GENEVA HEALTH FORUM 2026 · HEALTH PROMOTION & COMMUNITY ENGAGEMENT

Childhood lead exposure across seven Pakistani cities: a national biomonitoring survey and the evidence base for a Multi-Sectoral National Action Plan

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HEADLINE FINDINGS

25.5% of children had elevated blood lead (≥3.5 µg/dL)

1.0–89.3% prevalence range, Islamabad to Haripur

AOR 131.75 Haripur vs Rawalpindi: city is the top predictor

5× WHO lead limit in water near Hattar Industrial Estate

44.5% vs 37.6% stunting in lead-exposed vs unexposed children

Background & rationale

Lead is a neurotoxin with no safe level; the harm is greatest between 12 and 36 months. Pakistan has the second-highest mean childhood blood lead level among 137 low- and middle-income countries, with an estimated 46.7 million children exceeding 5 µg/dL.

Blood lead surveillance sits outside the national health and nutrition monitoring systems, and no biomonitoring mechanism exists. Existing studies are localised, facility-based and mostly over a decade old.

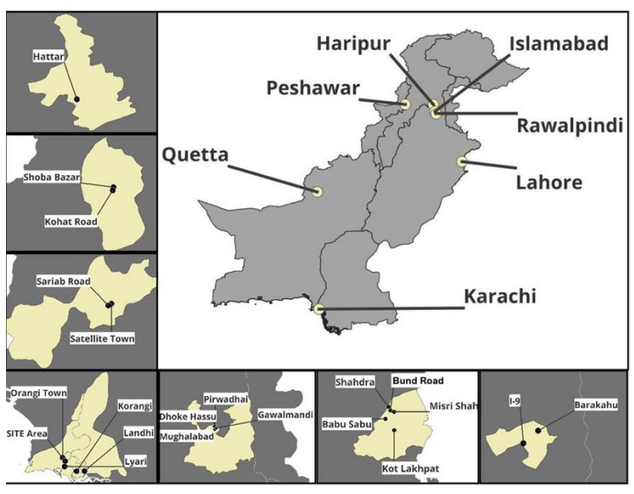
Objective: estimate the prevalence and determinants of elevated blood lead in children aged 12–36 months across seven high-risk cities, and translate the evidence into sector-specific action for Pakistan's M-NAP.

Methods

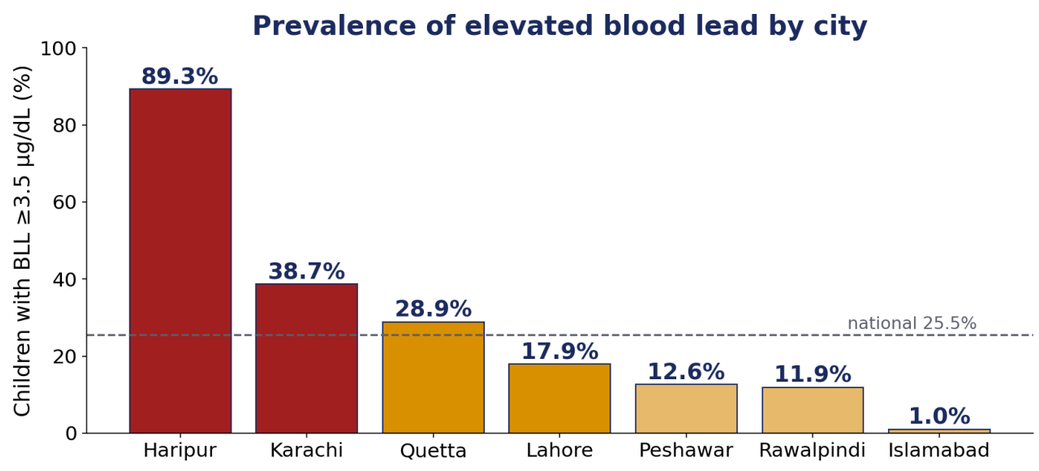
Community-based cross-sectional survey, 2025, across seven urban and peri-urban settings in all four provinces: Karachi, Lahore, Rawalpindi, Islamabad, Peshawar, Quetta and Haripur.

Multi-stage cluster sampling prioritised neighbourhoods near industry, heavy traffic and contamination. Recruitment via Lady Health Workers, vaccinators and community and religious leaders. Venous blood for lead (AAS) and complete blood counts, with anthropometric and household environmental data; 38 water samples analysed at the ISO-accredited PCRWR laboratory.

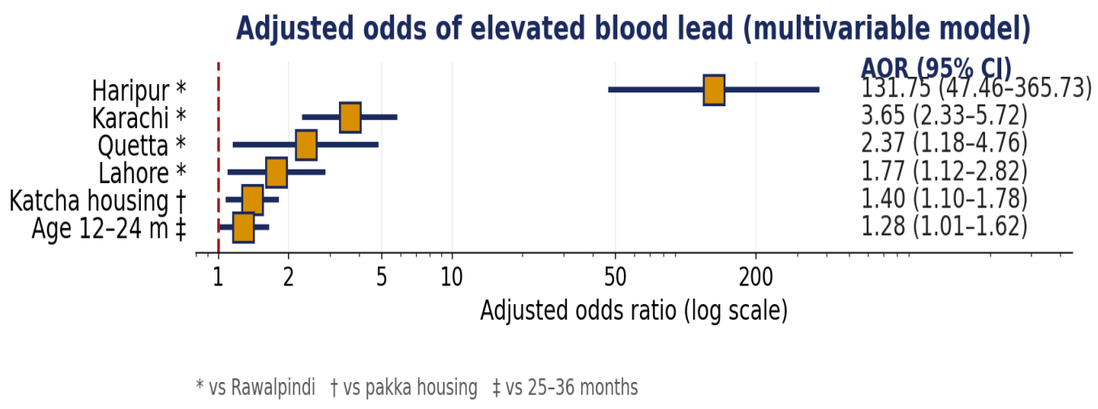
Elevated BLL: ≥3.5 µg/dL (CDC 2021). Multivariable logistic regression identified independent predictors.



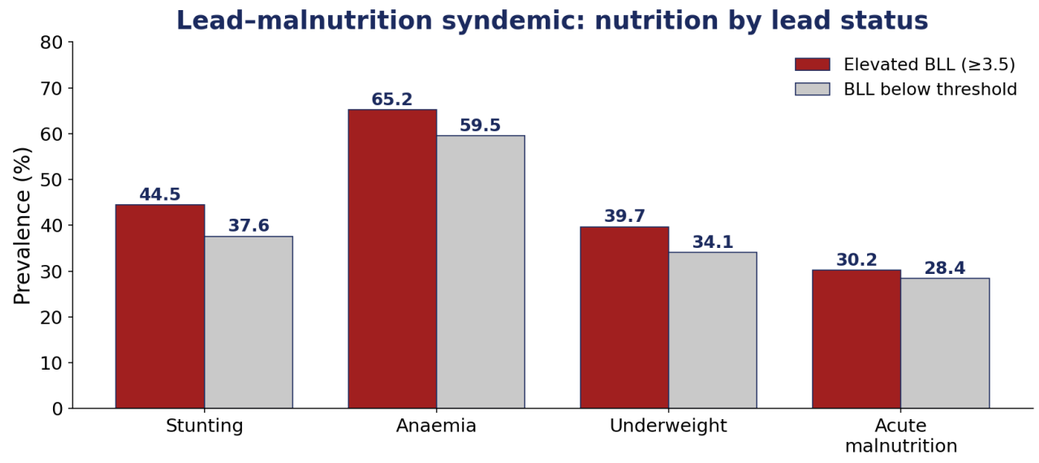
Sampling spanned seven urban and peri-urban centres across all four provinces, with neighbourhoods chosen near industry, heavy traffic and contaminated water. The insets show the specific high-risk localities screened within each city.



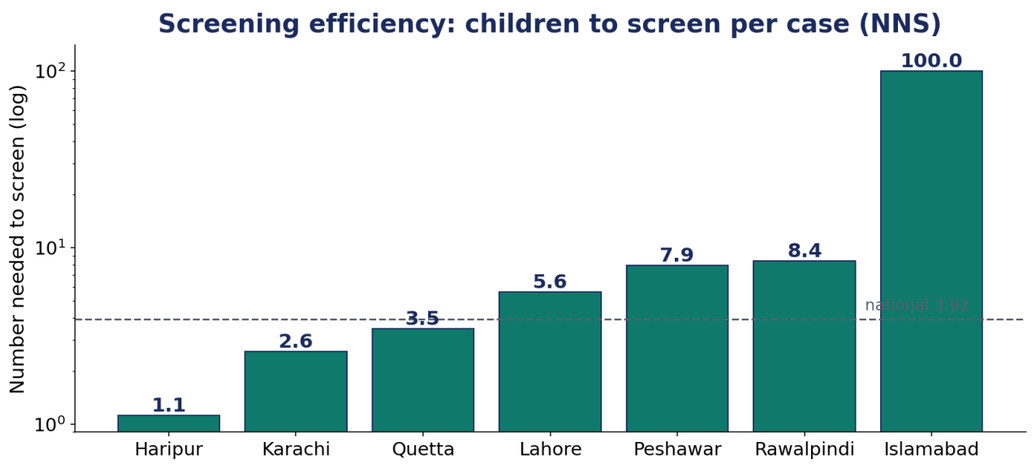
One in four children (25.5%) had blood lead ≥3.5 µg/dL, but the burden ranged from 1.0% in Islamabad to 89.3% in Haripur. The gradient follows local industrial activity, not province, so national averages hide the worst-affected communities.



After adjustment, city of residence was by far the strongest predictor: children in Haripur had 132 times the odds of elevated lead versus Rawalpindi. Semi-permanent (katcha) housing and age 12–24 months added independent risk, while income and proximity lost significance.



Children with elevated lead had higher malnutrition on every indicator, most clearly stunting (44.5% vs 37.6%) and anaemia (65.2% vs 59.5%). Lead exposure and undernutrition cluster together, compounding the threat to early child development.



In Haripur almost every child screened was a case (1.1 needed to screen); in Islamabad nearly 100 were needed to find one. This argues for universal screening in industrial hotspots and risk-based screening in low-burden cities.

Documented exposure pathways

- Informal recycling of lead-acid batteries
- Industrial emissions & smelting (e.g., Hattar Industrial Estate)
- Lead-based paint — 40% of residential paints exceed legal limits
- Surma eye cosmetic — up to 96% lead by weight, applied to infants
- Household dust and contaminated soil and water
- Adulterated spices and consumer products

Water sampling confirmed lead at 5× the WHO guideline near Haripur's Hattar Industrial Estate.

From evidence to action: a multi-sectoral mandate (M-NAP)

Sector	Priority action
Health	Lead surveillance integrated into PDHS and the National Nutrition Survey; targeted screening in high-burden cities; clinical case management
Environment	Monitor industrial emissions and remediate contaminated sites, prioritising Hattar and other hotspots
Industry & Commerce	Regulate informal battery recycling, smelting and manufacturing
Housing & Urban	Upgrade katcha housing and informal settlements
Food Safety	Monitor lead in spices, foods and cosmetics, including surma
Water	Revise national drinking-water standards (NSDWQ) to the WHO 10 µg/L guideline

Way forward

One in four young children in Pakistan's major cities carries elevated blood lead, concentrated in industrial settings and semi-permanent housing, and co-occurring with stunting, anaemia and underweight. These findings translate into three concrete next steps. 1. Multi-sectoral National Action Plan (M-NAP): finalise and cost a cross-government plan with clear sector mandates and accountability. 2. Standards & guidelines: revise the national drinking-water standard to the WHO 10 µg/L guideline and issue national screening, referral and clinical-management guidelines. 3. Service-provider training: train frontline and clinical staff in screening, case management and counselling, and embed lead surveillance within the PDHS and National Nutrition Survey.

References: 1. Ericson B, et al. Lancet Planet Health 2021;5(3):e145–e153. 2. Ruckart PZ, et al. MMWR 2021;70(43):1509–1512. **Funding:** UNICEF Pakistan. **Ethics:** approved; informed consent obtained.