Developing and deploying a field kit for lead in soils in NYC and Peru

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Lead (Pb) is known to be highly toxic and to irreversibly impact child development, but many communities particularly in developing countries do not have an access to soil Pb testing [1]. Even in the USA, many communities do not routinely test for Pb in soil. A recent study found more than 60% of backyards tested in New York City contained soil Pb above the residential limit of 400 mg/kg. [2]. We present here results for a new field kit intended for public use to screen soils for high levels of bioaccessible Pb.

The kit uses an extraction of glycine and hydrochloric acid, a modification of a widely used simulated gastric extraction [3] to estimate bioaccessible Pb, and relies on sodium rhodizonate as a color indicator. For confirmation, total concentrations of Pb were measured in soil and soil extracts by X-ray fluorescence (XRF) and, for a subset of extracts, by inductively coupled plasma mass spectrometry. The kit was deployed by residents of several small mining-impacted towns in rural Peru and by residents and undergraduate students in the historical industrial core of New York City.

In the first set of 63 field kit extractions from different contamination sources, concentrations of total and extractable soil Pb measured by XRF ranged from 40-50,000 mg/kg and 10-7,400 mg/kg, respectively. All 25 extracted solutions that the kit visually ranked high contained >360 mg/kg extractable Pb (>1200 mg/kg total Pb by assuming 30% bioavailability). In the first field deployment, parents in Peru collected 90 samples with the field kit, assessed these with local field staff, and ultimately identified an area contaminated with high soil Pb that had been previously missed during a prior gridded XRF survey. The test kit results from the field were consistent with follow-up laboratory measurements. Results from the ongoing kit deployment in New York City will also be discussed.

[1] Tong et al., (2000) *Bull. World Health Organ.* **78**. [2] Cheng et al., (2015) *Soil Science* **180**. [3] Drexler and Brattin (2007) *Human & Ecol. Risk Asmt.* **13**.