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‘Dying for gold’: the effects of mineral mining on HIV, tuberculosis, silicosis and occupational diseases in southern Africa

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Mineral mining in southern Africa is among the most hazardous occupations in the world. High levels of silica dust exposure can cause silicosis, an occupational lung disease leading to scarring of the lungs. Workers in South Africa’s gold mining industry have among the highest incidences of tuberculosis in the world, of between 3000 and 7000 cases per 100,000 population per year, compared with 981 per 100,000 population in South Africa overall and a global incidence of 128 per 100,000 population per year (1). About one-quarter of all miners had silicosis in 2008, about the same prevalence as recorded one century ago (2, 3).

Dust exposures inside the mines damage the lungs, but social conditions outside the mines have historically been major drivers of epidemics, starting in the past with the “circular transmission” of sexually transmitted diseases between rural areas and the mines, and now driving HIV and tuberculosis (TB)(4). The labour migration system creates a mechanism to spread miners’ HIV and TB risks to their families and home communities. Apartheid laws separated men from their wives for extended periods, fostering sex-trade in mining shantytowns in contexts of striking gender inequality in which some women faced few prospects for work outside of sex trading (5, 6); women in rural areas became exposed to sexually-transmitted diseases without knowledge or power to address the gender inequalities that heightened their risk (7, 8) (9). According to industry reports from Deloitte, about one-third of miners become infected with HIV within 18 months of working on the mines (10). HIV infection further significantly increases the risk of developing active TB (11).

Crowding, where up to 16 men are housed in one hostel room, is not uncommon, and facilitates airborne-disease spread; each additional adult per bedroom is estimated to increase the risk of TB by 27% in South Africa (12).

This combination of social and epidemiological risk factors makes mining among the largest drivers of TB in southern Africa. Each year, mining is estimated to be attributable for about 760,000 cases of tuberculosis in sub-Saharan Africa (7, 8, 11, 13). Mining activity is also found to be significantly linked to the spread of HIV/AIDS at a population level in Africa (14), such that the risk is not isolated to just the mining community. As Aaron Motsoaledi, health minister of South Africa, notes, “if TB and HIV are a snake in Southern Africa, the head of the snake is here in Southern Africa. People come from all over the Southern African Development Community to work in our mines and export TB and HIV, along with their earnings. If we want to kill a snake, we need to hit it on its head”(8).

Although occupational diseases are neglected worldwide, the problem is especially acute in southern Africa (15). Some mining companies have constructed high-quality tertiary care facilities often to treat acute traumatic injuries, but ironically this infrastructure fails to provide adequate detection and treatment of TB (16). The industry has repeatedly failed to comply with health and safety legal requirements (17–19). Autopsies of black miners reveal that about 40% of active pulmonary TB is undetected (20), even though reports based on official estimates including those reported by mining doctors, claim high levels of TB detection and treatment in miners (13). Partners in Health and other non-governmental organizations have documented multi- and extensively-drug resistant strains of TB have the greatest incidence among miners and their families (21–23).

Two main factors are contributing to mining companies’ inadequate response to HIV, TB, and silicosis on the mines. First, the migrant labour system weakens incentives to control dust and diseases because the costs can be externalized from the mining industry to labour-supplying communities and the state (8, 24). Mining industries in the Australasia region and North America are able to operate without the secondary impact on lung disease and sexually-transmitted disease observed in Africa. Yet African mining relies heavily on migrant labour; South Africa’s mines, for example, draw on employees from Botswana, Lesotho, Mozambique, Swaziland, and Zimbabwe. As one doctor from the South African Department of Mineral Resources summarized the situation: “These miners are expendable. Skills are easy to acquire. Much cheaper to have high turnover than keep employees...” (8). Second, the main strategy to incentivise prevention – occupational health compensation – does not operate effectively. Recent data find that the estimated unpaid occupational lung disease compensation is about 20 billion rands (US \$2.9 billion) (24, 25), leading to a series of lawsuits which are currently underway.

Mining companies will continue to do what governments allow them to do. Historically, mining companies sought to undermine public health regulatory efforts. In the case of asbestos, even as evidence became clear of its harms were established in the 1960s and 1970s, asbestos production continued to increase (26). Only after legal bans did asbestos mining come to a halt in 2008 in South Africa (leaving Zimbabwe and Swaziland as the only remaining countries in the region to mine asbestos) (27). Similar to other industrial

epidemics, mining companies have vested interests to subvert public health prevention strategies if these interventions threaten profitability.

With a failure of South African states, miners' unions, and mining companies to address the problem, the failure also rests with the global health community. There has been extensive research to indicate which groups are most vulnerable to the dual epidemics of HIV and TB(23), yet the global health community has been virtually silent on the primary social drivers of these twin epidemics. A quick search of leading international reports from UNAIDS and the Global TB yearly reports reveals very vague references to 'social determinants' of health, but little to no specific policy recommendations or interventions to address these determinants (28, 29). Poverty and inequality are vague and general risk factors, but the 'causes of the causes' of these risks are traceable to the region's mining activity and provide a specific areas for policy-relevant action.

Taken together, the combination of vulnerable populations, weak public health oversight, and vested interests of mining companies create a 'perfect storm' for southern Africa's unmitigated public health disaster.

This problem has motivated a new series in the *International Journal of Health Services*, focused on vulnerable populations and specific policy contexts in which multi-national companies profit on the suffering of such populations. The series starts with miners and mining companies in southern Africa and in subsequent series will expand beyond sub-Saharan Africa to address more broadly the social determinants and health impacts of extractive industries globally.

In the first paper of this series, Dharmadhikari and colleagues of Partners in Health set out a vision for a world free of TB deaths among miners. Their report builds on the 2012 "Declaration on Tuberculosis in the Mining Industry" from 15 member counties of the Southern Africa Development Community calling for zero deaths among the region's miners (1). The authors note the extraordinary TB statistics among miners arising from a combination of risk factors: silica dust, HIV, and substandard working and living conditions. They call for critical medical interventions to reduce active TB. This includes rapid diagnosis of TB (using semi-annual radiographic screening at places where miners work and live), early treatment of active TB (including effective use of drugs to treat multi-drug resistant TB), and better management of HIV treatment among miners living with HIV/AIDS.

However, the authors' recognise that mining companies operate extensive tertiary care facilities but still fail to prevent TB transmission among miners. Concerns have also been raised that rapid, effective diagnostic tools may be perversely used by mining companies to dismiss workers who develop TB, rather than to invest in their health (30). To stop TB in the mines, the authors' recognise that it will be necessary to complement critical biomedical interventions with improvements to workers' housing standards. The South Africa's Department for Mineral Resources calls miners' housing "appalling", with single-sex hostels crowded, unsanitary, and poorly ventilated. While some mining companies have taken steps to rectify the situation following a 2002 Act mandating provision of adequate housing, a

2009 investigation by the Department for Mineral Resources found less than 30% of mining companies have actually improved housing standards. Until basic living conditions improve, the miners' disease toll will continue to be staggering.

In the second paper, "Human trafficking, labor brokering and mining in Southern Africa", Steele reveals how and why mining sites have become centers of human trafficking, and what can be done to address involuntary cycles of debt and risk among those trafficked (31). A large population of men on the mines with disposable income creates an attractive site for trafficking of sex-workers. Similarly, some men themselves are reportedly trafficked through a system of "labour-brokering". As Steele notes, "the result is a toxic combination of vulnerable men and women, whose tragic exploitation intensifies the already troubling epidemics in the region." Steele calls for more attention to be paid to the intermediaries between the mining companies and the workers: labour-brokers who often entice modern forms of indentured servitude through exploitative contracts. About half of labor-recruitment occurs with TEBA (The Employment Bureau of Africa, the recruitment arm of the mining industry established in 1902) and the remainder through other, unclearly specified labor-brokering groups (32). Some miners report being offered a 'second wife', which reportedly comes with a *lobola* ('bride price'), indenturing them to the mining company (which can be seen in financial reports of TEBA bank). USAID and IOM also note the practice of *ngoanatsela*, involving bringing a young girl from home to the mines as a 'girlfriend' who is shared among mineworkers. Given the dearth of statistical data on labor-brokers and trafficking, a first step for researchers is to conduct further work to investigate the scope of the problem and the dimensions of gender inequality and power underlying them. There is a need for joined efforts between lawyers working on human trafficking and public health workers interested in targeted interventions to address practices that sustain themselves through informal social networks. Extending Dharmadikari and colleagues' call to improve living conditions, Steele calls for strategies to build communities at mining sites hospitable to families, in an effort to reduce demand for sex-work at mines and forced/bonded marriage.

The next two papers offer two country case-studies of the political economy of infectious diseases. Udoh investigates "Oil, migration, and the political economy of HIV/AIDS prevention in Nigeria's Niger Delta". He explores why Nigeria, through ExxonMobil and Shell's investments among other foreign oil companies, has become heralded as an 'economic miracle' (33) and US President Obama declared Nigeria "the world's next economic giant" (34). Yet the so-called "resource curse" has applied, whereby the availability of mineral wealth benefits a minority of the population at the expense of the majority. Oil accounts for 85% of government revenue and about one-quarter to one-half of GDP, such that Nigeria is heavily dependent on mineral mining. Using semi-structured interviews and focus groups, Udoh finds that oil companies are able to 'divide and rule' through payments to community leaders, silencing discontent and preventing community mobilization for healthcare and other public goods to respond to poverty and longstanding health threats. As one participant noted, "If a job is awarded in my community, the contractor settles the chiefs and youth; but the chief also wants to take the portion given to the youth, almost taking it all. When Shell paid to the community, the chiefs took it all. The

community liaison officer [from Shell] is the middle man, but sided with the chiefs, not the youth.” In poorly regulated and undemocratic conditions such as these, where corruption and foreign company investment are merged, it is difficult to envision that greater foreign investment, whether through western multi-nationals or increasingly from Chinese companies, will help solve the region’s most challenging social problems, even if economic growth rates rise, as is often argued (35).

The final paper, by Barwise and colleagues with the International Organization for Migration, focuses on “Intensifying Action to Address HIV & TB in Mozambique’s Cross-Border Mining Sector.” The authors focus on the HIV risks created by the system of migrant labor in mining production. Not only are men separated from their wives and children for extended periods in those mines that still lack family housing, but are exposed to a flourishing sex industry at the mining sites. The women in the sex industry at these sites suffer from a lack of power and alternative means of income. Meanwhile, women in home regions are more likely to engage in multiple sexual relationships that itself poses health risks as well as risks of domestic violence. To explore the importance of these risks, the authors conducted 30 interviews in Xai Xai, the capital of Gaza province, and a further 30 interviews at a border crossing in Maputo province. Two highlights are worth noting. In Xai Xai, 80% of miners interviewed reported seeing their wives between every three months and once per year. Additionally, Barwise and colleagues note that there are social barriers to accessing healthcare at mining sites including discrimination against foreign migrants, and that such barriers lower the quality of care that miners receive. Half of interviewees at Maputo crossing described xenophobia as a major problem. One explained, “In South Africa, Mozambicans face a big problem of discrimination. South Africans don’t like Mozambicans, they treat them bad, we don’t feel good in South Africa; in Mozambique we feel a lot better.”

Taken together, the series reveals at least three important theses. First, there is no reason why miners and their communities should suffer such a high a rate of disease. The disease toll of mineral mining is staggering, yet avoidable, as it has been mitigated in other regions.

Second, the mining industry cannot – and will not – stop mining-related health epidemics without new pressure to do so. Public regulation is needed where self-regulation has failed for decades, as it has done in numerous areas of public health (36). The mining companies will do what the state allows them to do, as their legal imperative is to extract profit. They have made clear that if this means sacrificing worker health, in a context of high unemployment, surplus labour, and a relatively low-skill industry, the turnover costs are worth bearing. There are an estimated 480,000 cases of compensable silicosis and 226,000 cases of gold mining attributable TB in South Africa (37). But practical barriers – from personal injury lawyers who prey on miners, to cumbersome testing demands to prove an association between injury and mining company neglect, to lack of awareness of miners’ rights – prevent people from accessing benefits to which they are entitled. A study of former miners in Eastern Cape with compensable silicosis found only 2% had received compensation (38); similarly, an audit of the mining companies’ Compensation Fund found that less 1.5% of claims were paid out (39) (nor does it help that links between the unions and mining companies appear to create a complex set of conflicts of interest).(8) In

response, mining companies often claim that families would “prefer” pensions over lump-sum payments, or that miners’ families can’t prove causality in claiming that TB deaths are truly caused by mining per se (and often require families to ship the lungs or heart of the deceased to do so, which almost never happens for cultural and pragmatic reasons), or simply lack the capacity to manage money and therefore shouldn’t be given compensatory funds. Yet if such pay-outs happened, it would likely incentivise mining companies to take greater, pro-active action to prevent mining from amplifying disease. Mining companies’ own reports document how social housing can prevent HIV and disease spread, but the approach has been one of financial management of “cutting and trading away the costs” (10).

Third, the public health community has failed to mount an effective response to this longstanding public health threats linked to mining. Partly, this reflects the public health field’s lack of engagement with institutions and agents that determine the social determinants of health. It also reflects a westernised, donor-driven approach to prioritising health needs that are of primary interest to grant-making bodies. Had public health institutions first focused on the needs of the most vulnerable populations – such as miners and their communities – the approach taken would likely differ from the questions currently being asked, and the results potentially more fruitful in turning the tide against HIV, TB, and other avoidable mining epidemics over the long term. Politically, bringing forward regional and national policy to implement safeguards seen elsewhere the same mining companies operate has been described as “a one hundred-year old policy stalemate.” Miners’ risks of illness are as high as they were about a century ago in this region, and potentially higher given the burden of HIV (2, 3, 40).

Hence, what we need to do is recognize that the plight of miners reflects quite literally the canary dying in the shaft—the underlying social production of epidemics in the most vulnerable communities. The researchers who have started to engage in this field have to begin using the key tools of public health and epidemiology—the combination of ethnography and survey-based methods to investigate the constraints facing the lives of miners and their families, and the assembly of large-scale data and epidemiological metrics to identify key levers to change. Using these tools, public health researchers have a critical opportunity to reinvigorate what has been a stale conversation that suffered ultimately from a lack of a mobilized, engaged public health presence to address the underlying cause of some of the world’s most persistent, damaging, and avoidable epidemics.

Acknowledgments

We invite submissions that investigate global health effects of extractive industries. We seek health impact assessments of the ongoing asbestos mining in Swaziland and Zimbabwe. Recently, the Indian government also lifted its ban on indigenous chrysotile asbestos mining (with reports of children playing in piles of asbestos dust). We also especially invite papers that cover regions other than sub-Saharan Africa and within the region to address the political economy barriers to accessing occupational compensation and implementing effective public-health interventions.

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