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EDITORIAL

Preventing tuberculosis with silica dust controls

TUBERCULOSIS (TB) is one of the greatest public health challenges of the twenty-first century, killing about 2 million people each year.[1] In response, major programs have been initiated, such as the 10-year Global Plan to Stop TB (2006–2015), with an estimated budget of $56 billion.[2] These efforts emphasize identification and treatment, however, and few resources go towards prevention. About 36 million people have been cured since 1995, with a standard medical approach of early detection and treatment that has been replicated around the globe.[3]

Despite these efforts, evidence is building that significant reductions in disease rates have not been achieved in communities with high human immunodeficiency virus (HIV) burdens and significant exposures to silica, where incident cases and TB-related deaths continue to rise.[3,4] Consequently, without diverting resources from the current approach, we need to consider prevention strategies to reduce risk factors for TB that are feasible and have a significant impact and proven efficacy. This editorial examines the case for a greater focus on silica dust control within a comprehensive strategy to eliminate TB, particularly in countries with high TB burdens and large silica-exposed populations.

Reducing silica exposure will have a significant impact in preventing TB. Silicosis increases the risk of TB by a magnitude similar to that conferred by HIV infection.[5] A 7-year follow-up of South African gold miners before the HIV epidemic found a relative risk of TB in men with silicosis compared to those without of 2.8 (95%CI 1.9–4.1); the incidence of TB rose to 6.3% per annum in miners with advanced pneumoconiosis.[6] Importantly, silica exposure is associated with TB even in the absence of silicosis.[7,8]

Exposure to silica is very common around the world in a range of industries, including mining, quarrying, stone cutting, and construction.[9] Populous countries with high TB rates have millions of silica-exposed workers. For example, Brazil has an estimated 3 million people exposed in the formal economy and many more in the informal sector.[10] Small-scale mining is increasing in many low-income countries, employing an estimated 13 million people in 1999.[11]

TB burdens in silica-exposed populations have also been strongly influenced by the HIV pandemic, partly because the TB risks of silicosis and HIV infection combine multiplicatively.[12] A TB incidence of 16 100 per 100 000 person-years has been reported in HIV-positive gold miners with silicosis.[12] Consequently, the highest recorded rates of TB occur in silica-exposed populations, with an incidence as high as 7000/100 000 in South African gold miners.[13]

Migrant and temporary labor is common in silica-exposed work places, which increases the potential to transmit TB widely in distant communities often poorly served by health services. This impact is compounded by an increased life-long risk of active TB conferred by silica exposure.[7] These factors contribute to a strong link between TB in the mining population and that in the general population in sub-Saharan Africa that is disproportionate to the level of employment in this sector.[14] In addition to miners, significantly increased risks for TB have been reported among stone crushers, foundry workers, construction workers, and stone masons.[15]

Two studies have demonstrated the efficacy of dust reduction in reducing rates of TB among exposed workers. A 1937 publication from South Africa showed a progressive fall in average dust levels concomitant with a fall in the incidence of TB.[16] Similarly, a cohort study of Vermont granite workers showed that the reduction of dust levels over time was effective in eliminating TB in this population.[17]

The feasibility of silica dust control is well documented; pollution controls have been shown to be effective at reducing silica exposure in both small and large enterprises. Even in resource-poor settings, water spray controls have been shown to reduce respirable silica by 80% in small stone crusher mills in India.[18] The costs associated with dust reduction should not inhibit promoting their use, as engineering controls, respirators, and other methods to reduce silicosis have been shown to have a significant cost benefit ratio per healthy year.[19] Significantly higher cost effectiveness would result if costs of TB and other silica-related diseases were included in the analysis.

Silica-generating activities, including mining, quarrying, mineral processing, construction, stone crushing and road building are common and often central to economic development in poor countries with high TB burdens. Strategies to encourage a renewed focus on silica can be readily incorporated into existing endeavors, and have the potential to improve the health of millions of workers and their communities. As a first step, silica dust controls could be more explicitly included in international and national TB prevention and control strategies and program guidelines, as has been done in South Africa.[13] The World Health Organization (WHO) document 'Healthy workplaces: a model for action'[20] makes a compelling case for a comprehensive approach to protecting and promoting health through workplace-based interventions. This approach can be used to encourage businesses to reduce silica exposures.

International lenders, including the World Bank, can take a greater role in setting and enforcing silica dust standards for projects in which they are involved.

As an example, infrastructure programs using crushed stone can incorporate dust suppression into project specifications. Support of national programs on the elimination of silicosis by the International Labour Organization (ILO)/WHO Global Elimination of Silicosis Campaign[21] should continue, as these have led to the regulation of particularly risky work activities, such as banning sand blasting in Brazil.[22]

In countries with significant TB rates, it may be feasible to influence industry through a combination of regulatory measures and financial incentives. Workers' compensation programs can be expanded to cover TB for employees in high-risk industries. The costs of expanding these programs should be passed on to employers partly as a financial incentive to reduce dust exposures. Discounts, subsidies or tax credits can be provided for enterprises that invest in dust control. Finally, strengthening regulation and enforcement agencies will be necessary to reduce TB in many occupations.

In conclusion, more action is needed to prevent TB in occupations with significant exposure to silica. Investments in global public health should consider adopting the basic tenet of financial investment: diversifying a portfolio will increase long-term performance. TB program activities should be expanded beyond the diagnosis and treatment model to incorporate promising prevention strategies.

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