR to US$ exchange was 29.5.
DRG = diagnosis-related group; ALOS = average length of stay; RR = Russian roubles.

- ✓ **Coker RJ, Dimitrova B, Drobniewski F, Samyshkin Y, Balabanova Y, Kuznetsov S, Fedorin I, Melentsiev A, Marchenko G, Zakharova S, Atun R. Tuberculosis control in Samara Oblast, Russia: institutional and regulatory environment. IJTLD 2003; 10: 920-32.**

Cumulative hosp. length of stay



Atun R, Samyshkin YA, Drobniewski F, Kuznetsov SI, Fedorin IM, Coker RJ. Social factors influencing hospital utilisation by tuberculosis patients in the Russian Federation: analysis of routinely collected data. IJTLD 2005; 9: 1140-6.



Perverse incentives

- ✓ **Screening without clear benefit**
- ✓ **Unnecessary hospitalisations**
- ✓ **Unnecessary long-term observations**
- ✓ **Focus on volume of service rather than outcomes**

Key problems

- ✓ Health system financing based on historic budgets and retrospective data rather than ‘true’ need
- ✓ RA ignores the rapidly changing profile of the case-mix in tuberculosis burden with the likely increasing burden of multi drug resistant tuberculosis
- ✓ RA unlinked to clinical outcomes and poor linkage to clinical need (cf social need)
- ✓ Hospitals get lions share of the budget

Atun R, Samyshkin YA, Drobniewski F, Kuznetsov SI, Fedorin IM, Coker RJ. Social factors influencing hospital utilisation by tuberculosis patients in the Russian Federation: analysis of routinely collected data . IJTLD 2005; 9: 1140-6

Repeated hospitalisations

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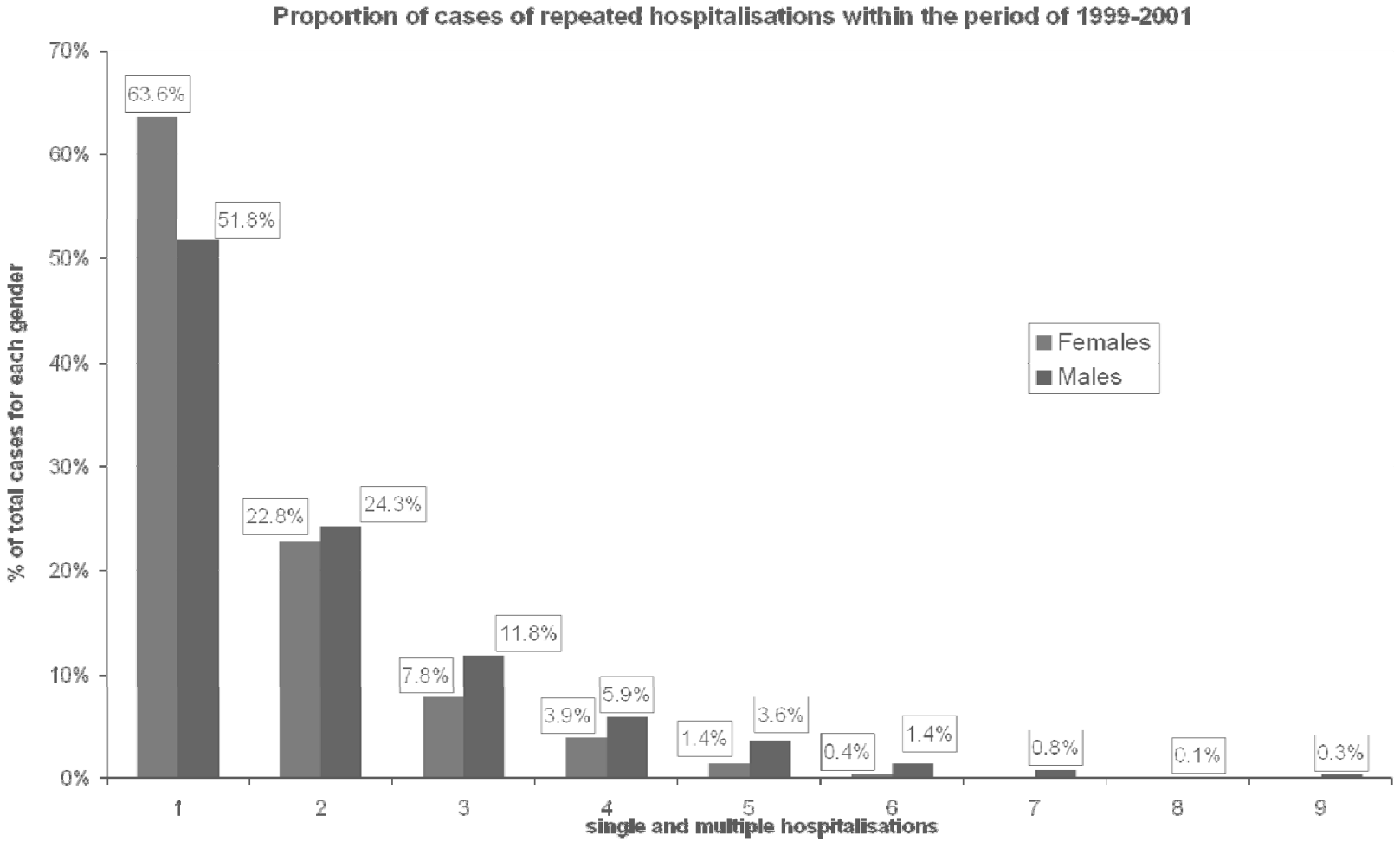
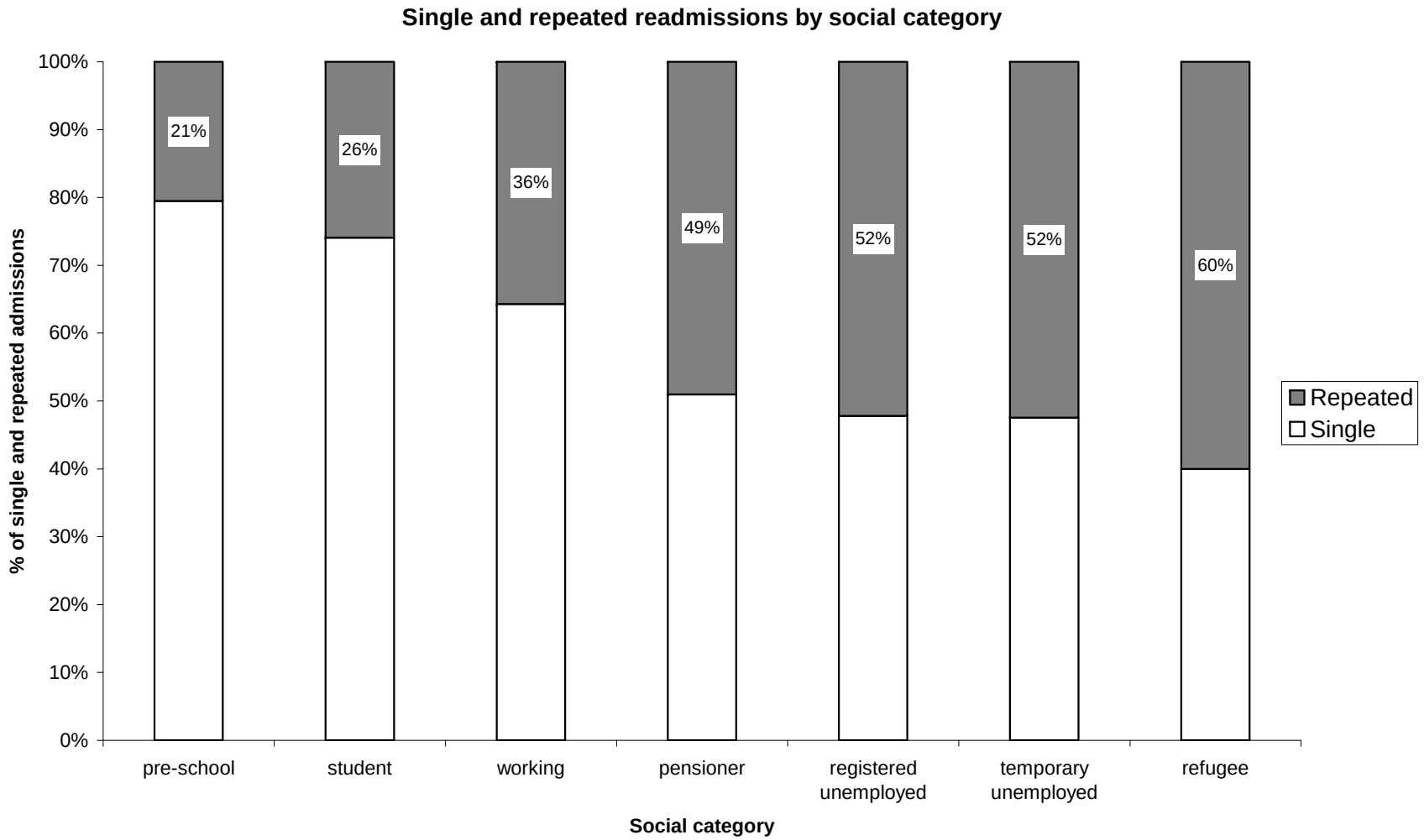
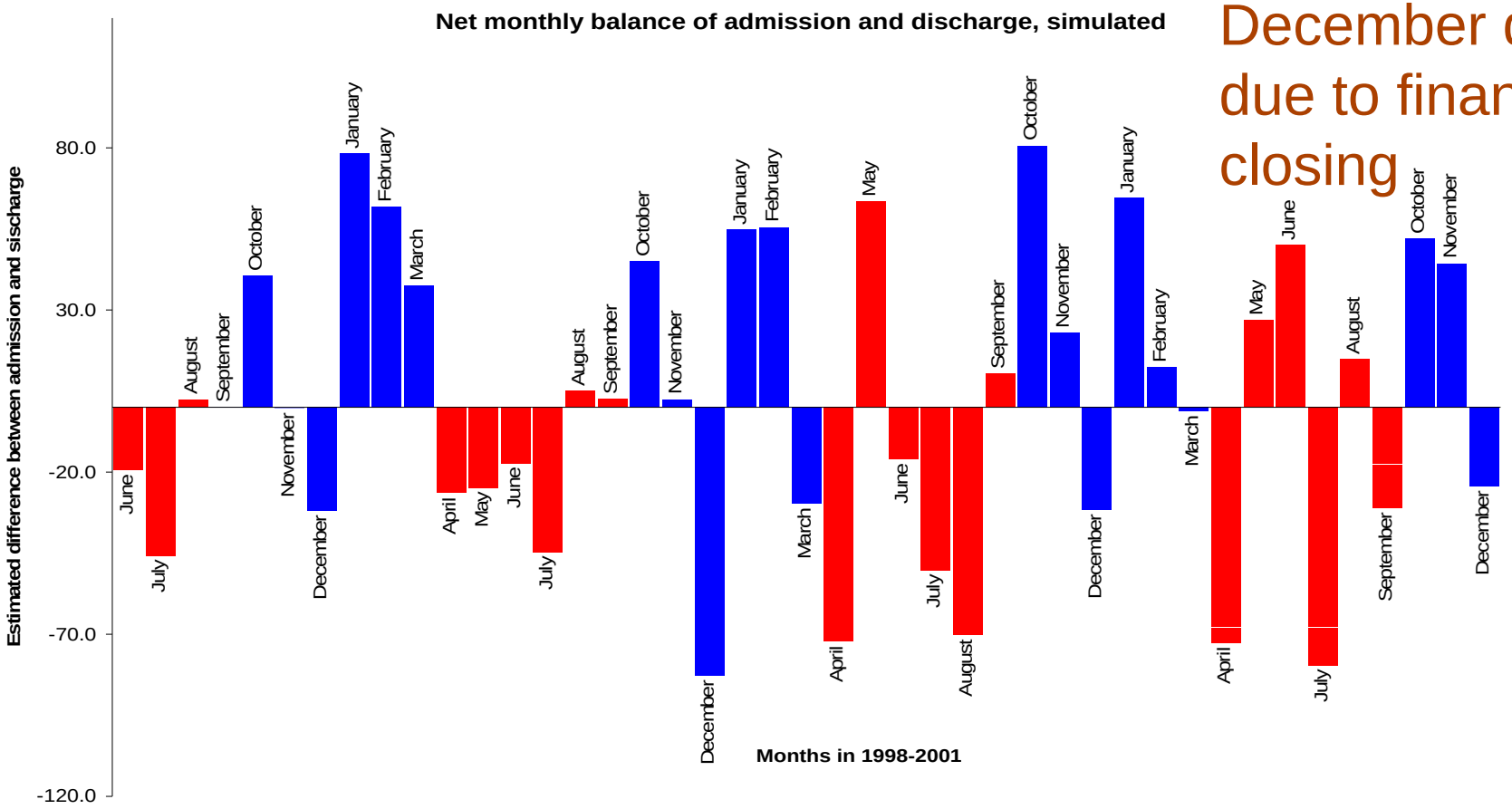


Non-clinical factors influence service delivery patterns



Seasonality of admission and discharge

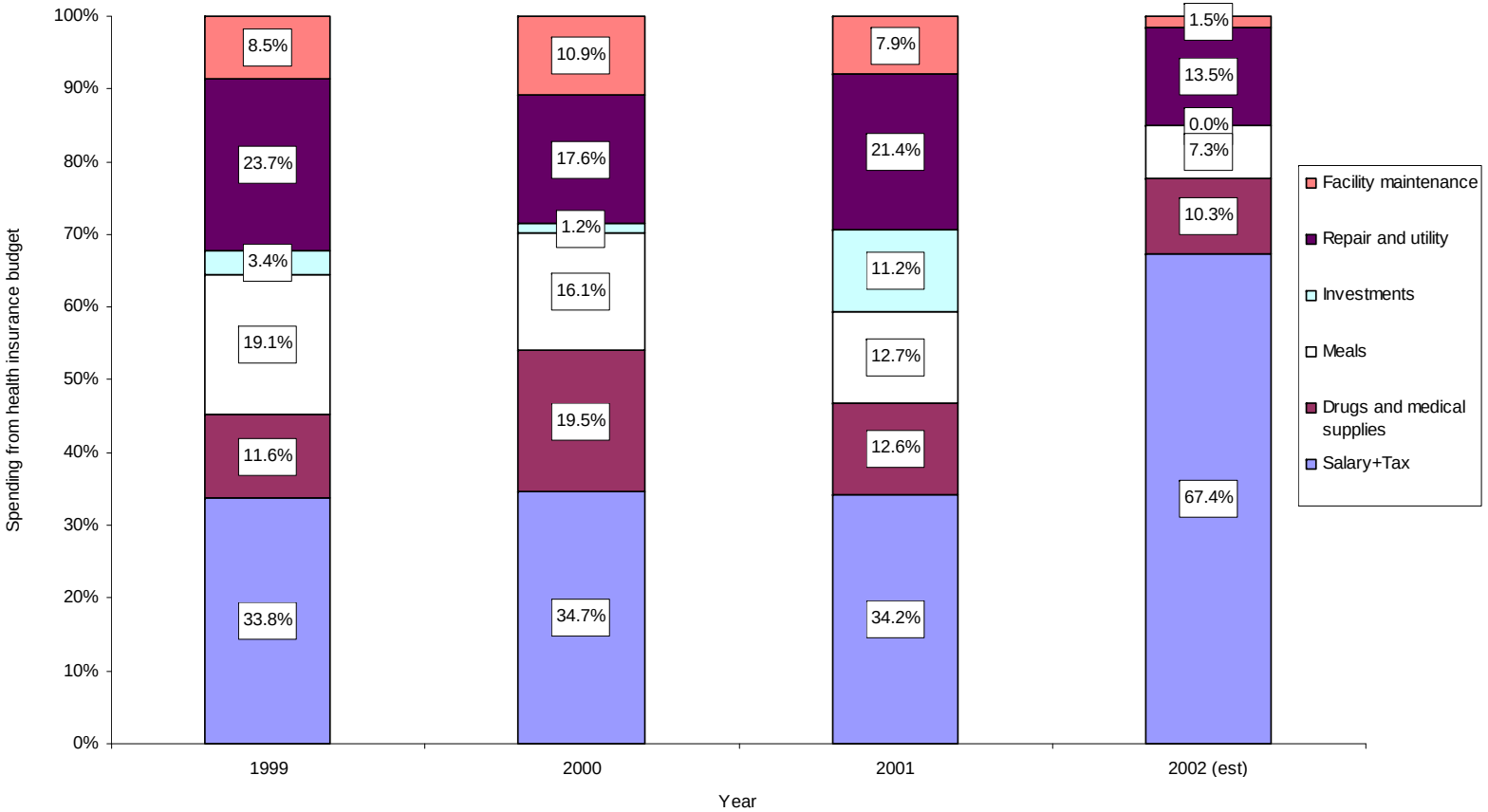


December discharge due to financial book closing

Hospitals admit more patients in the cold seasons and discharge patients in spring and in summer months.

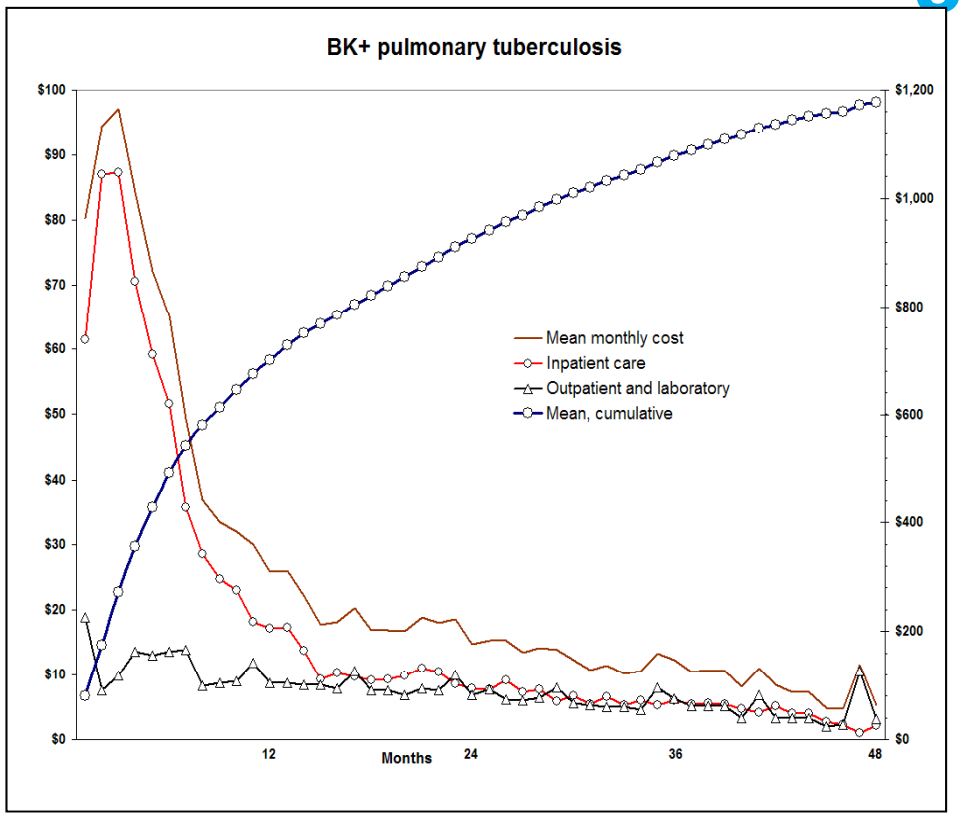
Atun R, Samyshkin Y, Drobniewski F, Kuznetsov S, Fedorin I, Coker RJ. Seasonal variation and hospital utilization for tuberculosis in Russia: hospitals as social care institutions. EJPH 2005; 15: 350-4.

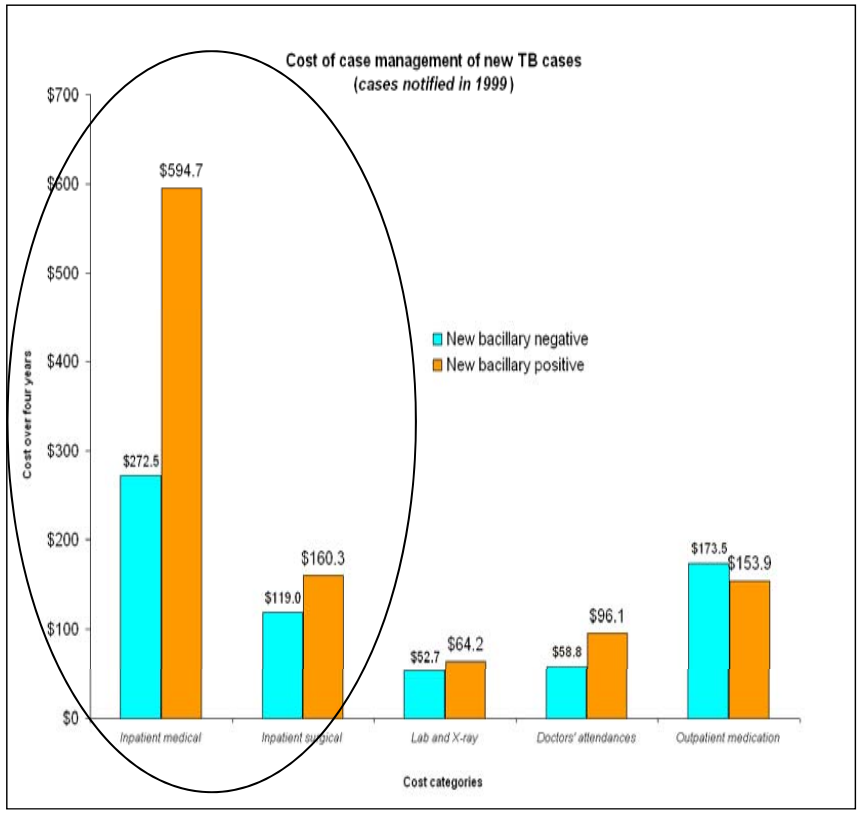
Resource allocation and possible programme-specific indicators



Coker RJ, Dimitrova B, Drobniewski F, Samyshkin Y, Pomerlau J, Hohlova G Y, Skuratova N, Kuznetsov S, Fedorin I, Atun R. Health system frailties in tuberculosis service provision in Russia: an analysis through the lens of formal nutritional support. Public Health 2005; 119: 837-43

Cost of case management





Costs are spread across a number of years starting from treatment and shifting to managing chronic and social conditions

Costs are driven by hospitalisation, both for BK+ and BK- cases.

In summary (1): TB and TB control in Russia

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- ✓ **Epidemiology/socio-economic**
  - Incidence and prevalence
  - Mortality
  - Drug-resistant TB
  - HIV
- ✓ **Outcomes (effectiveness)**
  - High mortality
  - Drug resistance
    - Acquired
    - Primary
- ✓ **Process efficiency**
  - Reliance on inpatient care
  - Long periods of observation
- ✓ **Issues of equity**
- ✓ **Medical care vs social care**

In summary (2): TB and TB control in Russia

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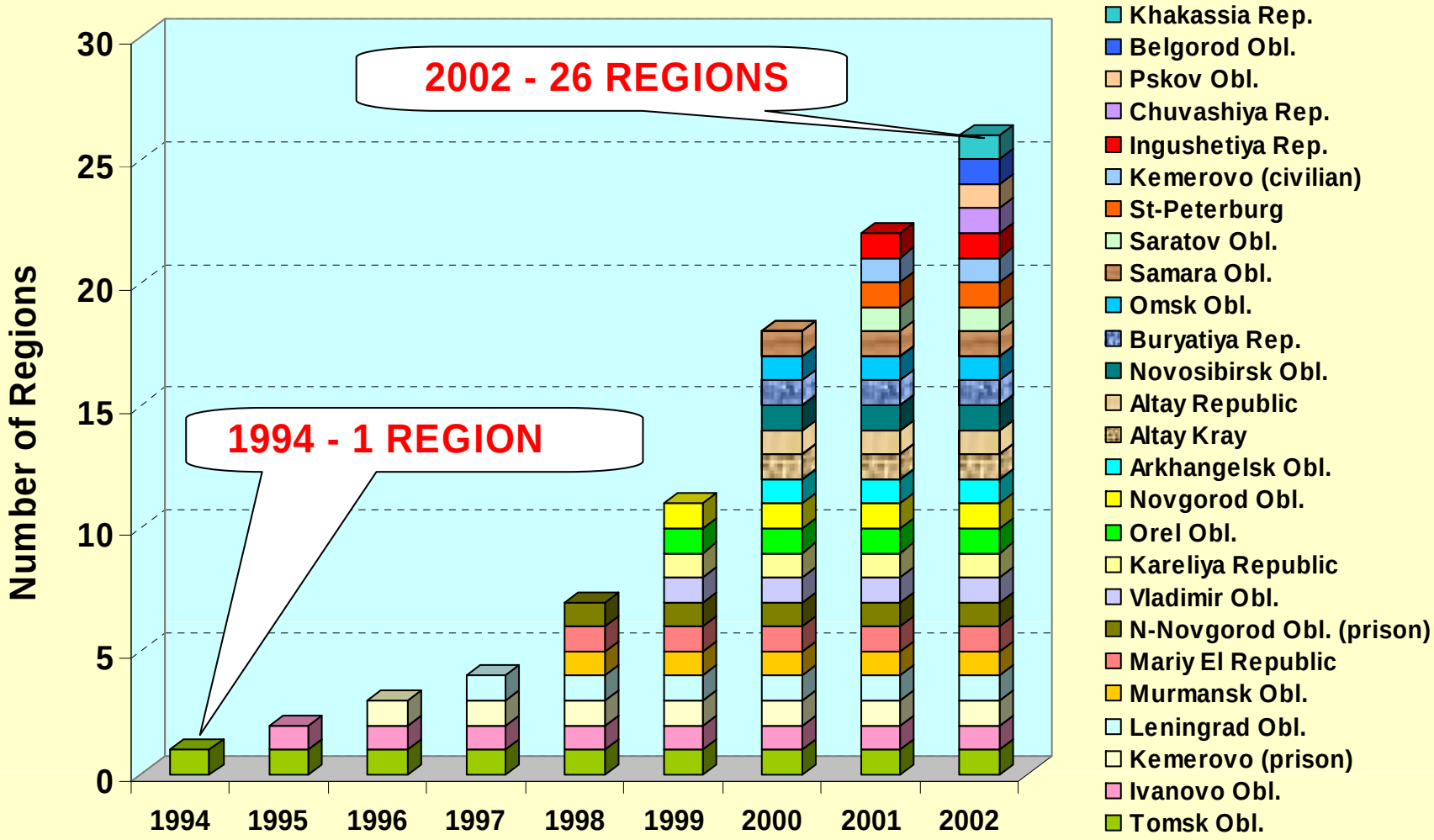
- ✓ **High cost of treatment**
  - **Among the 22 high-burden countries Russia is No1. by the cost per case**
- ✓ **Systems inefficiency**
  - **Organisation and financing and perverse incentives which do not reward outcomes**
  - **Screening**
- ✓ **Unresponsive to changing clinical need**
- ✓ **Sustainability of DOTS programmes?**
- ✓ **Need for health system reform AND DOTS implementation**

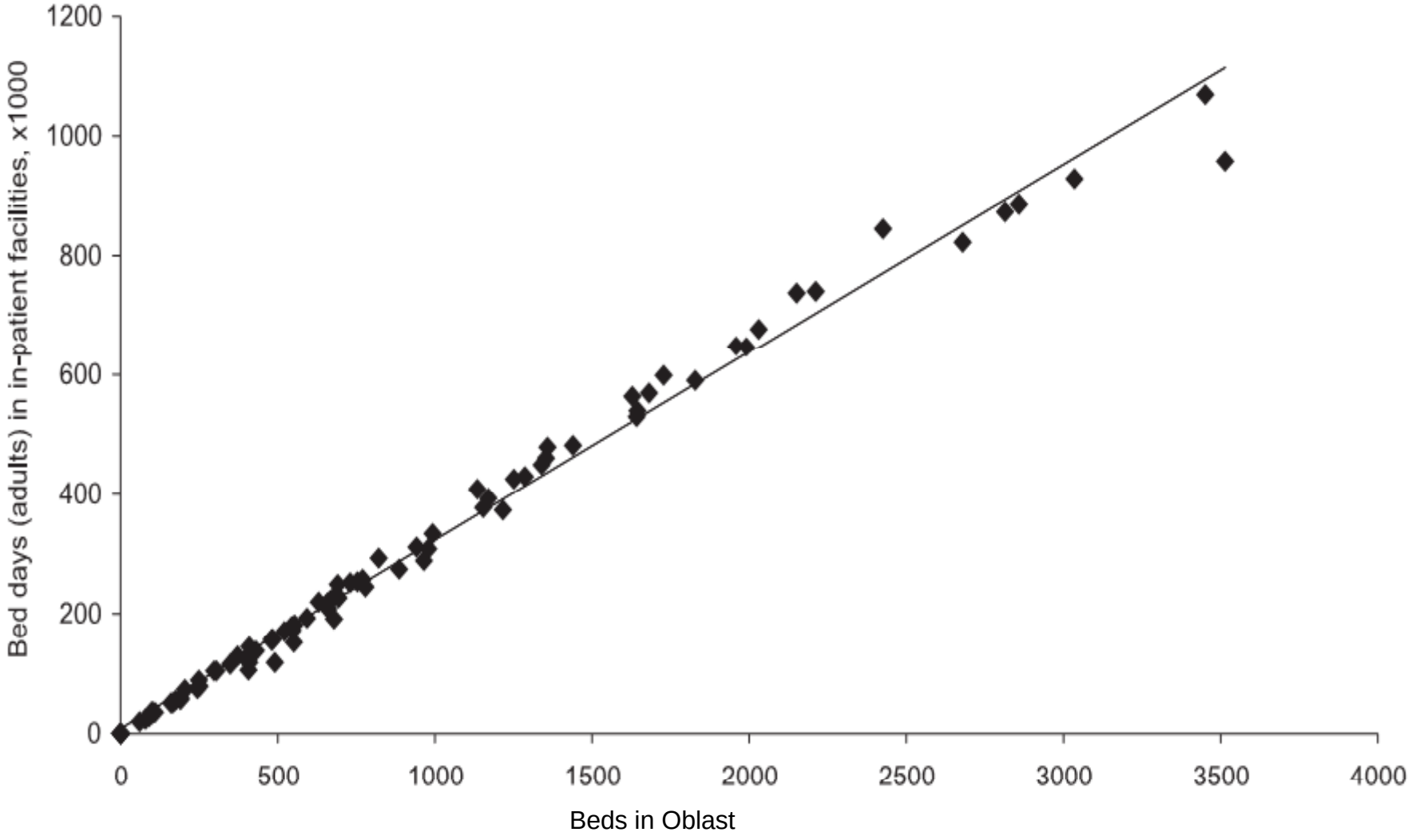
TB Pilot Projects in the Russian Federation



And after more than $300 million of international aid (and insights gained through research) is TB control more efficient?

	Russian Federation (89 administrative regions)		81 non-DOTS regions	8 DOTS pilot regions
	Average (range)	Median (regions)	Average	Average
TB beds per newly notified case (ratio, beds for whole year)	0.90 (0.34–2.3)	0.85	0.91	0.86
Bed occupancy (days per year, adults)	324 (214–360)	329	325	315
Duration of hospital stay (days per admission, adults)	86 (53–132)	86	86	86
Hospital admissions per outpatient visit	15		15	23

Eur J Public Health 2007; 17: 98-103.



Eur J Public Health 2007; 17: 98-103

- ✓ **Drivers**
  - ★ **poverty, incarceration, HIV etc**
- ✓ **Health system**
  - ★ **Professional silos**
  - ★ **Institutional silos**
  - ★ **Performance management perversities/clinical management perversities**
  - ★ **Cultural insensitivities**
  - ★ **Financing**
  - ★ **Social/public health function**