

## A dusty business

For the **Thibela TB study** see <http://www.aidsmap.com/Thibela-TB-Community-wide-IPT-did-not-improve-TB-control-in-South-Africas-mines-at-the-population-level/page/2285760/>

For more on the **risks of long-term exposure to silica dust in China** see <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1001206>

For more on **mining and tuberculosis in southern Africa** see <http://www.globalizationandhealth.com/content/5/1/11>

For more on the **use of water-spray equipment** see *Int J Occup Environ Health* 2008; **14**: 94–103; <http://www.okinternational.org/docs/IJOEH%20gottesfeld.pdf>

For the **industry study** see <http://deloitte-ftp.fr/Lot-B-Energie-ressources/doc/onminingandmetalsoct06.pdf>

Earlier this year, the authors of the Thibela TB study released their findings. Their study had been based in 15 gold mines in three South African states. The researchers prescribed a 9 month course of preventative isoniazid therapy to around 24 000 miners who were not infected with tuberculosis. But the results were disappointing: levels of tuberculosis in the intervention groups remained roughly the same as those in the control groups.

The failure of preventative isoniazid therapy as a means of controlling tuberculosis in this high-risk population emphasises the need to ensure healthy working practices for miners. “Globally, the highest recorded rates of tuberculosis have occurred in silica-exposed populations like miners”, explains occupational health expert Perry Gottesfeld (Occupational Knowledge International, San Francisco, CA, USA). South Africa’s Department of Health estimates that its gold-mining industry has the highest incidence of tuberculosis in the world. In Angola, it is the eastern diamond producing provinces where tuberculosis is most prevalent. In China, recent research suggested that workers in the country’s metal mines and pottery factories are almost five times more likely to die from tuberculosis than the general population. “Rates

of tuberculosis among miners can be anywhere between five and 15 times the background rates of tuberculosis”, adds Gottesfeld.

A key issue is exposure to silica dust. It is thrown up whenever one drills into or crushes rock, most notably during the processes of gold mining. Exposure to silica dust leads to silicosis, which in turn results in a tripling in the risk of tuberculosis. Roughly a quarter of gold miners in South Africa and Botswana are thought to show signs of silicosis. Moreover, silicosis is associated with a heightened lifelong risk of tuberculosis. Factor in HIV infection and the chances of developing tuberculosis are even higher.

Yet measures by which to minimise the inhalation of silica are well established, inexpensive, and locally available: adequate ventilation for underground mines, respirators for dust-exposed workers, and the use of equipment that covers the rock face with a fine mist of water. “Spraying of the area where they drill is paramount to the health of miners”, affirms Christo van Niekerk (TB Alliance, South Africa). Indeed, a study co-authored by Gottesfeld showed that the use of water-spray equipment reduces respirable silica by up to 82%. And there’s an economic benefit too: it helps capture gold that would otherwise be lost.

“We would like to produce standards for the mining industry to ensure that when they initiate activity in a country, they do a health assessment and look at the community effects of their work” said WHO’s Maria Neira. Newmont Mining Corporation, which operates on five continents, told *TLID* that they “control dust exposures using air conditioned sealed vehicle cabins, water trucks to suppress dust generation and respiratory protection where required”. Still, it is a diverse industry. First, there are mines in the developed world. In

terms of tuberculosis, there is little risk. Certainly, there are concerns that the silica-exposure limit currently mandated in the USA (and upon which other nations base their safety standards) does not protect against silicosis, and the country’s Occupational Health and Safety Administration has proposed reducing it, but at least there is an assurance that developed countries will tend to enforce health and safety standards (and tuberculosis incidence tends to be low anyway). Then there are countries such as India, where an estimated 10 million workers are exposed to silica, and China, where at least 23 million workers are at risk. In the absence of any real enforcement, safety standards are meaningless. Moreover, the Chinese Government is hostile to trade unions and other lobbying organisations, while in India records on worker health tend to be scanty and unreliable. WHO works with national authorities to develop and apply occupational health standards, but it is a painstaking process, and requires commitment from national authorities that may not always be forthcoming.

The problems in South Africa—which has a sizeable organised mining industry, employing at least half a million people—are different. The country’s national tuberculosis programme guidelines specifically mention silica control. “Ensuring the health of miners is a very high priority in the mining communities of South Africa”, said van Niekerk. Mining corporations provide extensive, well-staffed health-care services. They offer annual examinations, radiographs, provision of antiretroviral therapy, and are compliant with the directly observed treatment, short-course (DOTS) strategy; although admittedly, as private industries they are under no obligation to release precise health-care statistics. “The legislation in South Africa has been in place for many years, it is very strict and often there’s very



Miners are at an increased risk of tuberculosis and HIV

John Mead/Science Photo Library

good oversight from the mine workers' unions", adds van Niekerk.

Instead, the issues largely seem to stem from migration. In South Africa, at least 40% of miners hail from outside the country. There is a well-established pattern of circular migration of mine workers across southern Africa. About 230 000 men enter the South African mining industry every year from nearby nations. For example, some 50 000 miners move back and forth between Lesotho and its encircling country. Needless to say, this is conducive to the spread of tuberculosis both within mining communities and the communities from which the miners have come. Most patients with tuberculosis in Lesotho have worked in South Africa's mines. There are also commonly problems with ensuring continuity of care for those diagnosed with tuberculosis while away from home—a quarter of Lesotho's drug-resistant tuberculosis patients are migrating miners.

"Traditional mines disrupt family networks and that leads to risky environments", explains Human Rights Watch's Joseph Amon. Miners may be confined to the kind of close living conditions that facilitate the spread of tuberculosis; they might fall into alcoholism, depression, or start engaging in unsafe sex with the sex workers that congregate around the hostels. HIV is a significant problem. Estimates suggest that miners are three-to-four-times more likely to contract the virus than the wider community. One industry study concluded that almost a third of miners will become infected with HIV during their initial 18 months of employment.

Making certain that miners' living quarters and work-sites are well ventilated and that they have access to, and information on, safer sexual practices would help ameliorate matters. Equally vital is ensuring a seamless transition of medical care for those undergoing treatment—this could be tricky, some miners come from regions with very little

health-care provision. But given that silicosis takes many years to develop, there is also a need to maintain follow-up care for former miners, who might not otherwise have access to diagnostic facilities. Where there are concerns over working conditions, Gottesfeld advocates that governments offer subsidies and tax credits to businesses to invest in better controls and to adopt safer practices. More generally, international organisations involved in infrastructure works could enshrine limits on exposure to silica dust in their project plans.

The final group of miners are the most difficult to reach: those engaged in artisanal mining. This is essentially subsistence mining conducted by individual miners, or perhaps an informal co-operative, working with makeshift shafts and rudimentary tools. It occurs in more than 50 developing countries, and hit the headlines recently in Nigeria, where a serious outbreak of lead poisoning was traced to artisanal miners working a seam of gold heavily contaminated with the element. "The vast majority of small scale mining is outside of any regulatory framework", affirms Amon, "it occurs without any kind of government oversight and health and safety rules."

Artisanal mining can occur in remote areas, outside the reach of a country's health-care infrastructure. "They don't have any protection, they are exposed to deadly diseases, and there is no national law in place or even trade union to protect these informal miners", adds WHO's Neira. She said that WHO was working to put some basic occupational health services within nations' primary health-care services—as things stand, the global percentage of workers who have access to occupational health services is 17%. It is not as if subsistence miners are an impossible to reach community—after all, they also have to trade what they extract. Furthermore, Amon points out, artisanal miners do tend to be



Small-scale ore processing in Nigeria without dust controls

receptive to inexpensive measures that improve health, particularly if there is a concomitant improvement to their yield. "It requires an upfront cost and government commitment to identify the areas and to offer support", he concluded.

The extractive industries are flourishing. Gold mining has never been so profitable: the past few years have seen sharp increases in the value of gold. There is growing interest in fracking—which a recent American survey showed was responsible for heavy clouds of silica dust. "Silica exposure is the number one occupational health issue throughout the developing world", said Gottesfeld. But he believes that it has been marginalised, particularly in tuberculosis campaigns. "It is a shame, because this is really low-hanging fruit in terms of prevention—we have simple measures that are proven to work and have significant health benefits". The water-spray is the most practical measure, particularly for small-scale mining. He urged stakeholders in The Global Plan to Stop TB to become more involved. "If parties get together and begin to promote demonstration projects and more enforcement and better regulation of mining and dust exposures, it would really go some way to raising the profile of this issue."

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