

Tuberculosis and Toxic exposures; TB is environmental, occupational and substance use related!

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Saturday, March 24 is World Tuberculosis Day (#WorldTBDay). According to the World Health Organization (WHO) "Despite being curable, tuberculosis is the world's leading infectious killer". WHO "needs more leaders for a TB-free world! To #EndTB, we need YOU." It is intended that "Ending the TB epidemic by 2030 is among the health targets of the Sustainable Development Goals."

In 2015, 10.4 million people became ill with TB and 1.8 million people died from the disease, mainly in developing countries according to Doctors without Borders/Médecins Sans Frontières (MSF). Global trends of TB have decreased in recent decades. In Canada, the incidence of TB slightly decreased and remains low at [around 5 in 100,000](#) from 2006 to 2016. Provincial rates remained consistently higher than that of Canada in recent years. Majority of cases in B.C. are related to foreign - born residence, First Nations populations and marginalized groups such as the homeless.

[BC Strategic Plan](#) for Tuberculosis Prevention, Treatment and Control 2016 Status Report focuses on five strategic goals over a ten year period including preventing the progression of latent TB and ensuring a robust public health response to the problem. [Toxic exposures](#) are among the precipitating factors of tuberculosis:

What are the main toxic exposures that increase the incidence of tuberculosis?

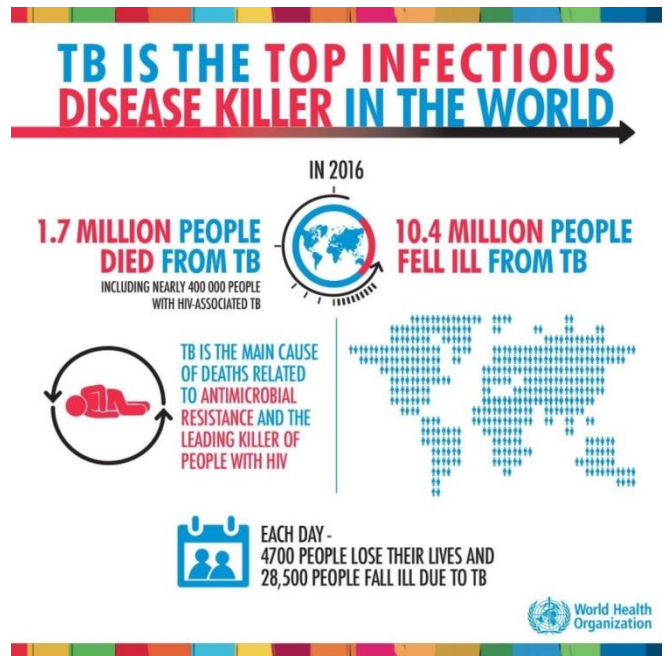
Environmental

- Smoking; smoking increases the risk of TB by *three* fold.¹
- Exposure to second hand smoking was found to be statistically significantly associated RR=1.59, 95% CI 1.11-2.27) with the risk of TB disease.²
- Indoor air pollution with second hand smoking, solid fuels and kerosene was associated with active TB.^{3,4}
- Ambient air pollution was associated with the risk of tuberculosis.^{5,6}
- Residential proximity to road traffic volumes and traffic density were associated with increased all-cause mortality in patients undergoing treatment for active tuberculosis.⁷
- Pulmonary TB was associated with ambient CO and NO₂.⁸
- "Chronic exposure to $\geq 50 \mu\text{g}/\text{m}^3$ PM₁₀ may prolong the sputum culture conversion of TB patients with sputum-positive cultures."⁹
- Biomass Fuel Use / exposure to combustion of biomass cooking fuel among Rural Women.^{10 11 12 13}
- A drop in particulate matter (13%) and smoke (19%) has been shown to coincide with the reduction of Tuberculosis incidence.¹⁴

Occupational

Occupational lung diseases are well recognized risk factors for TB.

- Occupational lung diseases, especially silicosis and mining.^{15 16 17 18}
- Asbestosis; prevalence of pulmonary TB infection was high among workers with asbestosis.¹⁹ Pulmonary tuberculosis also complicating asbestosis.²⁰
- Cancer; among asbestos exposure cohort, Standardized mortality ratio lung cancer has been shown to be 5.22 (95% CI) 1.08-15.25 for subjects with a history of PTB (2.35 (95% CI 0.49-6.85) after indirect adjustment for smoking).¹⁹
- Personnel in transport work, light truck drivers^{18 21}
- Ship and boat building and repair (OR = 1.84, 95% CL 0.76-4.43)¹⁸
- Nonmetallic mineral and stone products (OR = 4.00, 95% CL 0.72-22.10), and Pottery and related products (OR = 1.99, 95% CL 0.49-8.06)¹⁸



Alcohol and substance use

- Methadone treatment has improved tuberculosis treatment among hospitalized opioid dependent patients.²² The clinical symptoms in patients with tuberculosis and heroin addiction were shown to be more severe than those in the non-heroin-addicted group.²³ HIV prevalence, risk behaviors among patients with Tuberculosis.²³
- Alcohol abuse⁶, and heavy drinkers OR = 3.33, 95% CL 1.99-5.59.¹⁸

A considerable knowledge gap exists with regards to "toxic exposures" and increased risk of tuberculosis that could be environmental, occupational or substance-use related. There is room for improvement in all those areas. Public health should get more involved in environmental toxic exposures and substance use. Research in this area and public communication should be considered a priority.

Work related TB - including industrial exposure - should generally be considered work related unless a community exposure to the disease is identified.²⁴

"The Occupational Safety and Health Administration (OSHA) has preliminarily determined that the engineering, work practice, and administrative controls, respiratory protection, training, medical surveillance, and other provisions of the proposed standard are technologically and economically feasible for facilities in all affected industries."²⁵

What can be done about it? What do you plan to do - at your capacity to limit the toxic exposures that may increase the risk and severity of tuberculosis?

References

1. Lopez-Hernandez Y, Rivas-Santiago CE, Lopez JA, et al. Tuberculosis and cigarette smoke exposure: An update of in vitro and in vivo studies. *Exp Lung Res* 2018;1-14.
2. Dogar OF, Pillai N, Safdar N, et al. Second-hand smoke and the risk of tuberculosis: a systematic review and a meta-analysis. *Epidemiol Infect* 2015;143(15):3158-72.
3. Elf JL, Eke O, Rakgokong M, et al. Indoor air pollution from secondhand tobacco smoke, solid fuels, and kerosene in homes with active tuberculosis disease in South Africa. *BMC Res Notes* 2017;10(1):591.
4. Pedrazzoli D, Boccia D, Dodd PJ, et al. Modelling the social and structural determinants of tuberculosis: opportunities and challenges. *Int J Tuberc Lung Dis* 2017;21(9):957-64.
5. Lai TC, Chiang CY, Wu CF, et al. Ambient air pollution and risk of tuberculosis: a cohort study. *Occup Environ Med* 2016;73(1):56-61.
6. Lonnroth K, Jaramillo E, Williams BG, et al. Drivers of tuberculosis epidemics: the role of risk factors and social determinants. *Soc Sci Med* 2009;68(12):2240-6.
7. Blount RJ, Pascopella L, Catanzaro DG, et al. Traffic-Related Air Pollution and All-Cause Mortality during Tuberculosis Treatment in California. *Environ Health Perspect* 2017;125(9):097026.
8. Smith GS, Van Den Eeden SK, Garcia C, et al. Air Pollution and Pulmonary Tuberculosis: A Nested Case-Control Study among Members of a Northern California Health Plan. *Environ Health Perspect* 2016;124(6):761-8.
9. Chen KY, Chuang KJ, Liu HC, et al. Particulate matter is associated with sputum culture conversion in patients with culture-positive tuberculosis. *Ther Clin Risk Manag* 2016;12:41-6.
10. Rabbani U, Sahito A, Nafees AA, et al. Pulmonary Tuberculosis Is Associated With Biomass Fuel Use Among Rural Women in Pakistan: An Age- and Residence-Matched Case-Control Study. *Asia Pac J Public Health* 2017;29(3):211-18.
11. Haque MA, Barman N, Islam MT, et al. Biomass Fuel Smoke and Tuberculosis: A Case-Control Study. *Mymensingh Med J* 2016;25(1):31-8.
12. Kurmi OP, Sadhra CS, Ayres JG, et al. Tuberculosis risk from exposure to solid fuel smoke: a systematic review and meta-analysis. *J Epidemiol Community Health* 2014;68(12):1112-8.
13. Garcia-Sancho MC, Garcia-Garcia L, Baez-Saldana R, et al. Indoor pollution as an occupational risk factor for tuberculosis among women: a population-based, gender oriented, case-control study in Southern Mexico. *Rev Invest Clin* 2009;61(5):392-8.
14. Fernandes FMC, Martins ES, Pedrosa D, et al. Relationship between climatic factors and air quality with tuberculosis in the Federal District, Brazil, 2003-2012. *Braz J Infect Dis* 2017;21(4):369-75.
15. Hnizdo E, Murray J. Risk of pulmonary tuberculosis relative to silicosis and exposure to silica dust in South African gold miners. *Occup Environ Med* 1998;55(7):496-502.
16. Hung CL, Su PL, Ou CY. Prognostic effect of tuberculosis on patients with occupational lung diseases: A 13-year observational study in a nationwide cohort. *Medicine (Baltimore)* 2016;95(37):e4748.
17. Rees D, Murray J. Silica, silicosis and tuberculosis. *Int J Tuberc Lung Dis* 2007;11(5):474-84.
18. Rosenman KD, Hall N. Occupational risk factors for developing tuberculosis. *Am J Ind Med* 1996;30(2):148-54.
19. Tse LA, Chen MH, Au RK, et al. Pulmonary tuberculosis and lung cancer mortality in a historical cohort of workers with asbestosis. *Public Health* 2012;126(12):1013-6.
20. Shea YF, Ip JJ. Pulmonary tuberculosis complicating asbestosis. *Hong Kong Med J* 2014;20(3):265 e3-5.
21. Seidler A, Nienhaus A, Diel R. Review of epidemiological studies on the occupational risk of tuberculosis in low-incidence areas. *Respiration* 2005;72(4):431-46.
22. Morozova O, Dvoryak S, Altice FL. Methadone treatment improves tuberculosis treatment among hospitalized opioid dependent patients in Ukraine. *Int J Drug Policy* 2013;24(6):e91-8.
23. Wang W, Xiao H, Lu L. Case-control retrospective study of pulmonary tuberculosis in heroin-abusing patients in China. *J Psychoactive Drugs* 2006;38(2):203-5.
24. Evenson W. Occupational exposure to *Mycobacterium tuberculosis*. Legal issues in workers' compensation. *AAOHN J* 1999;47(8):373-80; quiz 81-2.
25. Occupational exposure to tuberculosis--OSHA. Proposed rule and notice of public hearing. *Fed Regist* 1997;62(201):54160-308.