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Health Risk Assessment of Environmental Arsenic Exposure Among Residents in Four Villages in Luzon, Philippines

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BACKGROUND/OBJECTIVE: In 2014, several residents from 5 villages in Luzon were examined for arsenic exposure due to complaints of skin itchiness, discoloration and warty lesions on the palms and soles. Seven of 10 specimens from drinking water sources of 4 villages revealed arsenic levels ranging from 0.09-0.6mg/L which exceeded the Philippine National Standards for Drinking Water (0.01mg/L). The study aimed to assess the extent of arsenic exposure and characterize the risk to development of skin disease among asymptomatic residents and cancer among the symptomatic residents.

METHODS: Environmental monitoring data of from drinking water sources with elevated arsenic levels were used to compute the exposure rates, hazard quotients (HQs) and excess lifetime cancer risks (ELCRs) for children and adults from these villages. The average drinking water consumption was assumed to be 1.5L/day (children) and 2L/day (adults). The average body weights were derived from the health assessment data. The reference dose for arsenic (oral route) was 0.0003mg/kg/day and cancer potency slope was 1.5 per mg/kg/day as set by the United States-Environmental Protection Agency.

RESULTS: Exposure rates were higher for children as compared with those of adults. The HQs among young and older children from 3 villages were > 100 (107-213) which needed immediate risk reduction. The HQs for adolescents and adults were between 10-100 (11-56.6) which required further investigation. The ELCRs from all villages were significant for all age groups (9 x 10⁻³–10 x 10⁻⁴), requiring immediate action considering that generally, cancer does not have any threshold level.

CONCLUSION: Exposure of children and adults to arsenic concentration in drinking water from 4 villages posed significant risk in developing arsenicosis. Immediate risk reduction measures were implemented such as identifying contamination source and alternative drinking water supply; conducting medical evaluation and surveillance among exposed populations.