**Taskforce Statement on the Occupational Burden of Lung Disease:**

**The Occupational Burden of Tuberculosis**

**Draft Tables**

| Table 2. | | | | | | | | | | | | | | | | |
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| Author  Year  Location | | Type of Study | | Population  Sample Size  # Subjects /  Cases | Disease  Definition  Respiratory Outcome | | | Exposure / Job Information | | Key Findings | | PAR%  Reported / Calculated | | Other | | Comments  Strengths Weaknesses Study |
| **Silica Exposed Workers (Case Control Studies)** | | | | | | | | | | | | | | | | |
| Rosenman and Hall  1996  New Jersey | | Population based Case Control study | | New TB cases selected from New Jersey TB Register 149 cases selected with 290 referents from previous cancer epidemiological studies | TB based on bacteriological or treatment reporting. | | | SIC and SOC codes were used to describe occupational exposures. Several of these were specifically analysed because of their potential silica exposure | | Unadjusted odds ratios quarrying (OR = 3.96, 95% CL 0.36-44.02),  Pottery/related products (OR = l.99, 95% CL 0.49-8.06), nonmetallic mineral and stone products (OR = 4.00, 95% CL 0.72-22.10),  ship and boat building and repair (OR = 1.84, 95% CL 0.76-4.43).  combined OR: 2.36 (1.15-4.88)  The combined OR for silica industries, adjusted for living with a TB contact 1.57 (95% CI: 0.65-3.78) | | quarrying = 1.01  pottery= 1.34  mineral and stone= 2.03  ship repair= 3.08  all silica=7.78  all silica adjusted=4.91 | | HIV + and foreign born cases were excluded during selection from Register. | | Dated study, but being population based and adjusting for key risk factors, this study provided good data for calculation of PAR. However, most of these risk estimates were not statistically significant. |
| Chen, GX et al  1997  US | | Case Control  Mortality data | | 8,740 cases; 83,338 controls  National Occupational Mortality Surveillance (NOMS) database  Silica exposed workers  Mortality study  1983-92 | Mortality study, using death certificates | | |  | | The risks for TB from high and intermediate exposures to silica were 1.30 (95% CI 1.14-1.48) and 1.07 (95% CI 0.77-1.47), respectively, adjusting for silicosis, other pneumoconioses, age, gender, race, socioeconomic status, and potential exposure to active TB. | | Intermediate: 0.15  High: 3.19 | |  | |  |
| Calvert et al  2003  US | | Case Control | | NOMS database was used for several disease outcomes. This mortality study of silica exposed workers, assessed between 1982-1995  TB Cases: 6570  TB Controls: 32843 | Death certificates were used to define cases based on the disease of interest. Control groups were selected if the death certificate did not mention disease of interest or any disease likely to be associated with silica exposure. | | | Subjects were assigned into a qualitative crystalline silica exposure category based on the industry/occupation pairing found on their death certificate. | | TB outcomes (adjusted odds ratios)  Ever vs Low/No: 1.47 (1.37 to 1.57)  Med (n=769): 1.34 (1.23 to 1.47)  High (n=624): 1.60 (1.45 to 1.76)  Super High (n=39): 2.48 (1.68 to 3.65) | | -  3.04  3.4  3.6 | |  | |  |
| Yaramadi et al  2013  Iran | | Case control | | List of registered TB patients over the age of 15 was obtained from the Infectious Disease Control Center of Lorestan Province for the period 2006-2011. Data were collected from 871 TB patients through interviews and a checklist.  429 controls were selected. | TB diagnosis was made according to sputa microscopy. | | | Participants were divided into 32 categories of silica exposure groups | | History of silica exposure among those with TB: 453(52%) and those without TB: 107(24.9%)  Unadjusted OR: 3.39, for silica exposure (95%CI: 2.63-4.36). | | 36% | |  | | The authors describe this as a cross sectional study, but seems more like a case-control.  Extremely high proportion of cases exposed (52%), compared to only 25% among controls – not sure about the randomness of the selection of cases vs controls |
| **Silica Exposed Workers (Cohort Studies)** | | | | | | | | | | | | | | | | |
| Churchyard et al, 2000, South Africa | | Cohort | | Reported rate: 2476/100000 of goldminers at a single mine in South Africa studied from 1993-1997 | TB was determined through bacteriological and clinical diagnosis | | |  | | 2893 cases diagnosed  2476/100000 | | 7.9 | | Using World Bank data for total population, and SA data for number of goldminers employed in this year | |  |
| Kleinschmidt et al  1997  South Africa | | cohort | | 4976 goldminers from a single mine in South Africa, followed over 18 years from 1974-1995; 449 developed TB with a total person time of 55822 years. | TB was determined through bacteriological and clinical diagnosis | | |  | | The annual incidence of TB was 804.34/100000 over the 21 year period. | | 2.3 | | The total number of goldminers during this time was 379423. The World Bank rate of TB was 317/100000 for 1995, resulting in an incidence rate ratio of 2.5 | |  |
| Murray et al  1999  South Africa | | cohort | | 28 522 goldminers from 4 goldmines in SA, assessed between January – December 1995  376/28522 | TB defined as sputum culture positive | | |  | | 376 developed TB of which 190 (50%) were HIV positive. The incidence was 1318/100000 | | 4.8 | | Total number of goldminers employed during this period was 379423. The World Bank rate of TB was 317/100000 for 1995, resulting in an incidence rate ratio of 4.16 | |  |
| Sonnenburg et al  2005  South Africa | | cohort | | 1991-1997  Goldminers from 4 mines with a total population of 28 000. A total of 23,874 individuals were followed for a total of 53,296 person-years.  747 new cases identified from the 23874 participants | Cases either were culture confirmed or classified as “probable TB” through a score of chest radiographs, sputum smear examinations, tuberculin tests, histological tests, and a therapeutic clinical trial. | | |  | | TB incidence: 1430/ 100 000  HIV-: 800/ 100000 | | 3.79 | | Total number of goldminers employed during this period was 339078.  The World Bank rate of TB was 359.95/100000 for 1997, resulting in an incidence rate ratio of 3.89 | |  |
| Glynn et al  2008  South Africa | | Retrospective cohort | | 7583 goldminers from 4 mines in South Africa, followed up between 1991-2004 | TB diagnosis made on : culture and clinical findings | | |  | | ALL: 620/7583 (with 1890/100000)  HIV-: 288/5702 (630/100000) | | 2.0 | | The WHO rate for the general population was 898/100000 and among those HIV-: 554/100000.  The total exposed goldminers during 2004 was 179964 | | Total person time not provided, hence could not calculate incidence over time of exposure. Instead the author reported rate for 2004 was used (1890/100000). |
| Halsema, et al, 2012 | | Cohort, 2002-2008 | | Two goldmines in SA (19476 and 8414 miners respectively | TB diagnosis made on culture | | |  | | 3018/100000 and 2468/100000 respectively reported | | Mine A: 1.1;  Mine B: 0.8 | | WHO population rate and WB data used to calculate unexposed population | | Rates from 2008 as reported by researcher used in calculations |
| Park et al., 2009, South Africa/Lesotho | | Cohort, 1999-2001 | | 553 Basotho ex-mineworkers from a single mine in South Africa | TB diagnosed on x-ray, questionnaire and commencement of anti-TB treatment | | |  | | 3085/100000 incidence was estimated | | 2.6 | | WHO population rate and WB data used to calculate unexposed **South African** population. Government data used for total number of South African mineworkers | | The lack of total number of Basotho mineworkers to calculation proportion of exposed prevents calculation of the PAR% for Lesotho. However, all these miners worked exclusively on the South African mine. |
| **Health Care Workers (Cross-sectional)** | | | | | | | | | | | | | | | | |
| Laraqui et al  2001  Morocco | | Case notification review of the total HCW population in the country | | 1994-97  130 cases at risk HCW: 85.3  Doctors in specialist: 1094 |  | | |  | |  | | -0.068 (general population risk greater than that of the HCW population) | | Incidence in general population: 100 (WHO: 118). Total number of HCW in 2004: 40 319 | |  |
| **Health Care Workers (Cohort)** | | | | | | | | | | | | | | | | |
| Eyob et al,  2002  Ethiopia | | 10 year Records review | | 1989-1998  175 HCW’s at a specialist TB centre  24/175 with TB |  | | |  | | Incidence:  1669/100000 (1989);  5556/100000 (1998) | | 0.38 | | WHO  1998 Not available  2000: 421 | |  |
| Jiamjarasrangsi et al  2005  Thailand | | cohort | | A cohort of 3959 HCWs at Chulalongkorn  Memorial Hospital, Thailand, was observed from 1988 to 2002. | TB diagnosed on medical records database | | |  | | 3894 HCW contributed a total of 41 462.3 person years, 188/100000 with specific incidence rates of 77/100000 for confirmed cases, over the 15 year period, 1988-2000. The mean annual overall IR=77/15= 5.1/100000 | | -0.22 | | Bangkok population incidence of 55.4 (95%  [CI] 54.4–56.4)(1998) and 52.8 (95%CI 51.9–53.8) (2000) | |  |
| De Vries et al  2006  Netherlands | | National TB Register review | | cohort comprised of all consecutive TB patients registered in the Netherlands during the period of January 1, 1995 to December 31, 1999, who were classified as  ‘‘working in the healthcare/social-welfare sector’’. | restriction fragment length polymorphism (RFLP) typing, (DNA fingerprinting) | | |  | | In the 5-yr study period, 123 patients were recorded as working in the healthcare/social-welfare sector, but only 94 contributed to the analysis.  IR of hospital based HCW:: 7.9/100000 | | -0.16  Because rate is lower than WHO gen pop rate of 9, PAR cannot be calculated | | IR in general population: Dutch citizens: 4.4.  All citizens: 9.8 | |  |
| Ong et al  2006  SF, US | | Cohort study | | a population-based assessment of tuberculosis in HCWs in San Francisco between January 1, 1993 and December 31, 2003, using data from the San Francisco Tuberculosis Control Section’s database. | restriction fragment length polymorphism (RFLP) typing, (DNA fingerprinting) | | |  | | 2510 TB cases reported in San Francisco with IR of 6.9/100000. Reported IR in SF in this time period: 30/100000 | | 0.95 (using WHO data) | | WHO IR in the general population: 5.9 (2003). The exposed population (HCW)  8903311 | |  |
| Raitio and Tala  2000  Finland | | National register review, compared with general population | | All HCW working between 1966-1995 assessed for occupational TB, and compared to other TB cases in the general population within the age group 15-64. 658 cases of occupational TB was diagnosed among HCWs. | Cases are confirmed bacteriologically, histologically and/or clinically | | |  | | The annual incidence of TB among HCWs peaked in the 1971-1975 period, with 57/100000 population, dropping to 6.1/100000 per year in the 1991-1995 period. | | -1.84 | | The TB incidence rate in 1995 was 6.1, and in the general population, 9.1 - a rate ratio of 0.67 | |  |
| Pazin-Filho  2008  Brazil | | Database review | | 21 cases among health care workers from October of 1997 to January of 2003 from the Tuberculosis Control Program of the city of Ribeirão Preto | Clinical, sputa | | | Categories of HCW Total population for city: 514160; total nurse-technician population: 4520 | | IR of 110.6/100000 for nurse technicians in the City | | 1.42 (for City) | | Researcher report of 41.8/100000 for city. The IRR was 2.64 ((95% CI, 0.85-6.27). | |  |
| Roche et al;  2008  Australia | | Database review | | 2006 review of reported TB to national register.  Information on notified  cases for 2006 sent electronically to the National Notifiable Diseases Surveillance System (NNDSS) | Laboratory, clinical diagnosis of TB | | |  | | 65 cases among HCWs. The IR in the general population was 5.8/100000 | | 3.95 (using researcher gen pop incidence of 5.8 and WHO population of HCW) | | The total exposed population was 548 384 (WHO) | |  |
| Costa et al  2011  Portugal | | cohort | | 6,112 HCWs working or training at the São João Hospital Porto, Portugal, between 2005 and 2010. | Clinical, bacteriological, radiological | | | Categories of HCW | | 62 cases of active TB, the IR for 2009 was 93/100000. The IR for Porto for 2009 was 33.7/100000 | | 4.4 (Based on WHO data) | | The IR of 29/100000 (WHO)  The exposed population for 2009: 144551 (WB) | |  |
| Kehinde et al;  2011  Nigeria | | Cohort | | 271 HCW at two hospitals between January – December 2008 | Sputa stain and culture | | |  | | 9/271 cases identified, with an incidence of 3321/100000 | | 3.7 | | The IR in the general population was 341/100000. The exposed population was 352476 | | Not clear about the cohort nature of the study…not sure if all those with current TB excluded, and only those with new TB are reported |
| Lambert et al  2012  US | | Database review | | TB cases reported to the Centers for Disease Control and Prevention from the entire US from 1995 through 2007 |  | | |  | | Of the 200 774 cases reported in 1995-2007, 6049 were from HCWs. A IR of 4.2/100000 (range, 3.8–4.6) | | -0.9 | | The IR in the general population was 4.4-5.1. The total exposed population was 89033311 | |  |
| Claasens et al;  2013  South Africa | | Retrospective cohort record review | | 133 primary healthcare  facilities were visited between May and September 2009 in five  provinces of South Africa  smear positive TB  SIR calculated | Smear positive diagnosis | | |  | | SIR (95%CI):  2008: 2.29 (1.34 3.67)  TB incidence/100000  2008: 887 (95%CI 517-1420) | | -0.1 (WHO data)  1.1 (using SIR as risk estimates) | | The IR in the general population was:  2008 (WHO): 977/100000  The total exposed population estimated: 279449 | |  |
| Chu et al;  2014  Taiwan | | cohort | | A nationwide, population-based cohort study using Taiwan National Health Insurance Database during 2000-2010. 11,811 HCW 11,811 matched  62 HCWs and 38 control with TB in 9.4 year follow-up | All TB cases reported to the national database. | | |  | | adjusted hazard  ratio [aHR], 1.62; 95% confidence interval [CI], 1.08-2.43  IR for all TB: 61.08/100000 | | 0.043 (using IRR, with population data from WB) | | Matched cohort IR: 37.81  National (2010): 54.5 | | d/w KT: Can the aHR be used as the estimate of risk in calculating PAR? |
| Klimuk et al;  2015  Belarus | | Retrospective record review | | TB health care facilities in Belarus  Retrospective record review, sputum smear, culture and drug susceptibility testing, from 2008 - 2012 |  | | |  | | Cases of TB: 116/5441; TB incidence: 2012: 349/100000 | | 14.6 (researcher IR)  8.9 (WHO IR) | | The IR in the general population:  2012: 40 (author report)  2012: 64 (WHO). The total exposed population was 148775 | | The researcher report of population IR differs from WHO rate – results in large difference in PAR |
| Tudor et al.,  2014  South Africa | | Retrospective cohort | | A retrospective cohort study was conducted in three district hospitals in KwaZulu-Natal, South Africa with specialized MDR-TB wards. Data were abstracted via chart review from occupational health medical records from January 2006 – December 2010 | TB diagnosis based on records captured | | |  | | Cases of TB: 112/1313  PTB: 72  The IR for 2010 was 1 958/100000. | | 1.3 (WHO)  0.8 (Researcher reported IR) | | IR (per 100000) reported by the authors:  SA (2011): 981  KZN (2011): 1142  WHO 2010: 948  The total exposed population: 421 393 | |  |
| Tam et al., 2006, Hong Kong | | National Registry Records Review | | surveillance data of the Labour Department,  30 to 42 cases of occupation-related TB were notified each  year during the period 2001 to 2005. 141 cases of occupational TB in a  combined period of 5 years |  | | |  | | 48.7 per 100 000 population | | -0.54 | | Using WB data for unexposed population (4841010), researcher report of 57869 population of HCWs | |  |
| Toms et al;  2014  Australia | | National database review | | Data for 2013 were reviewed |  | | |  | | 77 cases of TB in 2013 were reported in people who were currently or had previously worked in a health care setting in the past 12 months. | | 0.12 | | The IR in the general population for 2013: 6.2. The total exposed population in 2013: 417346 | |  |
| **Health Care Workers (Case-Control)** | | | | | | | | | | | | | | | | |
| Rosenman and Hall  1996  New Jersey | | Population based Case Control study | | New TB cases selected from New Jersey TB register 149 cases selected with 290 referents from previous cancer epidemiological studies | TB based on bacteriological or treatment reporting.  HIV + and foreign born cases were excluded. | | |  | | hospitals (OR= 2.77, 95% CL 1.35-5.70), adjusted for living with TB contact | | 8.2 | |  | | Dated study, but being population based and adjusting for key risk factors, this study provided good data for calculation of PAR. |
| **Other Workers/Exposures (Case-Control)** | | | | | | | | | | | | | | | | |
| Odone et al  2013  Malawi | Population based case control study | | 1707 cases and 2678 controls from the Karonga District in Malawi were selected during the 1997-2010 period | | | New cases of adult laboratory confirmed TB were selected, with frequency matched age, sex and area community selected controls. Risk estimates were adjusted for sex, age, calendar period and area. |  | | employed in small businesses/trade/manual work (OR=1.90, 95%CI: 1.50-2.41)  salaried/employed in large businesses (OR=1.94, 95%CI:1.46-2.59) compared to subsistence farming. Adjusted for HIV | | small businesses/ trade/ manual work: 6.5  being salaried/ employed in large businesses:  5.7 | |  | | While not specific for workplace exposures, the study, with its large sample size, does provide an indication that work itself may present a risk for tuberculosis. | | |
| Sacchi et al  2013  Brazil | Population based case-control study. | | 63 cases and 126 controls identified in this study among an indigenous population between June 2009 and August 2011 in Dourados, Brazil. | | | TB cases were obtained from the national disease surveillance programme, and paired with two controls, matched by age and location  The annual incidence of TB was 222 (95% CI, 148-321) per 100 000. |  | | TB infection was associated with work performed in a sugar cane factory (9 workers of the 63 cases) (OR 6.8; 95% CI 1.2-36.9). | | 12.2 | |  | |  | | |
| Rosenman and Hall  1996  New Jersey | Population based Case Control study | | New TB cases selected from New Jersey TB Register 149 cases selected with 290 referents from previous cancer epidemiological studies | | | TB based on bacteriological or treatment reporting. | SIC and SOC codes were used to describe occupational exposures. Several of these were specifically analysed because of their potential silica exposure | | Unadjusted OR: light truck drivers (OR = 2.49, 95% CL 1.30-4.77); agriculture (OR = 2.31, 95% CL 0.82--6.50); eating and drinking establishments (OR= 2.83, 95% CL 1.11-7.20) | | Trucking: 2.0  department stores 0.2  eating and drinking 2.8  Farmworkers: 0.5  machine operator: 4.9  light truck drivers: 8.8 | | HIV + and foreign born cases were excluded during selection from Register. | |  | | |
| Tekkel et al., 2002, Estonia | Population based case-control study | | the cases were 248 adult tuberculosis patients treated in a hospital in Tallinn, Estonia between January 1999 and June 2000 | | |  | ISCO88 codes were used to classify occupation. Risk compared against technicians,  clerks, service workers | | OR for skilled agricultural and fishery workers, craft workers, plant and machine operators 2.24 (95% CI: 1.05–4.75)  Elementary occupations: 1.08 0.41–2.88 | | legislators, managers, professionals: -7.8  skilled, craft workers, machine operators: 32.6  elementary occupations: 0.74 | |  | |  | | |