Prenatal lead exposure in Pakistan: A prelude to intervention

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Introduction

- Lead toxicity remains a major environmental health risk throughout the world
- Developed countries have ongoing programs for lead prevention and mitigation
- Pakistan and other developing countries in the region consider phasing out of leaded gasoline as adequate for the control of lead and that lead is no longer a significant environmental problem
- There is growing evidence of an association between children exposed to very low levels of lead (<5 µg/dl) level and lowered cognitive function

Aims

- To estimate the mean umbilical cord blood lead levels(BLL) and the proportion of newborn with high cord BLLs (> 10 µg/dl)
  - Analysis will also use cord BLLs (> 5 µg/dl)
- To determine sources and levels of environmental lead exposure in subjects' homes and surroundings
- To identify determinants of cord BLL

Methods

- **Study Setting:** Two hospitals in Karachi, Pakistan
- **Study Population:**
  - Pregnant mothers presenting to the selected hospitals at the time of delivery
  - Inclusion Criteria: Singleton birth, full term delivery
  - Exclusion criteria: Antepartum hemorrhage, placental abnormalities, pre-eclamplsia or child with congenital anomalies
- **Study size:** 500 mother-infant pairs
- **Design:** Cross-sectional study

Data Collection

- **Exposure assessment (7-14 days following birth)**
  - Lead levels recorded from different items (utensils, toys, cosmetics etc) of routine use at using the NITON lead analyzer
  - Water samples collected and lead levels analyzed
  - Household paint: type and condition
  - Distance of house from road
- **Outcome**
  - Maternal blood for BLL
  - Cord blood for BLL

NITON XLi / XLp 300 Series Lead Analyzer

Monitor all aspects of lead exposure on-site (paint, dust, soil)

Data Collection

- **Covariates (maternal)**
  - Socio-demographic information
  - Current and past obstetric history
  - Diet
  - BMI
  - Serum ferritin and hemoglobin
- **Covariates (newborn)**
  - Anthropometric measurements (weight, crown-heel length, head circumference)

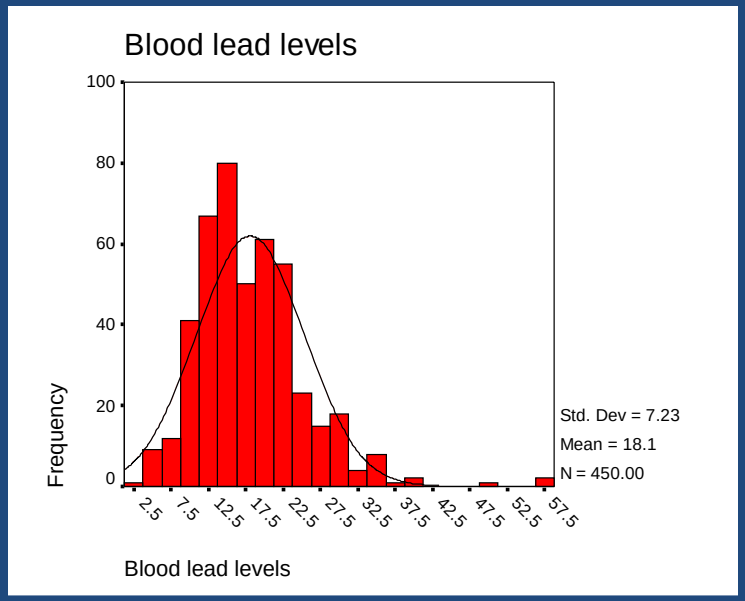
Preliminary Results

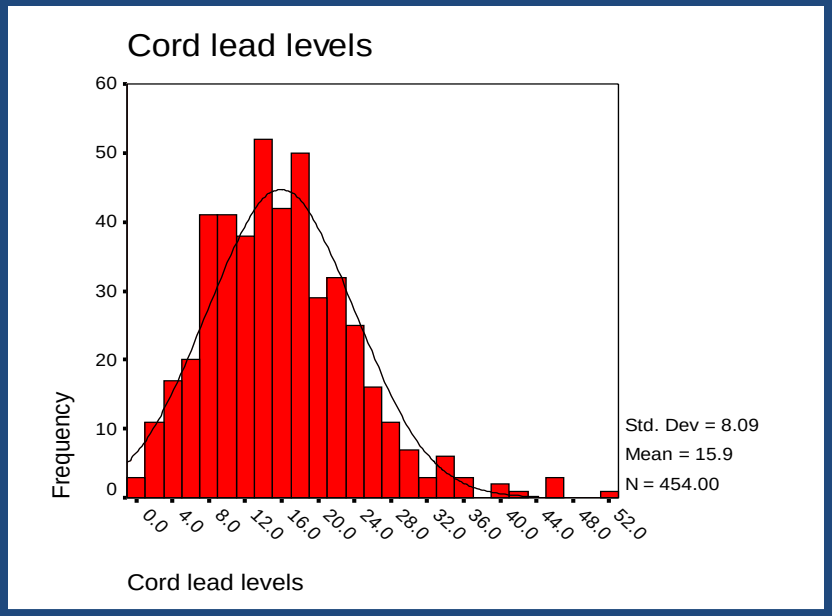
Table 1. Mean (SD) and medians (except when otherwise specified) of selected characteristics of mother-infant participants

Variables	Mean (SD)	Median
Child characteristics		
Gender		
Male gender (n, %)	225 (49.6%)	
Female gender (n, %)	229 (50.4%)	
Birth weight (Kg)	3.0 (0.38)	3.0
Mean (SD) crown- heal length (cm)	45.61(6.2)	47.0
Mean (SD) head circumference (cm)	31.68(3.2)	32.0
Geometric mean(SD) cord lead levels (µg/dL)	13.55	
Arithmetic mean(SD) cord lead levels (µg/dL) [Range :0.58 – 51.00]	15.93 (8.09)	15.1
Mother's characteristics		
Mother's mean age at delivery (years)	26.07(3.9)	26.00
Mother's blood lead level mean (SD)	18.10 (7.23)	16.8500
Mother's blood lead level Geometric mean	16.72	
Household income	8879.29 (7776.09)	9000.00
Maternal BMI	26.39(12.3)	25.1

Table 2

BLLs	N
Mother's BLL (>10µg/dl)	346 (75%)
Infant's cord BLL (>10µg/dl)	414 (90%)





Correlation between maternal BLL and cord BLL (R^2 =0.304; p <.001)

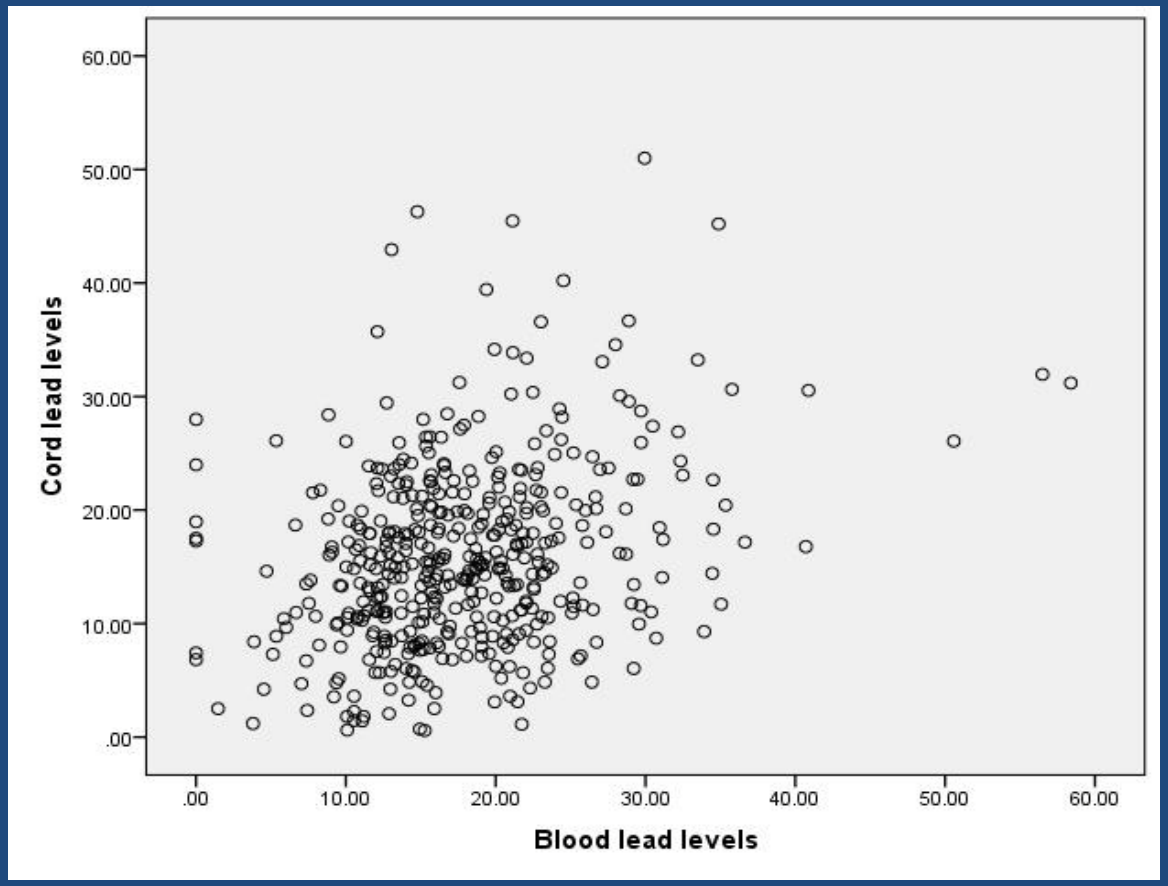


Table 3

Lead Sources	Mean lead levels (ppm)	Median
Walls		
$Wall_1$	387 (105.4)	27
$Wall_2$	4.8 (12.1)	0.01
$Wall_3$	0.1 (0.01)	0.01
Dust	317.23 (2084.5)	26.5
Kitchen Ware		
Cooking $ware_1$	6555.51 (14,423.7)	4446.0
Cooking $ware_2$	758.57 (2154.4)	195.0
Cooking $ware_3$	1350.65 (2793.2)	175.9
Eating $ware_1$	698.35 (5387.9)	73.0
Eating $ware_1$	326.79 (1281.9)	160.9
Eating $ware_1$	410.8 (1181.7)	82.7
Surma	316726.7 (1057020.2)	5705.0
$Toys_1$	77.7 (442.15)	0.0
$Toys_2$	184.0 (720.5)	2.2

Results

- About 90% of newborns had BLL > 10µg/dl
  - Using 5µg/dl as level of concern (LOC), 95% of newborns had BLLs > LOC (based on CDC's current level of concern)
- Major sources of lead in homes: surma (eye cosmetic), cooking utensils, walls and household dust
  - Cooking utensils had > lead levels compared to eating utensils
  - Certain walls had > lead levels than other walls
  - Toys had low lead levels compared to other sources

Challenges

- Purchase of equipment (NITON)
- Accessing homes for environmental samples
- Soil samples/dust samples

Next Steps

- Complete data analysis; publish results
- Prepare RO1 grant
  - Develop optimal interventions in collaboration
    - Educational
    - Dietary supplementation
    - Establishment of lead screening clinics for infants and children
    - Reduction of lead from major sources such as surma, utensils
  - Pilot test the interventions, conduct interventions and scale-up
  - Follow-up cohort to implement intervention, monitor BLL and adverse effects

THANK YOU