

Making Health Systems Responsive to Deal with the Dual Burden of Diabetes Mellitus and Tuberculosis

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Global epidemiology of TB and diabetes

Tuberculosis

- 9.6 million incident cases in 2014
- 1.5 million deaths annually
- 1/3rd of humans infected with latent TB infection
- >80% of global TB cases occur in 22 low- and middle-income high priority countries

Diabetes

- 8.8% of adults have diabetes
- Nearly 642 million will have diabetes by 2040
- 4.9 million deaths attributed to diabetes in 2014
- 77% of people with diabetes live in low- and middle-income countries

Risk of incident TB disease in patients with diabetes

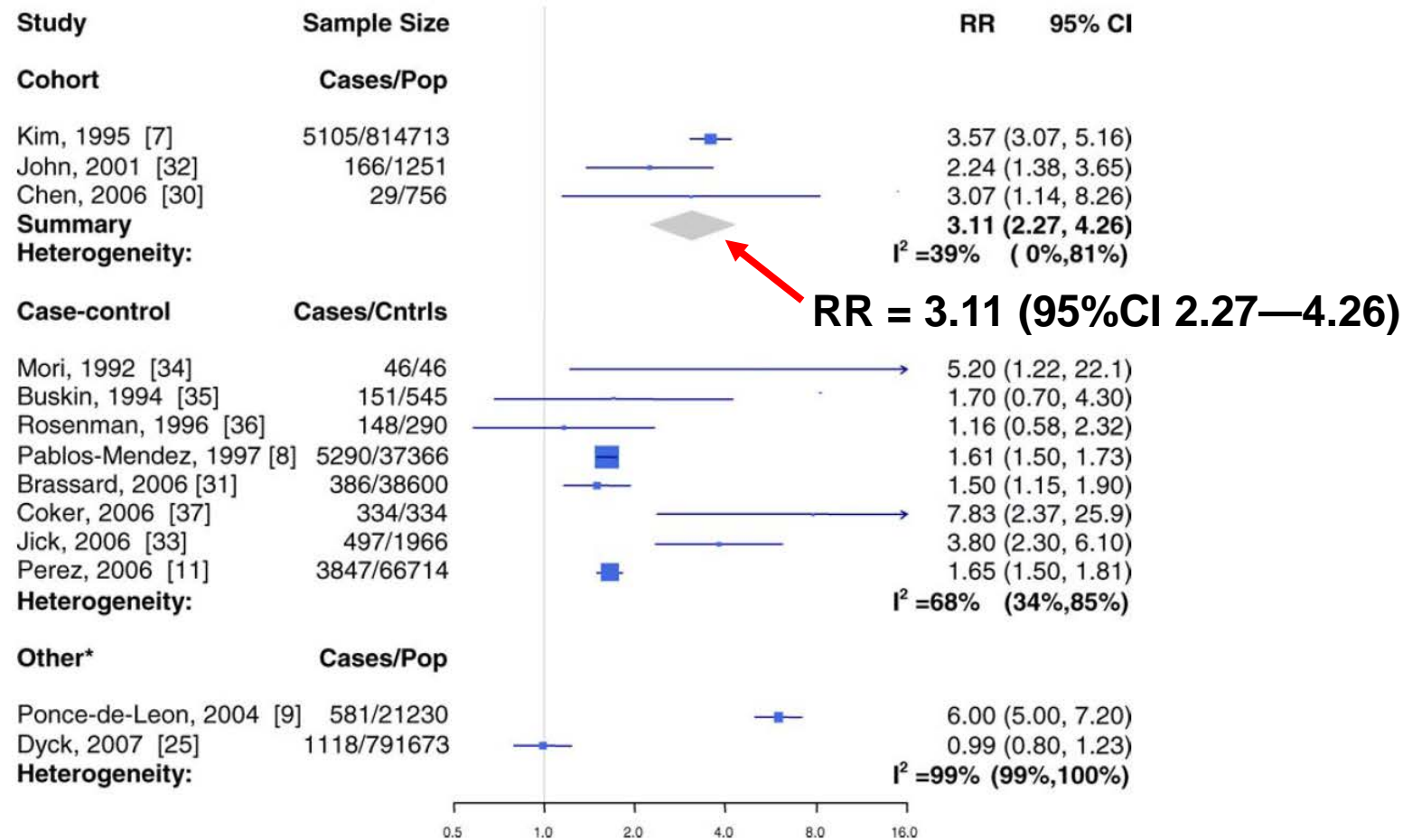


Figure 2. Forest Plot of the 13 Studies That Quantitatively Assessed the Association between Diabetes and Active Tuberculosis by Study Designs

TB attributable to diabetes

Table 1 The estimated contribution of diabetes mellitus (DM) to the burden of tuberculosis (TB) in the top ten countries with the highest number of new TB cases*

Rank	Country	Population in 2007 ($\times 1000$)*	TB		Diabetes		TB attributable to diabetes		
			Incidence in 2007 (all cases/ 10^5 /year)*	New cases in 2007*	Estimated prevalence (%) in 2010†	Estimated prevalence (%) in 2030†	Excess TB cases because of DM (2010)	% of all TB cases (2010)	% of all TB cases (2030)
1	India	1 169 016	168	1 963 947	7.0	9.0	252 745	12.9	16.0
2	China	1 328 630	98	1 302 057	4.0	6.0	101 341	7.8	11.2
3	Indonesia	231 627	228	528 110	5.0	6.0	50 399	9.5	14.4
4	Nigeria	148 093	311	460 569	3.9	4.0	35 019	7.6	7.8
5	South Africa	48 577	948	460 510	6.0	7.0	39 934	8.7	9.5
6	Bangladesh	158 665	223	353 823	8.0	9.0	39 760	11.2	12.9
7	Ethiopia	83 099	378	314 114	4.5	5.0	12 719	4.0	6.0
8	Pakistan	163 902	181	296 663	2.0	3.0	42 844	14.4	16.0
9	Philippines	87 960	29	255 084	7.0	8.0	32 827	12.9	14.4
10	DR Congo	62 636	392	245 533	2.6	3.0	12 769	5.2	6.0
		N	Q	N*Q	P ₁₀		TBaDM	TBaDM/N*Q	

>15% globally

TBaDM, TB cases because of DM = $(q_{DM} - q_{NDM}) \times p_{10} \times N$; where: N, total population in 2007; Q, total TB incidence in 2007; q_{NDM} , TB incidence among non-DM; q_{DM} , TB incidence among DM ($=q_{NDM} \times RR$); RR, relative risk of TB associated with DM (Jeon & Murray 2008); P₁₀, DM prevalence in 2010.

*WHO report 2009.

†<http://www.diabetsatlas.org>

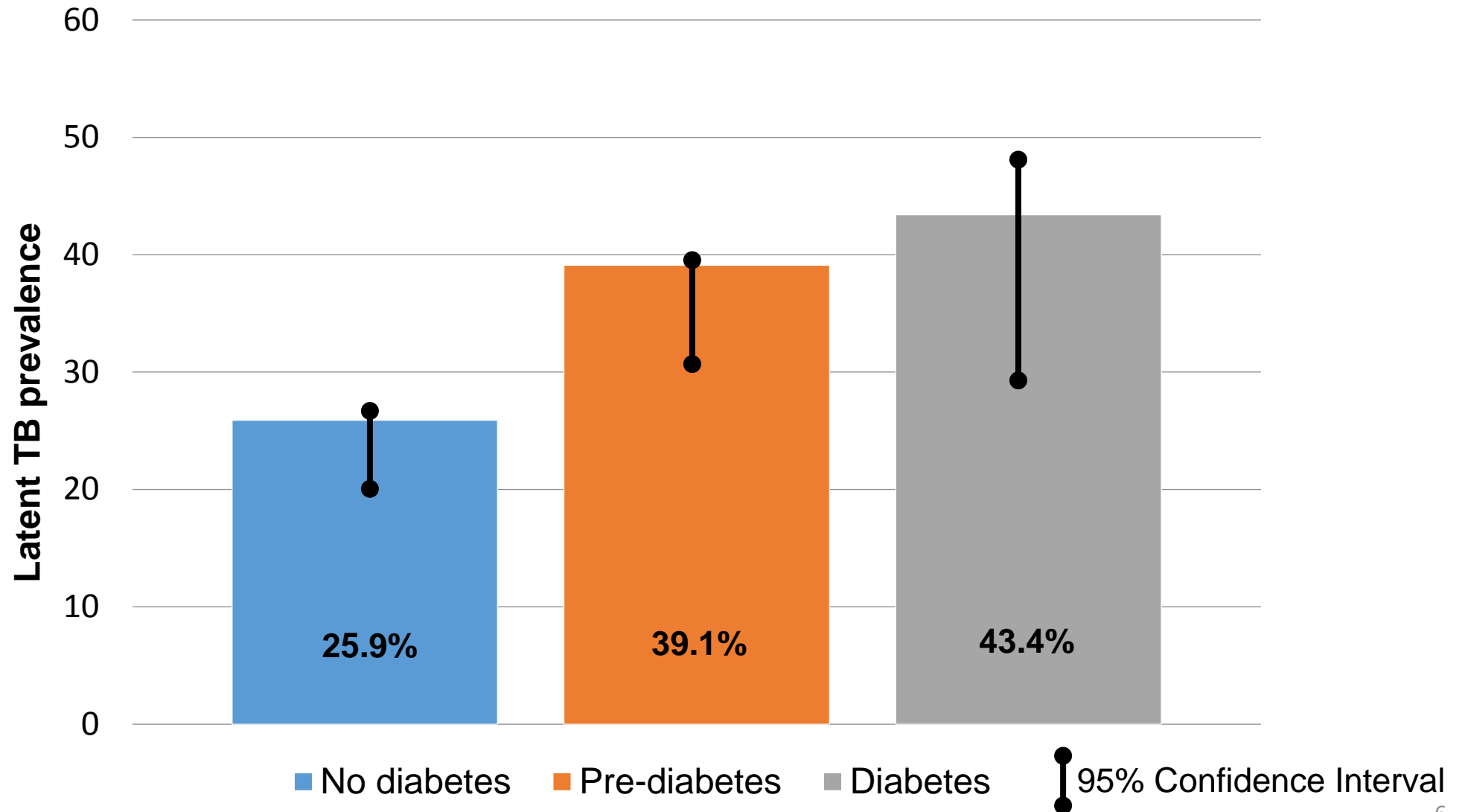
TB attributable to diabetes

Table 3. Most significant risk factors for tuberculosis

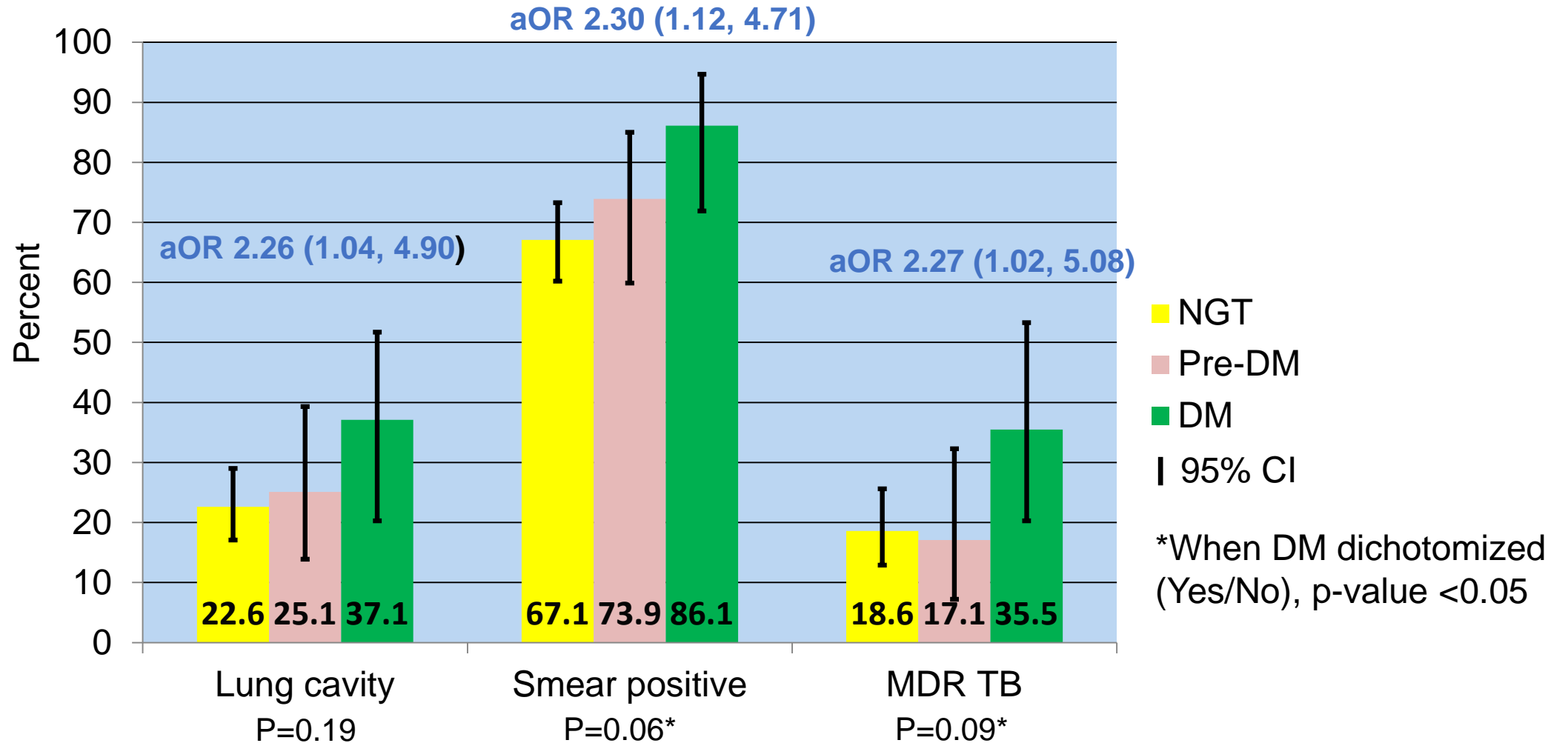
Risk factors	Relative risk	Population at risk (millions)	Population attributable fraction (%)
Diabetes	3	382	15–25
HIV/AIDS	20–37	35	13
Malnutrition	12·4	842	Unknown

Diabetes and Latent TB infection

Hensel et al. Int J Tuberc Lung Dis 20:71-78, 2016



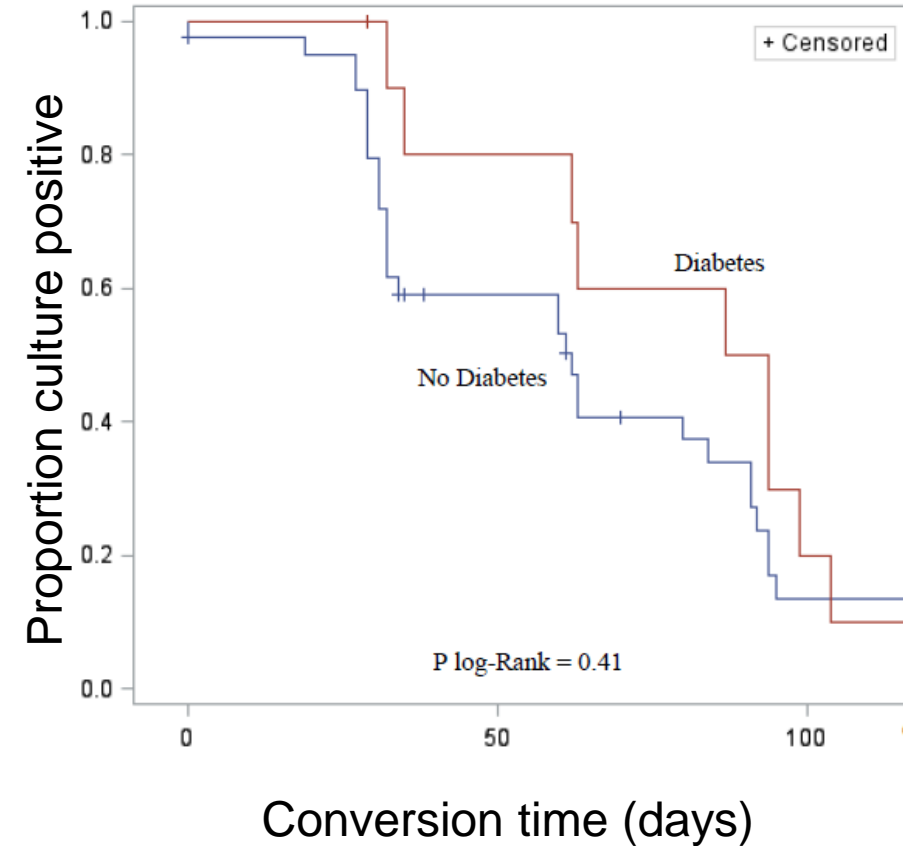
TB disease presentation, Tbilisi, Georgia



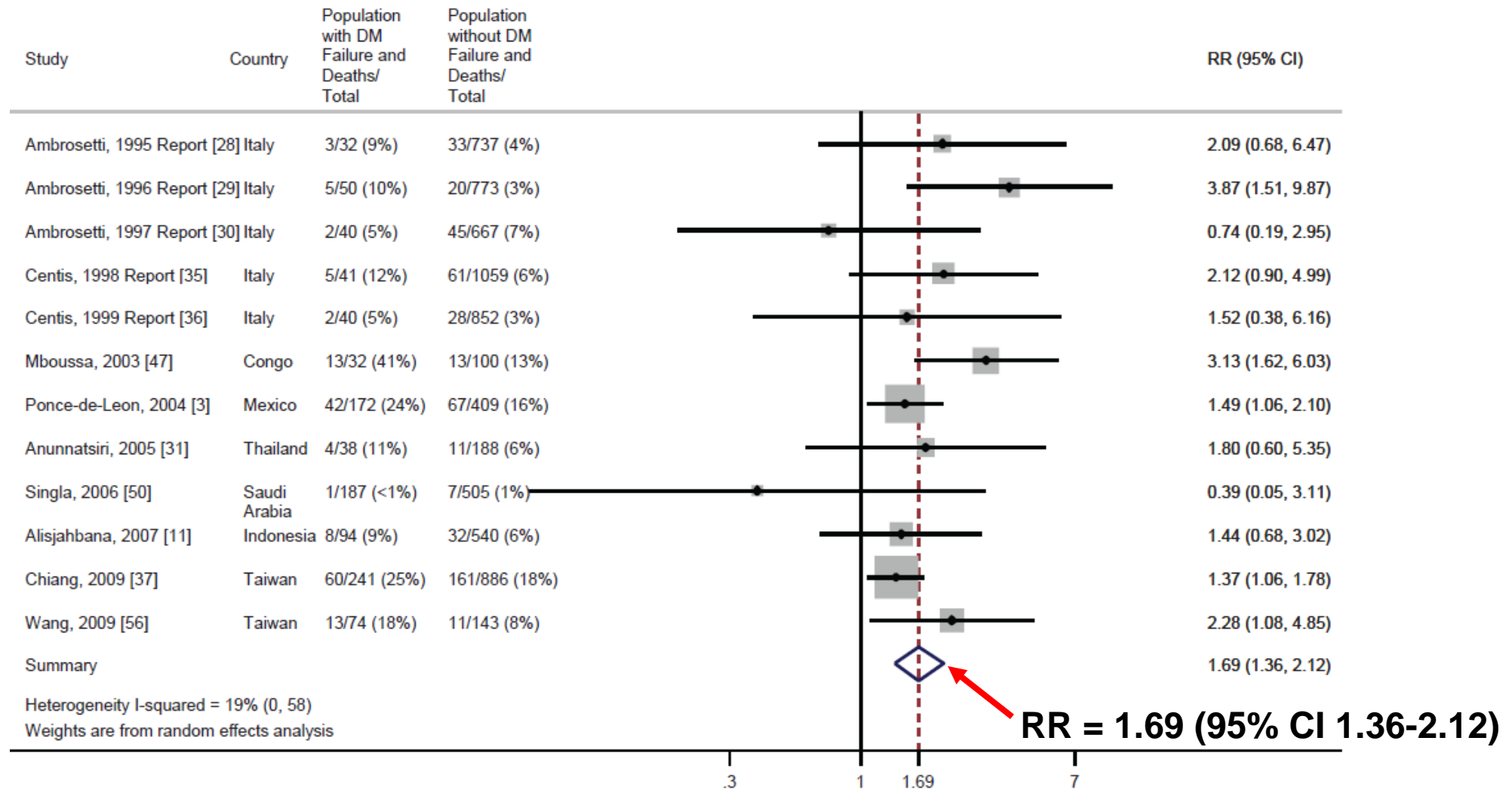
Diabetes reduces rate of sputum culture conversion in patients with MDR TB

	Hazard ratio (95% CI)	Adjusted hazard ratio* (95% CI)
Diabetes	0.8 (0.4-1.5)	0.3 (0.1-0.9)
Past smoker	1.0 (0.5-2.1)	0.6 (0.2-1.8)
Current smoker	0.4 (0.2-1.0)	0.2 (0.1-0.6)

*Adjusted for variables in the table and age, sex, socioeconomic status, HIV status, cavitory disease, and AFB smear



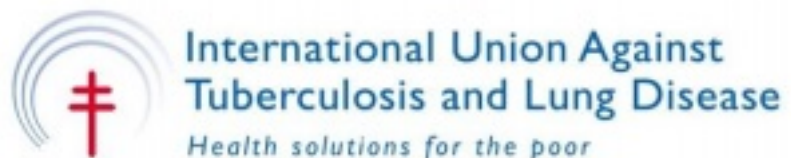
Risk of failure/death for TB patients with diabetes compared to patients without diabetes

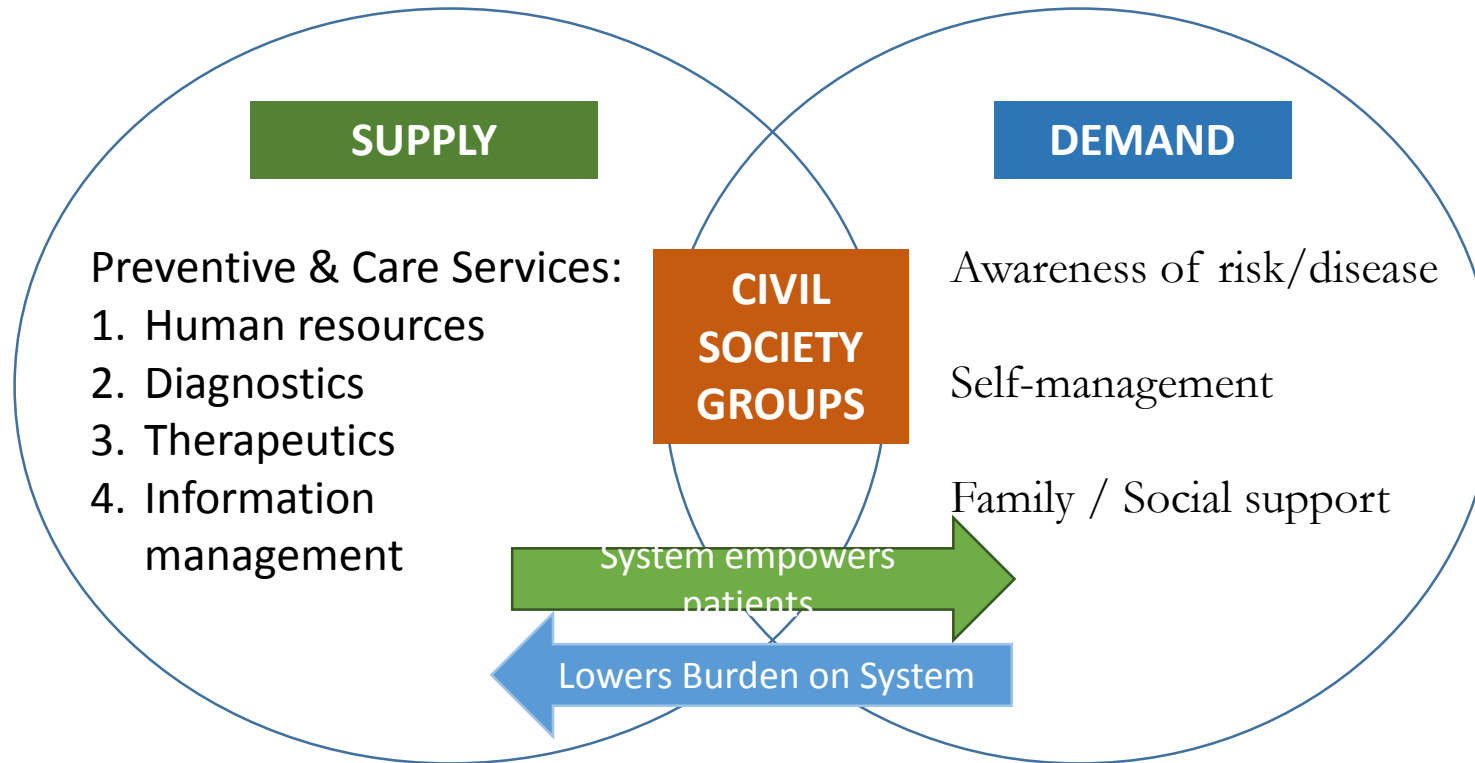


Integrated management of TB and diabetes

Collaborative framework for care and control of tuberculosis and diabetes

1. Establish mechanisms for collaboration
 - Conduct monitoring and evaluation of collaborative diabetes-TB activities
2. Detect and manage TB in patients with diabetes
 - Screen
 - Ensure TB infection control in health-care settings where diabetes is managed
3. Detect and manage diabetes in patients with TB
 - Screen
 - Ensure high quality diabetes management among TB patients





Standardized Guidelines

Quality Assurance

Workforce Development

Financial Protections

Technology
Surveillance

PUBLIC HEALTH INPUTS

Integration – some questions needing to be answered....

- What is the true joint burden of TB and DM?
- What are the challenges with pharmacodynamics and interactions?
- Do guidelines for each need to be modified?
- How will integration affect outcomes of each disease?
- Can integration be done with existing resources (e.g., DOTS infrastructure, staffing)?
- What are the political challenges?

EGDRC: Co-management of hyperglycemia and pulmonary tuberculosis (CHAT study)

- Cluster randomized control trial in 4 Indian states
- 90 TB Units and 1,800 patients with TB and diabetes
- Intervention:
 - Screen and detect diabetes (control and treatment arms)
 - Lifestyle education
 - Dietary counseling
 - Smoking cessation
 - Pharmacologic intervention
 - Linkage to DM care
- Study Outcomes: TB cure rate and change in HbA1c

Conclusions

- Direct data on co-existing DM and TB not available
- Diabetes importantly contributes to TB risk and TB control
- TB presents challenges for diabetes management
- Collaborative TB-diabetes programs lacking
- Evidence in most areas of TB-diabetes is underdeveloped
- Need for improved knowledge of TB-diabetes pathophysiology and clinical guidelines for concurrent treatment of TB and diabetes
- Way forward is through Implementation Trials