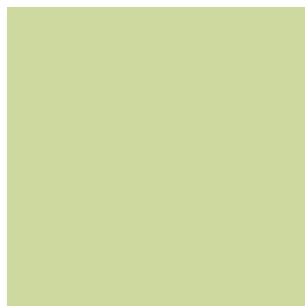


ENVIRONMENTAL HEALTH RESEARCH IN ARTISANAL AND SMALL-SCALE GOLD MINING SITES IN ZIMBABWE

Stephan Bose-O'Reilly



Zimbabwe

Economic decline

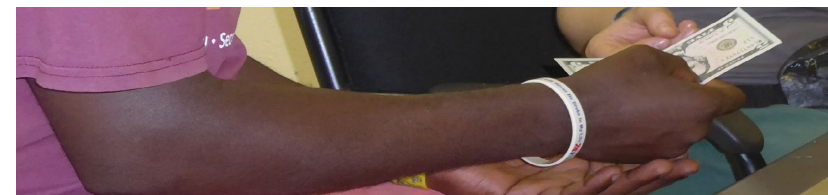
- Horrible economic decline



- Mercury, a most neurotoxic substance is widely used.



- Gold mining is one of the only opportunities to earn some dollars



Environmental health research over 20 years

Studies

- Health assessment
- Hg in blood, urine, hair
- Hg in breastmilk



Health assessments

Zimbabwe >70% of miners intoxicated

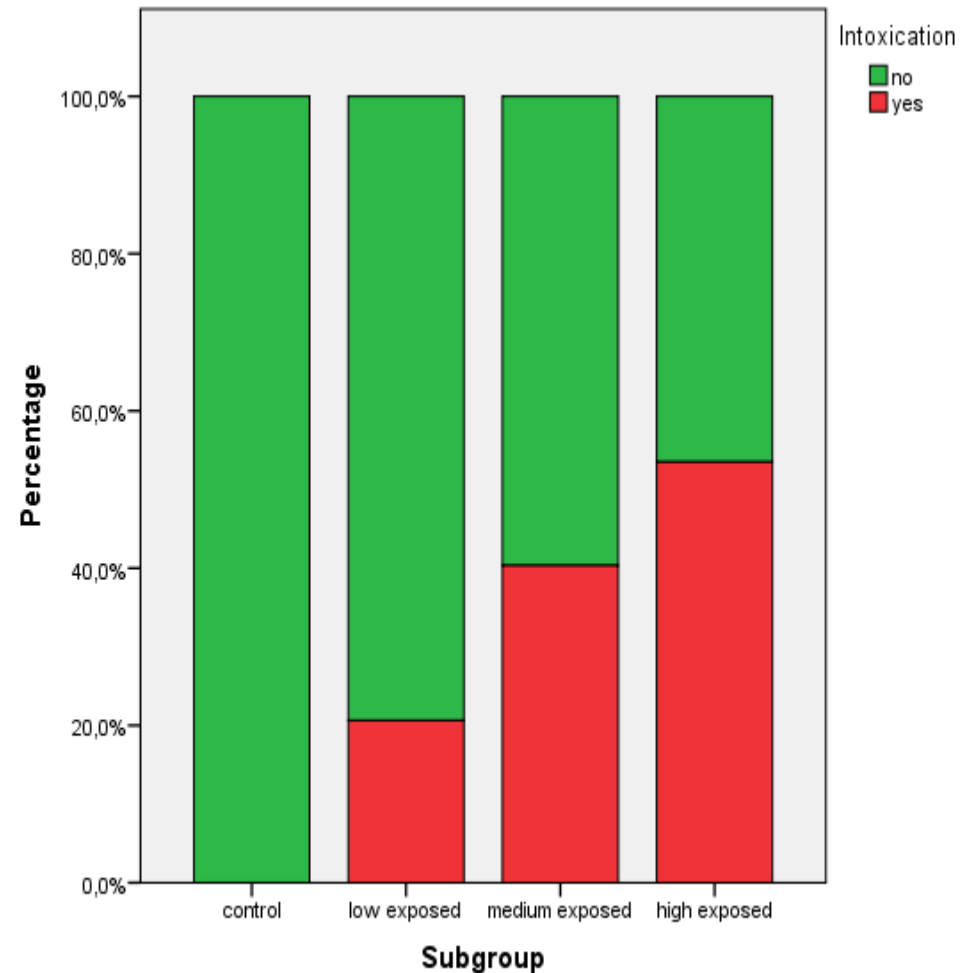
Typical symptoms (ataxia, coordination problems, tremor)

+

High mercury levels in human specimens

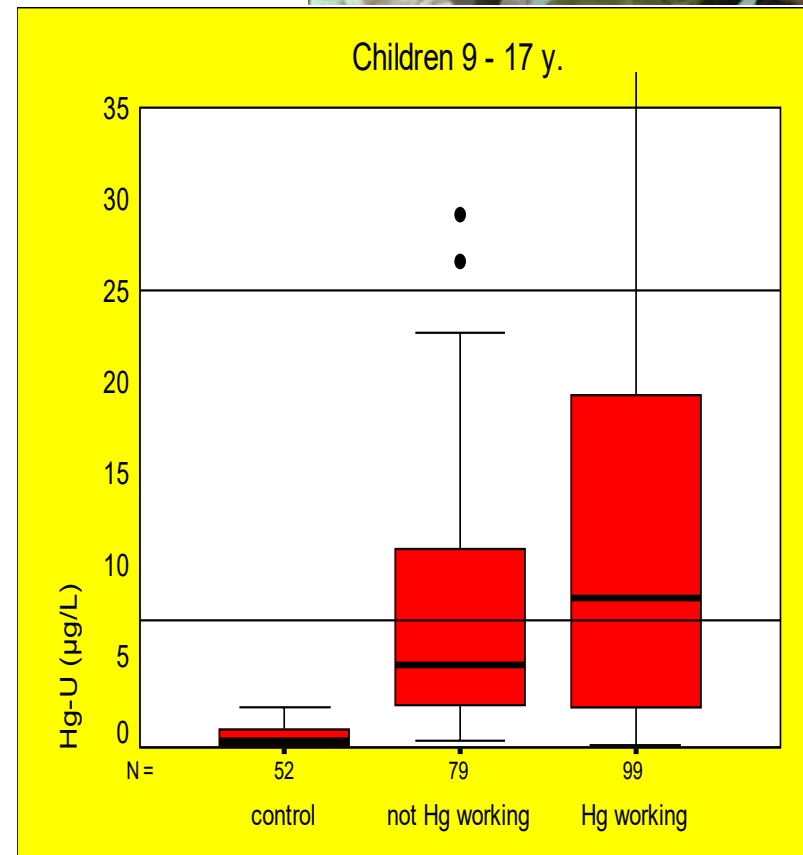
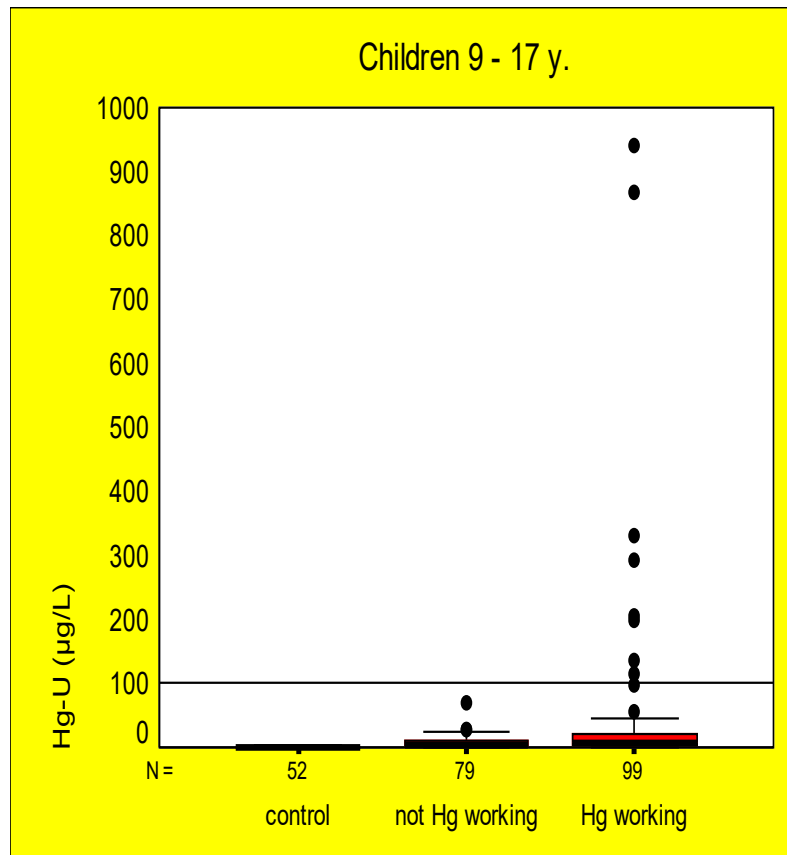
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Chronic mercury intoxication



Humanbiomonitoring

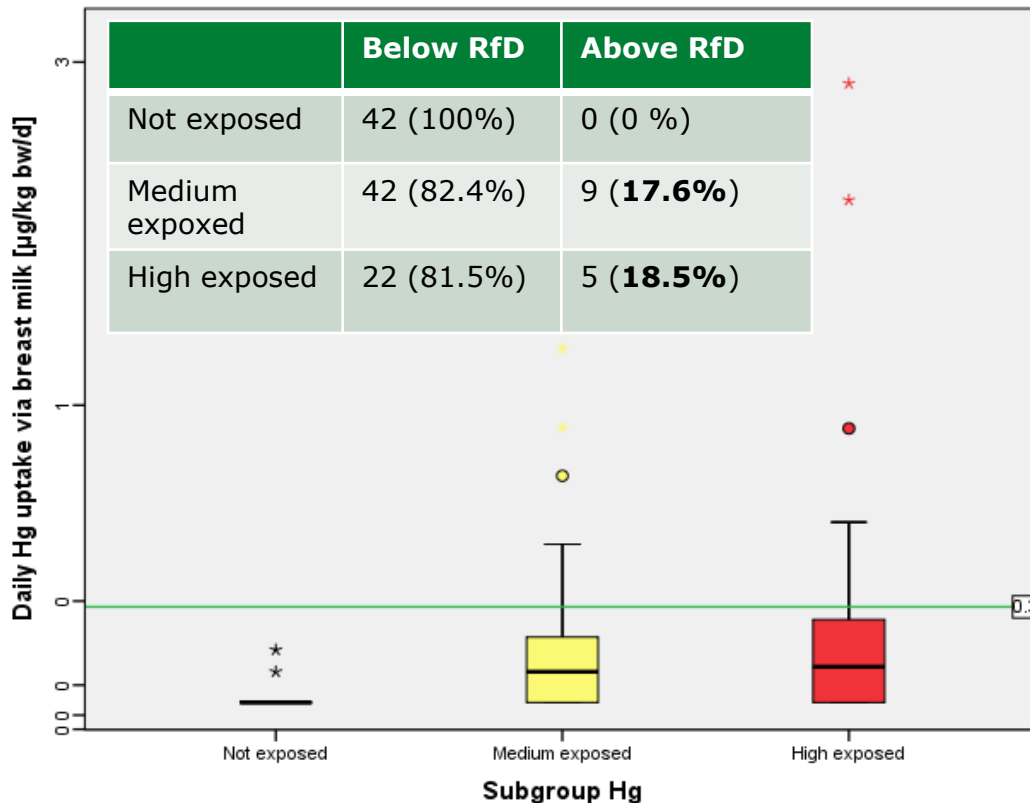
Children living and working in ASGM



Mercury (Hg) in urine ($\mu\text{g/L}$), Zimbabwe and Indonesia, $p < 0,001$

Breast milk study

Increased external exposure to Hg leads to increased levels of Hg in breast-milk



Environmental health research over 20 years

Studies

- Burden of disease (BoD)
- Health needs assessment
- Occupational safety and health (OSH)



Burden of disease (BoD)

- A total of 95,400 DALYs are estimated to be caused by chronic mercury intoxication due to artisanal small-scale gold mining (ASGM) in Zimbabwe
- Chronic mercury intoxication due to the use of mercury in ASGM would be amongst the top 20 causes of BoD in Zimbabwe

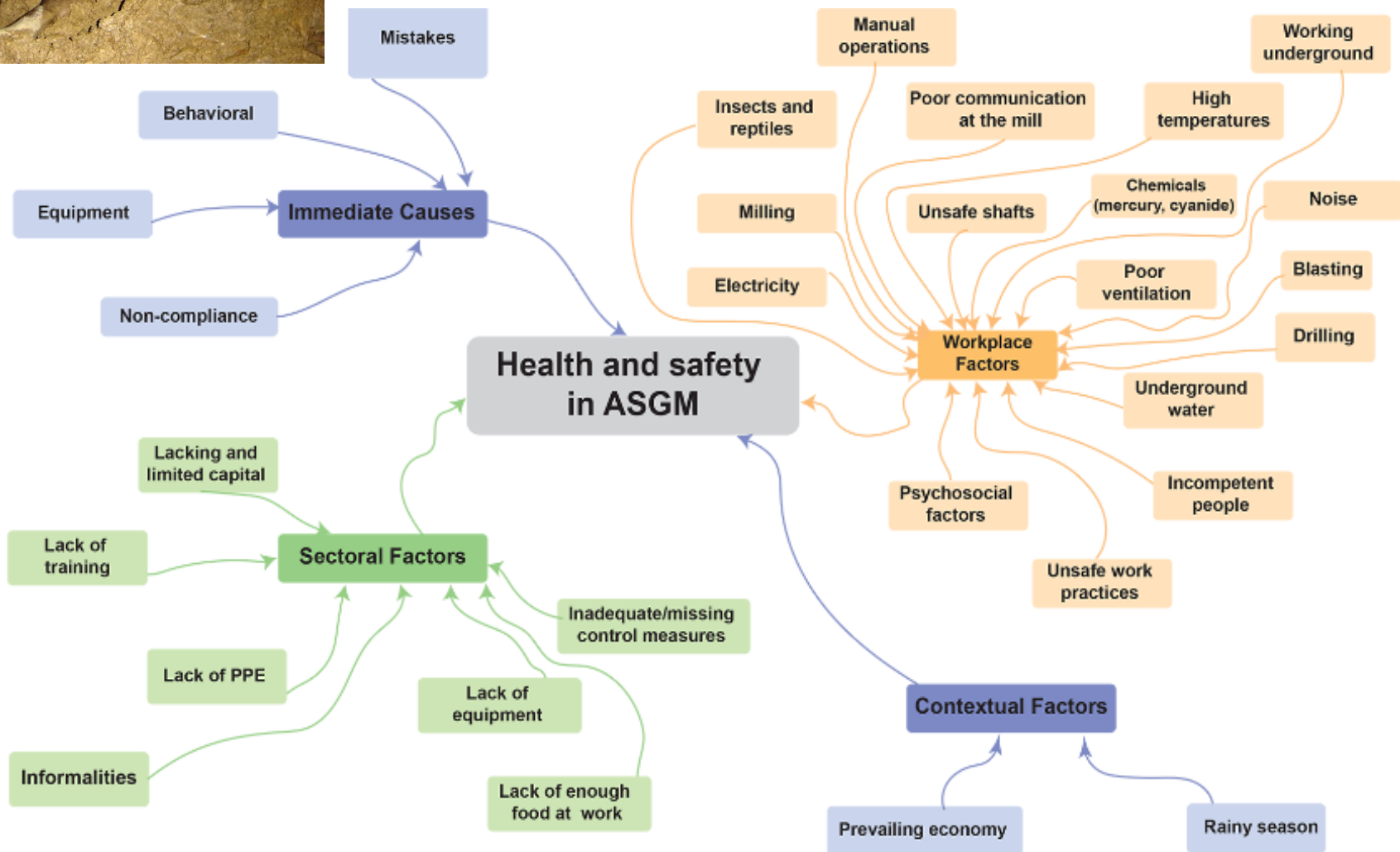


Health needs assessment





Occupational safety and health (OSH)



Environmental health research over 20 years

LMU publications – ASGM / Zimbabwe

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- 2. Singo, J., et al., Health and Safety Risk Mitigation among Artisanal and Small-Scale Gold Miners in Zimbabwe. *Int J Environ Res Public Health*, 2022. 19(21).
- 3. Singo, J., et al., Hazards and Control Measures among Artisanal and Small-Scale Gold Miners in Zimbabwe. *Ann Glob Health*, 2022. 88(1): p. 21.
- 4. Singo, J., et al., Accidents, Injuries, and Safety among Artisanal and Small-Scale Gold Miners in Zimbabwe. *Int J Environ Res Public Health*, 2022. 19(14).
- 5. Rakete, S., et al., Biomonitoring of arsenic, cadmium and lead in two artisanal and small-scale gold mining areas in Zimbabwe. *Environ Sci Pollut Res Int*, 2022. 29(3): p. 4762-4768.
- 6. Becker, J., et al., Determinants of health and health needs assessment of artisanal and small-scale gold miners in Kadoma, Zimbabwe: a mixed method approach. *Environ Res*, 2021: p. 111081.
- 7. Mambrey, V., et al., Artisanal and small-scale gold mining: A cross-sectional assessment of occupational mercury exposure and exposure risk factors in Kadoma and Shurugwi, Zimbabwe. *Environ Res*, 2020. 184: p. 109379.
- 8. Butscher, F.M., et al., Health-related quality of life (EQ-5D + C) among people living in artisanal and small-scale gold mining areas in Zimbabwe: a cross-sectional study. *Health Qual Life Outcomes*, 2020. 18(1): p. 284.
- 9. Bose-O'Reilly, S., et al., Infants and mothers levels of mercury in breast milk, urine and hair, data from an artisanal and small-scale gold mining area in Kadoma / Zimbabwe. *Environ Res*, 2020. 184: p. 109266.
- 10. Becker, J., et al., Comparing the self-reported health-related quality of life (HRQoL) of artisanal and small-scale gold miners and the urban population in Zimbabwe using the EuroQol (EQ-5D-3L+C) questionnaire: a cross-sectional study. *Health Qual Life Outcomes*, 2020. 18(1): p. 253.
- 11. Kolbinger, V., et al., Polymorphisms in potential mercury transporter ABCC2 and neurotoxic symptoms in populations exposed to mercury vapor from goldmining. *Environ Res*, 2019. 176: p. 108512.
- 12. Bose-O'Reilly, S., et al., Signs and symptoms of mercury-exposed gold miners. *Int J Occup Med Environ Health*, 2017. 30(2): p. 249-269.
- 13. Doering, S., S. Bose-O'Reilly, and U. Berger, Essential Indicators Identifying Chronic Inorganic Mercury Intoxication: Pooled Analysis across Multiple Cross-Sectional Studies. *PLoS One*, 2016. 11(8): p. e0160323.
- 14. Bose-O'Reilly, S., N. Steckling, and D. Nowak, Health hazards of artisanal and small-scale gold mining P130. *Occupational and Environmental Medicine*, 2016. 73(Suppl 1): p. A163-A163.
- 15. Steckling, N., et al., Testing local conditions for the introduction of a mercury-free gold extraction method using borax in Zimbabwe. *Journal of Health and Pollution*, 2014. 4(7): p. 54-61.
- 16. Steckling, N., et al., The burden of chronic mercury intoxication in artisanal small-scale gold mining in Zimbabwe: data availability and preliminary estimates. *Environ Health*, 2014. 13(1): p. 111.
- 17. Engstrom, K., et al., Polymorphisms in genes encoding potential mercury transporters and urine mercury concentrations in populations exposed to mercury vapor from gold mining. *Environ Health Perspect*, 2013. 121(1): p. 85-91.
- 18. Baeuml, J., et al., Applicability of two mobile analysers for mercury in urine in small-scale gold mining areas. *Int J Hyg Environ Health*, 2011. 215(1): p. 64-7.
- 19. Bose-O'Reilly, S., et al., Mercury in breast milk - a health hazard for infants in gold mining areas? *Int J Hyg Environ Health*, 2008. 211(5-6): p. 615-23.
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Environmental health research over 20 years

Impact?

- The question is:
- What impact has the research had on the real world in a mining area in Zimbabwe?



Zimbabwe

Reality 2022

- Zimbabwe in 2022, after a few years of pandemic related travel restrictions, the ASGM area of Kadoma is busy as usual.
- Many young miners in particular are digging in small tunnels to get a few sacks of ore out, processing the ore in tiny ball mills and applying mercury to form an amalgam, containing gold and mercury.



Zimbabwe

Reality 2022

- At the end of the day the miners heat this amalgam, releasing toxic mercury vapors, until the sponge gold remains, worth a few dollars per miner.
- It seems this year that there are more young miners, especially female miners, including their little kids.



Zimbabwe

Results

- They are living in unhealthy camps, all exposed day and night to noise, dust and mercury fumes.
- The reason to be here is the increasing poverty in Zimbabwe, a country which undergoes a never ending political and economic crisis, inflation being at the moment 250%.
- Zimbabwe is since we had been there first in 2004 on a nearly continuous decline.
- Poverty is increasing, and the former crop exporting country is now depending on food imports.

Zimbabwe

Conclusions

- Poverty, increased during the pandemic, the lack of alternative livelihoods, the desperate hope to get a bit of money, made people from Zimbabwe and elsewhere to become small-scale miners.
- Some decisionmakers back in clean places in the country for sure have benefitted from this crisis as well.
- Kadoma and elsewhere, mercury exposed children, dry, dusty, unhealthy places for children.
- Is this the modern version of Dante's inferno, eternal suffering, no hope, no way out?

Solutions: Capacity building

- Build up a system to monitor, diagnose and treat health problems in mining areas
- Capacity building including establishing laboratory facilities
- Clinical training of local health workers



Collegium Ramazzini Statement (2022) Reducing mortality and morbidity from ASM

Psychosocial hazards

Women

- **Sexual assault, violence, and psychological abuse**
- **Discriminatory work practices**

Children

- **Child labour**
 - **Risk of exploitation, physical and psychological abuses**
 - **Lifelong disabilities**
- **Financial incentives and peer pressure**

Poverty as the main driving force for ASM

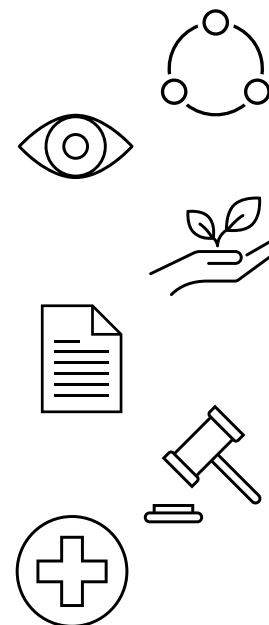
- **Corruption**
- **Malnutrition**
- **Violence, prostitution, criminal activities, substance abuse**
- **Lack of access to health care**
- **Lack of education/ training**
- **Lack of adequate and collaborative formalization efforts**

Collegium Ramazzini Statement (2022) Reducing mortality and morbidity from ASM Urgent call

to minimize all hazards related to ASM

Governments

- **Safeguarding access to OSH**
- **Transparent ASM management with participation from all stakeholders**
- **Decriminalization of ASM**
- **Support of formalization framework protecting human and ecological health**
- **Enforce ILO conventions**
- **Integrate OSH to primary health services**
- **Access to markets for environmentally & socially responsible mineral extraction**



THANK YOU VERY MUCH FOR YOUR ATTENTION



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