

**HEALTH EFFECTS OF GOLD MINING ACTIVITIES  
IN MIGORI AND KAKAMEGA DISTRICTS,  
WESTERN KENYA: AN ENVIRONMENTAL AND  
EPIDEMIOLOGICAL ASSESSMENT**

**NEYOLE, EDWARD MASINDE**  
*B.Sc. (Moi); MSc (Salford)*



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SCHOOL OF ENVIRONMENTAL STUDIES  
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## ABSTRACT

Concerns have often been raised about the health and safety of artisanal gold mining activities, but disease occurrence in these areas has not been sufficiently evaluated. This study investigated the environmental effects in the artisanal gold mining belts of Kakamega and Migori, and the associated health impacts on miners and people in the surrounding communities. To determine the level and extent of environmental pollution, soil, water, vegetation and sediment samples were collected from mining areas and analysed for selected pollutant metals, cadmium (Cd), chromium (Cr) and lead (Pb) as potential disease determinants. A total of 905 individuals, (489 in Kakamega and 416 in Migori) around gold mining areas were randomly selected, and interview questionnaires used to elicit information on their health conditions. Diseases of non-infectious origin, categorized into respiratory, cardiovascular, dermatological, gastrointestinal, urological, reproductive, haematopoietic and developmental ailments were recorded. Soil geochemical maps for Cd, Cr and Pb were generated using GIS spatial analysis techniques, and used to determine the spatial relationships between soil levels of metals and disease patterns.

Mean Pb, Cd, and Cr levels in environmental media were within natural ranges. In some few sites, water Pb and Cd levels were slightly higher than normally found in unpolluted fresh waters, presumed to be the consequence of additional urban and agricultural discharges, especially in Kakamega, but most likely due to mining in Migori. In both belts, Cd and to some extent Pb, demonstrated a significant difference where levels in water, sediment, soil and vegetation samples decreased with distances from mines ( $p < 0.01$ ), indicating a possible link with mining activities. Thus artisanal mining had limited effects on soil geochemistry, and except for a few localised sites, no significant levels of pollution were detected.

Prevalence in disease conditions was variable in the two mining belts, with respiratory (9.4%), gastrointestinal (5.5%), cardiovascular and dermatological (4.0%), nervous system (3.6%) and urologic (3.0%) being the leading by occurrence in Kakamega, whereas respiratory (13.5%), urologic (7.8%), dermatological (5.7%), reproductive (4.4%), gastrointestinal (4.2%) and nervous system (1.6%) were more dominant in Migori. Disease occurrence was found to be independently associated with occupation and distance, but not related to water source. The association between disease and

occupation was significant ( $p < 0.05$ ) in both mining belts, with a general higher prevalence of conditions in miners. Diseases with high prevalence did not necessarily represent the highest risks in miners, implying that other factors besides mining may be responsible for the disease occurrence patterns. Diseases with a high relative risk in Kakamega miners were urologic (4.53), cardiovascular and dermatological (1.82), developmental (1.81) and respiratory (1.45). In Migori, miners were at highest risk from nervous system (3.63), reproductive (3.33), cardiovascular (2.75), dermatological (2.12), and urologic conditions (1.55). The association between disease and distance from mines was observed in Migori ( $p = 0.01$ ) was more strong among smokers who were miners, while in Kakamega, it became significant in age category 20-29yrs, who form the majority of miners in the belt.

There was no clear evidence of association between the soil geochemistry and the diseases, most likely due to population dynamism, except for Cd, which showed a subtle spatial association with respiratory ailments. In order to fully understand associations between the diseases and mining activities, further detailed studies such as case controls are suggested. Nonetheless, in view of the existing health risks, artisanal gold mining should be encouraged as a source of livelihood for the rural population, but provide stricter controls for environmental protection and health and safety for mineworkers; as well as educate and encourage them to use safer equipments for mining and processing gold ores.