

# **Title: Occupational lead exposure among lead burners in a copper mining company, Zambia.**

**Kasyimbi Pauline Hayumbu<sup>1,2</sup>, Nompumelelo Ndaba<sup>1,3</sup>, Patrick Hayumbu<sup>4</sup>, Goitsewang Keretsetse<sup>1</sup>**

1. *University of the Witwatersrand, School of Public Health, South Africa*

2. *Ministry of Health, Mumbwa District Hospital, Zambia*

3. *National Institute of Occupational Health, Occupational Medicine, South Africa*

4. *Copperbelt University, School of Mathematical and Natural Science, Zambia*

Correspondence: *khayz@live.com*

## **Abstract:**

### Introduction

Enlisted among the World Health Organisation's 10 chemicals of major public health concern and causing 0.6% of the global disease burden, lead exposure occurs through multiple routes. Zambian literature is scanty. This study characterised exposure among lead handlers at a Zambian copper mine by comparing external occupational exposure with the internal lead body burden.

### Methods

The study was University of the Witwatersrand Medical - Human Research Ethics Committee, Tropical Diseases Research Centre Committee, and Zambian National Health Research Authority approved. Historical(n=51) and current(n=39) blood lead values, versus multi-route current external occupational exposure assessment was conducted. Palmar wipes(n=53), surface wipes(n=27), breathing zone air(n=37), and room air(n=5) samples determined external lead contamination. Convenience sampling was done. South African National Accreditation System - accredited laboratories performed chemical analyses. JASP software was used with 5% Alpha level of significance and Bayesian analysis.

### Results and Discussion

The data was log normal commonly. International reference standards were adopted since Zambia has none known to us. Mean age of participants, all male, was 41 years with median exposure duration 10 years. Mean blood lead was 1.61 units higher than the Occupational Health and Safety Administration's (OSHA) recommended value(10µg/dL). Personal and room air time weighted averages were below the OSHA recommended value(0.05mg/m<sup>3</sup>), National Institute for Occupational Safety and Health recommended value(0.1mg/m<sup>3</sup>), and American Conference of Governmental Industrial Hygienists recommended value(0.05mg/m<sup>3</sup>). Dermal and ingestion reference standards were unavailable. Dermal chronic daily intake(CDI=6.76x10<sup>-11</sup>mg/kg/day), Oral(CDI=5.97x10<sup>-3</sup>mg/kg/day), whereas Inhalation was(CDI=4.20x10<sup>-2</sup>mg/kg/day). All pathways showed low risk for adverse health effects with hazard quotient less than one. The highest contributing pathway was inhalation. Fifty-nine percent of blood samples collected exceeded 10µg/dL.

### Conclusion

The study contributes to Exposure science by considering exposure pathways of lead in an occupational setting. These findings could guide development of intervention strategies to mitigate exposure thus preventing negative health impacts.