

Economic Assessment of Lead (Pb) Pollution in Kabwe: Objectives, Progress and Prospects

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Outline

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II. Progress

- a) Socioeconomic Survey in Kabwe 2017: Survey Design and Descriptive statistics

III. Prospects

- a) Socioeconomic Conditions and Pb exposure
- b) Economic Costs of Pb exposure
- c) Impact Evaluation of Remediation
- d) Cost-Benefit Analysis

I. Introduction

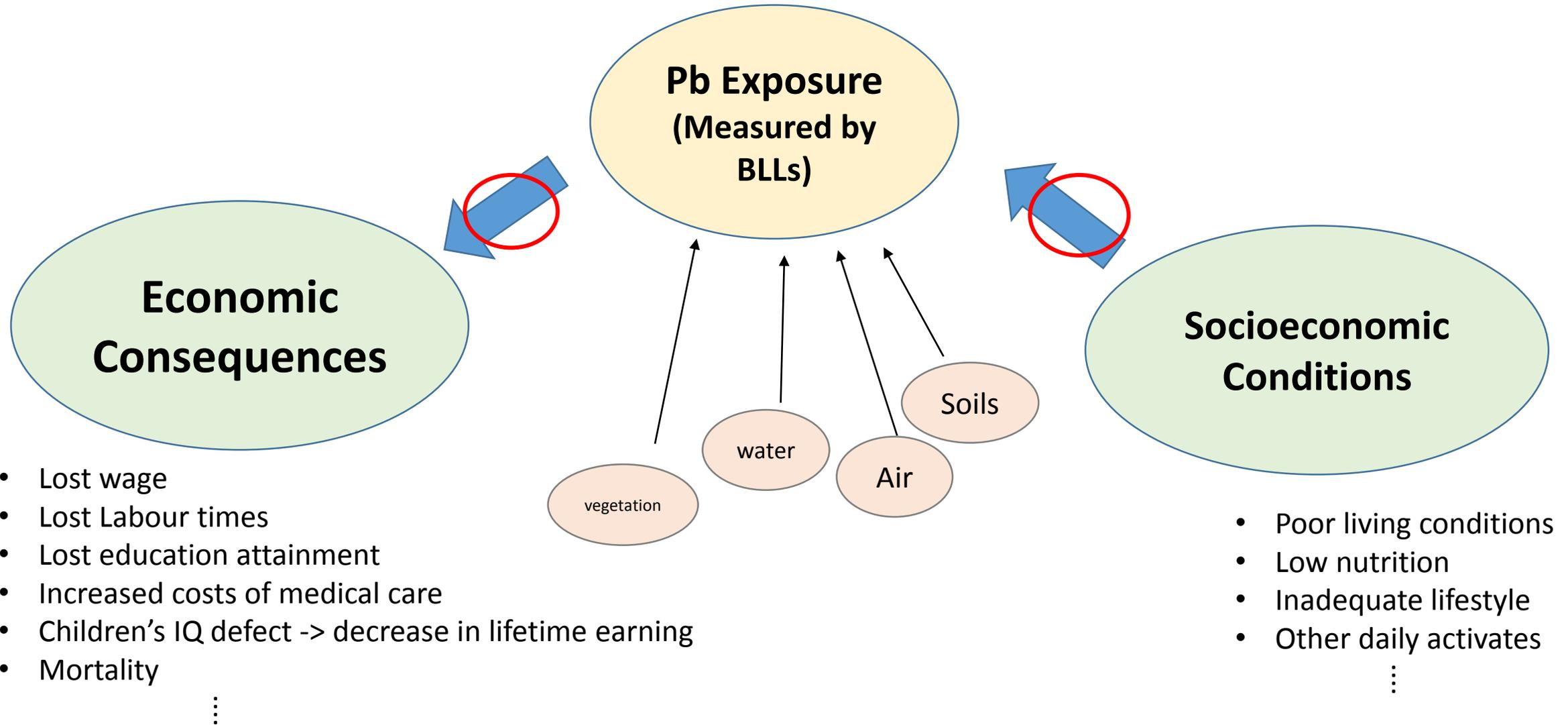
Gaps

- Kabwe has one of the highest Pb exposure yet no study has assessed how this could be associated with socioeconomic conditions.
- The value to society of possible remediation measures has equally never been assessed.

Objectives

1. Ascertaining the economic consequences of the health as well as the environment effects of the Lead (Pb) pollution problem in Kabwe.
2. Undertake a cost-benefit assessment of possible interventions. We will combine cost estimates of Pb pollution and impact evaluation of possible remediation programs.

Interactive Relationship between Pb Exposure and Socio Economic Factors



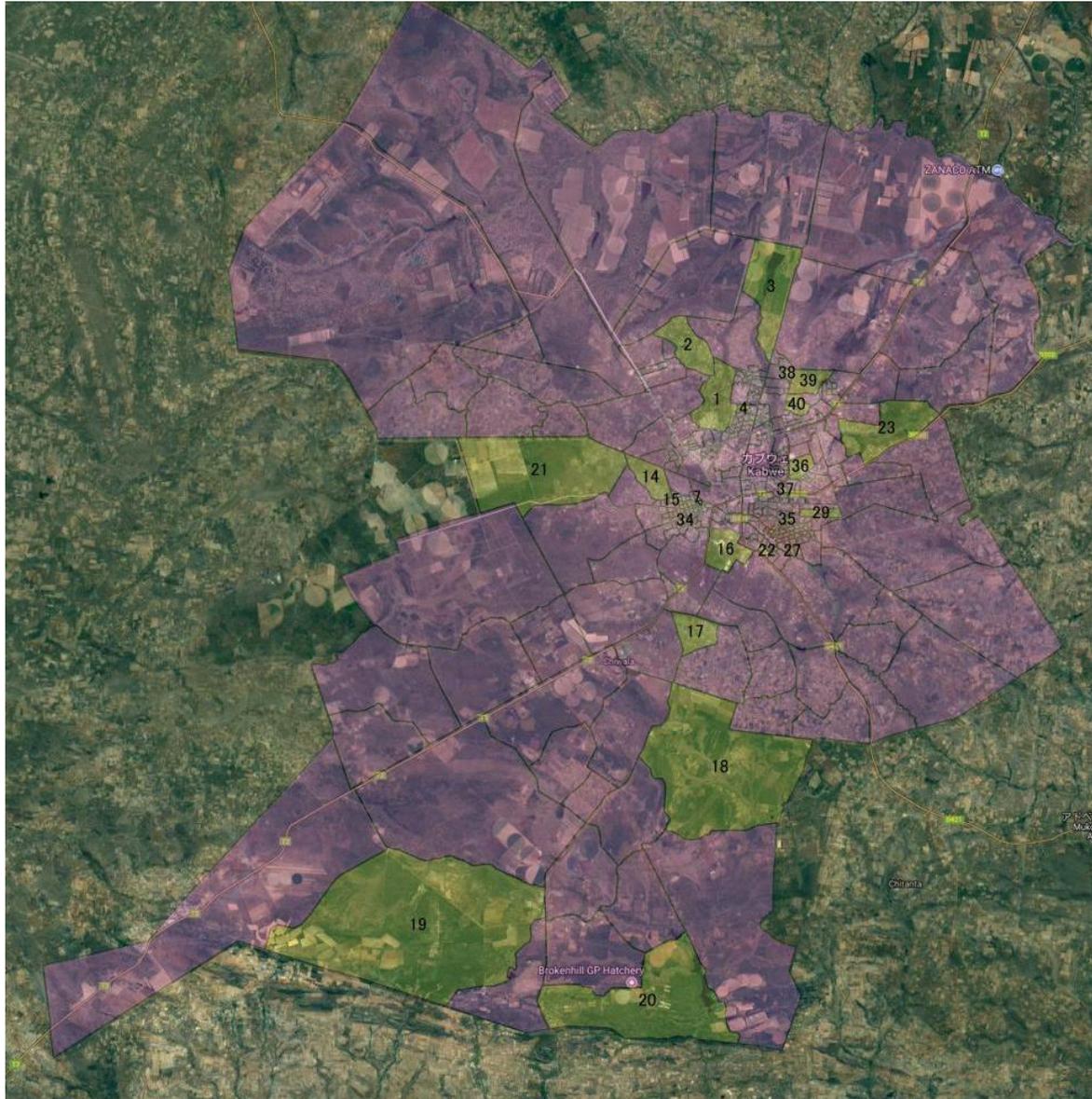
II. Progress: Socioeconomic Survey in Kabwe 2017

Background

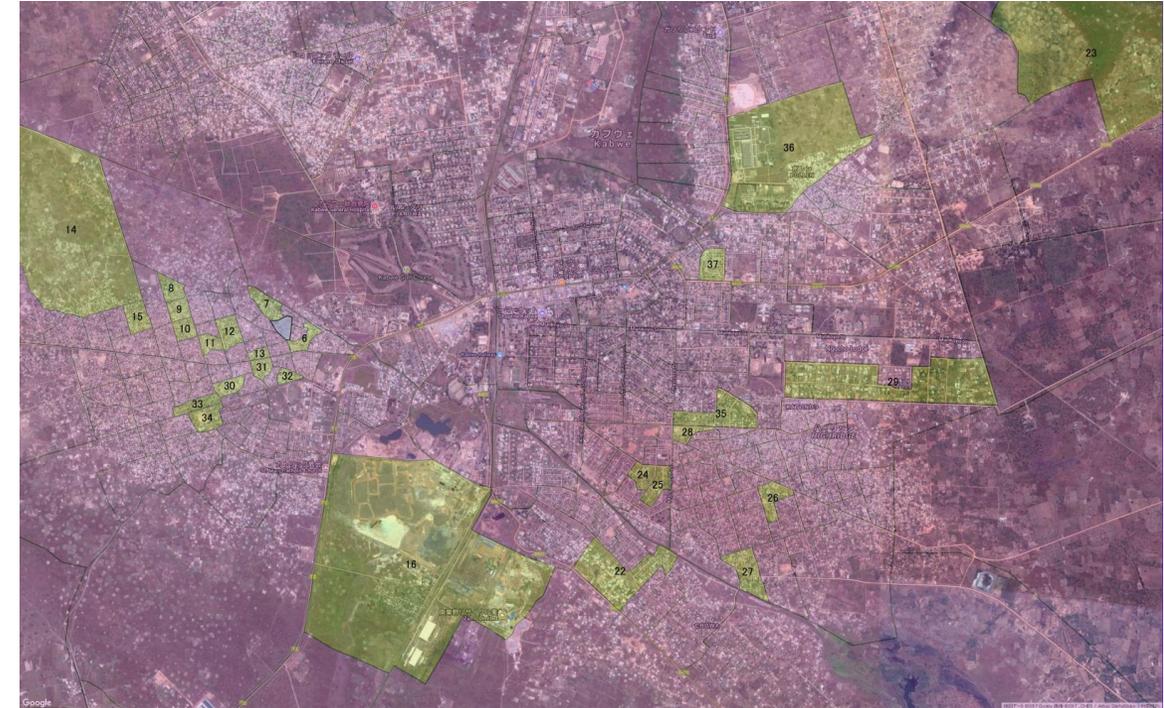
- In August-September 2017, we conducted a baseline survey of household socio-economic conditions in Kabwe.
- The survey was designed to be representative of Kabwe district.
- Detailed information on about 900 randomly selected households was collected.
- The socioeconomic survey was carried out in combination with a **health survey** that focused on blood lead levels (BLLs), **quality of life** and other health conditions.

Survey Design

- Similar to the 2015 Living Condition Monitoring Survey (LCMS), we used the 2010 census sample frame.
- Kabwe district can be divided into 384 Standard Enumeration Areas (SEAs).
- Multistage sampling: 40 SEAs were randomly selected in the first stage. In the second stage, 25 households were randomly selected from each SEA based on satellite information (or household lists).
- Computer-Assisted Personal Interviewing (CAPI) with the software “Survey Solutions” developed by World Bank was used.
- 21 enumerators conducted face-to-face interviews to target households from August 21 to September 8.



Geographical location of 40 SEAs in Kabwe District



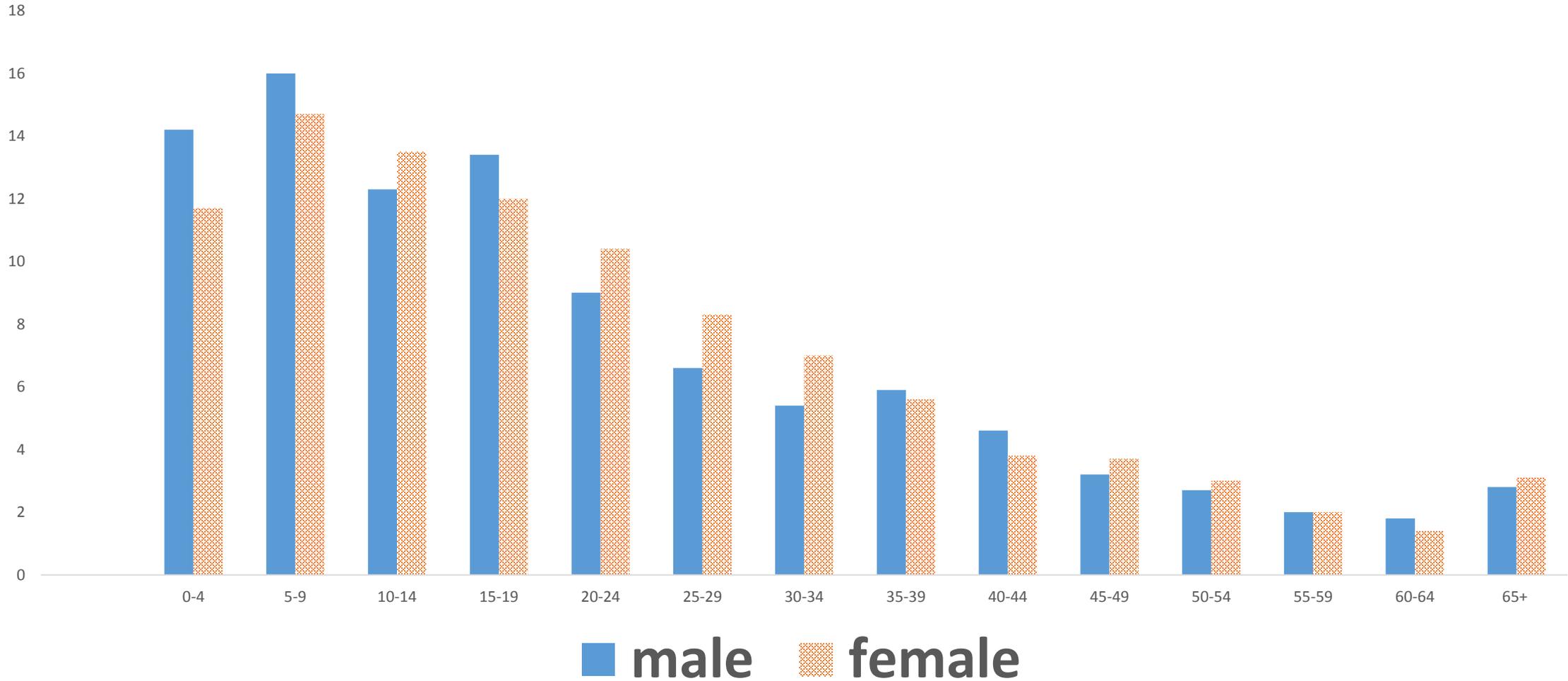
Central Area

Questionnaire

- The questionnaire mainly asks the same questions as in the 2015 LCMS, but supplemented with original questions. It takes 2-3 hours for one interview.
- Structure of the Questionnaire
 - Section 1. Household Roster
 - Section 2. Biological Relationship
 - Section 3. Health (for all persons)
 - Section 4. Education (for all persons)
 - Section 5. Economic Activity and Non-Farm Income
 - Section 6. Agricultural Production
 - Section 7. Other Income
 - Section 8. Household Assets & Durables
 - Section 9. Household Amenities and Housing Conditions
 - Section 10. Household Expenditure
 - Section 11. Child Health
 - Section 12. Deaths in the household

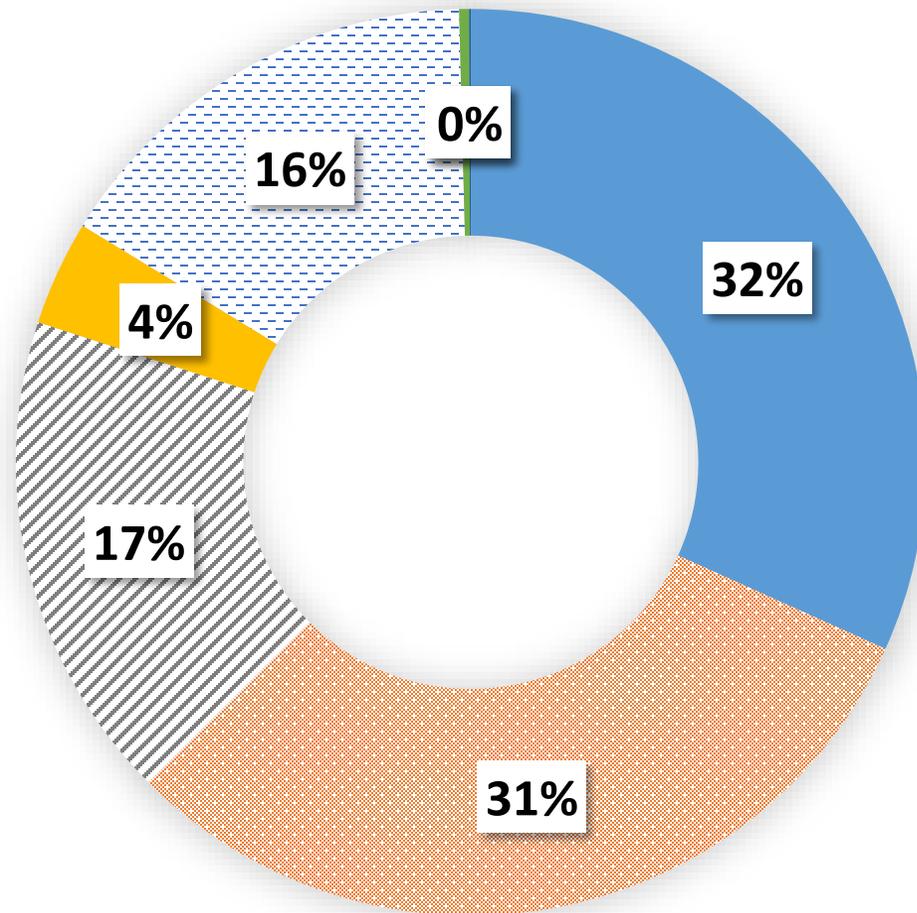
Preliminary Descriptive Statistics

Sex Distribution by Age



Descriptive Statistics

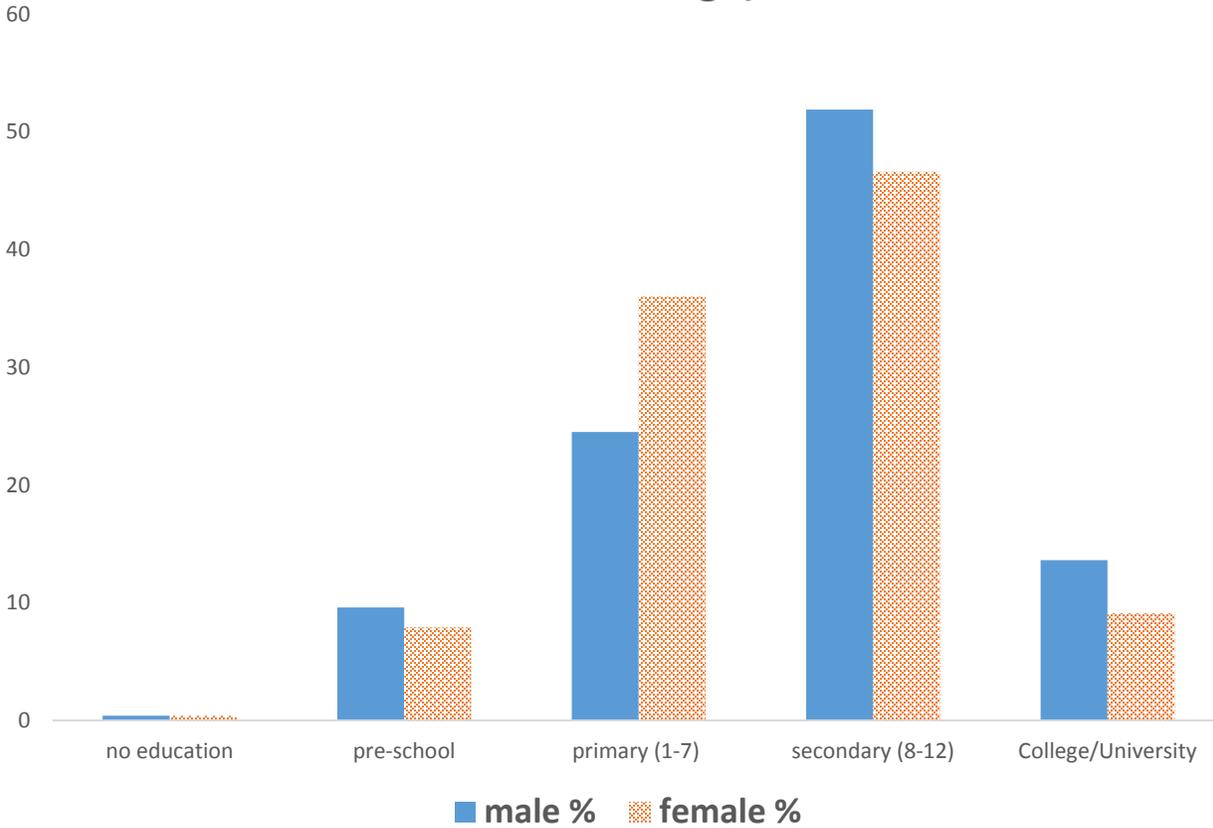
Migration



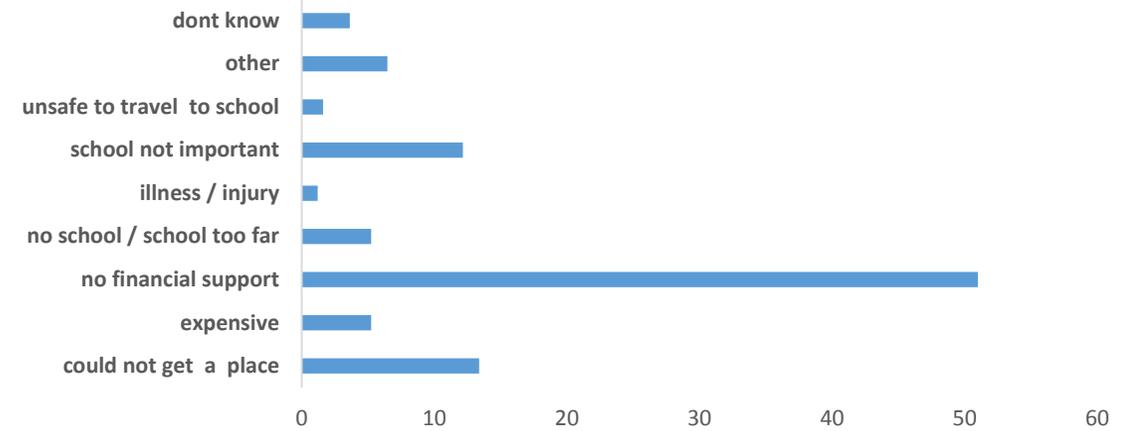
- has never moved
- different dwelling/ same township
- ▨ different township/ kabwe district
- different district/central province
- ▨ different province
- different country

Education

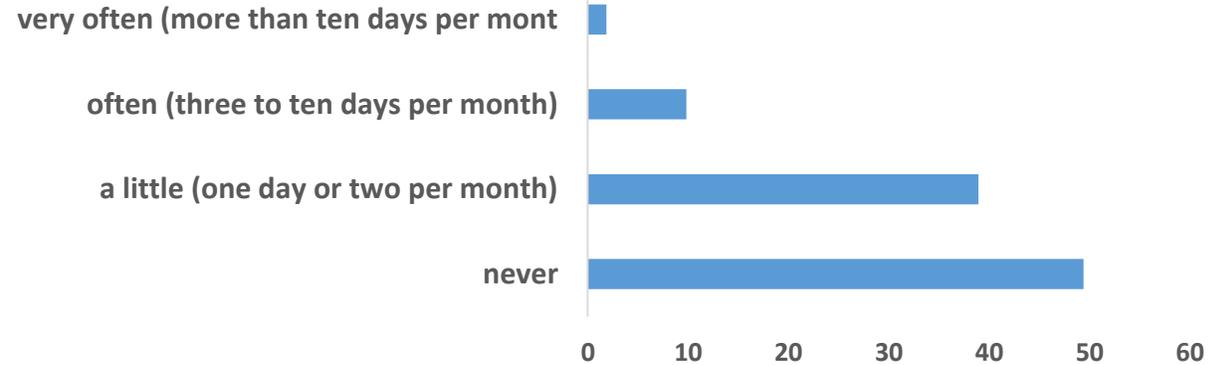
Highest Level of Education (for those who are not under age)



Reasons for not attending school



Percentage reporting missing school by frequency (Number of days)



Health

sick in last 2 weeks Prior to Survey	Sex		
	male (%)	female (%)	All Individuals (%)
yes sick	17.7	20.1	19
yes injured	0.8	0.3	0.5
yes both	0.1	0.1	0.1
no	81.4	79.4	80.3
dont know	0	0.1	0.1
Total	100 (N=2,378)	100 (N=2,519)	100 (N=4,897)

Continuously ill in last 3 months	sex		
	male (%)	female (%)	All individuals (%)
yes	2.9	3.8	3.4
no	97.1	96.2	96.6
Total	100 (N=2,378)	100 (N=2,519)	100 (N=4,897)

Continuously Sick and able to Carry out normal activities	male %	female %	All Individuals %
	yes	57.1	52.1
no	42.9	47.9	45.8
Total	100 (N=70)	100 (N=96)	100 (N=166)

Self Reported Type of Sickness in last 2 weeks	Percent
Cough/cold/chest infection	39.3
headache	15.7
Fever/malaria	9.2
Other	7.6
Abdominal pains	4.2
Hypertension	3.0
Diarrhoea without blood	2.9
backache	2.8
Toothache/mouth infection	2.3
Skin infection	2.1
Eye infection	2.1
Pneumonia	1.3
Constipation	1.1
Asthma	1.0
Diarrhoea with vomiting	0.9
Paralysis	0.9
Diarrhoea with blood	0.6
Diabetes	0.6
Bronchitis	0.5
Aneamia	0.4
Vomiting	0.3
Cancer	0.3
Tuberculosis	0.2
Stroke	0.2
Boils	0.1
Shingles/herpes zoster	0.1
Ear infection	0.1
measles	0.1
Total	100 (N=933)

Self Reported Type of Continous Sickness in Last 3 Months	Percent
Other	19.88
Cough/cold/chest infection	12.65
headache	12.65
Fever/malaria	10.24
Hypertension	6.63
Abdominal pains	5.42
Eye infection	5.42
backache	5.42
Paralysis	3.61
Diabetes	3.61
Cancer	2.41
Tuberculosis	1.81
Skin infection	1.81
Bronchitis	1.2
Diarrhoea without blood	1.2
Piles/hamoroids	1.2
Stroke	1.2
Toothache/mouth infection	1.2
Pneumonia	0.6
Diarrhoea with blood	0.6
Constipation	0.6
Boils	0.6
Total	100 (N=166)

Economic Activity Status

Current Economic Activity Status (12 yrs old or above)

	All	Male	Female
<i>Total</i>	100 (N=3,251)	100 (N=1,532)	100 (N=1,719)
<i>Working</i>	39.7	48.1	32.1
Wage employment	13.7	18.4	9.5
Non-farm business	13.7	11.8	15.4
Farming	6.0	6.9	5.2
Fishing	0.3	0.7	Na
Forestry	0.1	0.1	Na
Piecework	5.9	10.3	2.0
<i>Not working</i>	60.3	51.9	67.9
Unpaid family worker	0.7	0.9	0.6
Not working but looking for work	12.7	12.8	12.7
Not working and not looking for work (but available)	4.8	3.6	5.9
Full-time student	21.8	23.6	20.2
Home maker	9.2	0.1	17.3
Retired	3.5	3.0	3.9
Too young	6.6	6.7	6.6
Other	1.0	1.2	1.0

Income

Monthly Household Income

Our Survey in Kabwe 2017

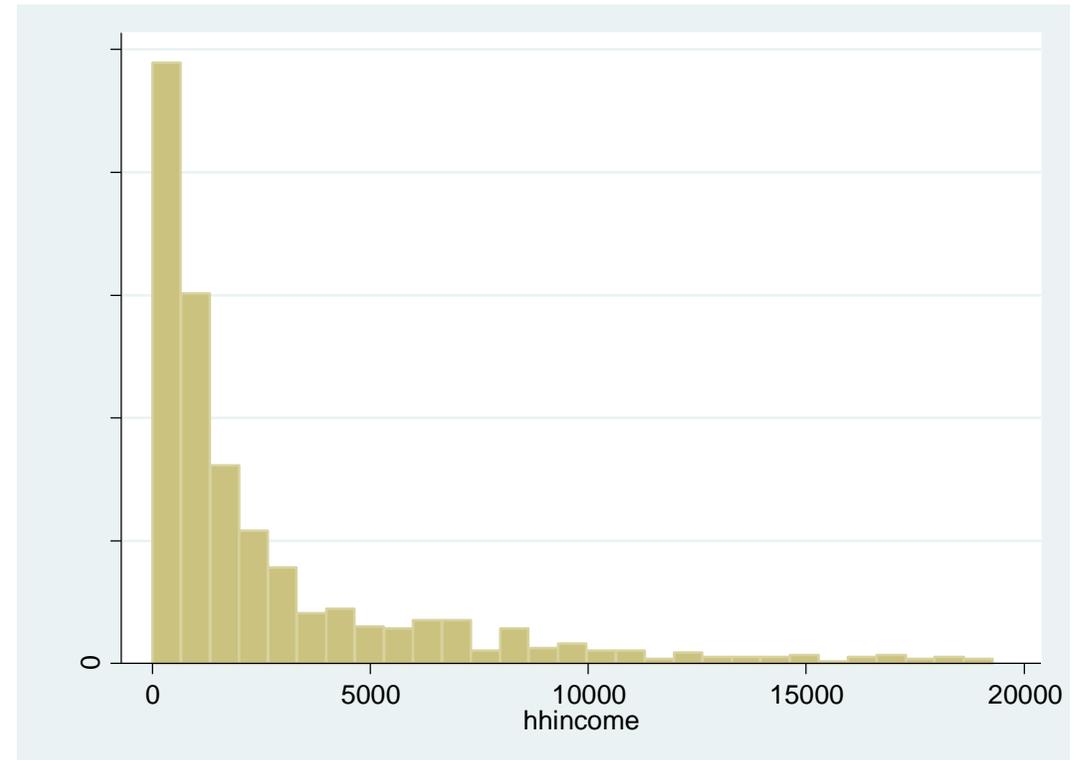
- Average in Kabwe: K 3,347
- Median in Kabwe: k1,220

2015LCMS

- Average in Zambia: K1,801
- Average in Urban: K3,152

Household Income, Yearly

	Mean	Std. dev
Household income, Yearly	40,167	77,494
Per capita income, Yealy	8,830	20,334
Labor income (incl. business)	34,620	68,952
Among those with non-zero labor income (N=710)	43,664	74,832
Agricultural income (sales – costs)	1,143	19,635
Among those with non-zero agricultural income	2,842	30,907
Remittances and gift	1,209	5,496
Among those receiving remittances and gifts	2,824	8,131
Other	1,209	5,496
Among those with non-zero other income (N=259)	8,550	35,921
Household income, monthly	3,347	6,458
Per capita income, monthly	736	1,695



Expenditure

Monthly Household Expenditure

Our Survey in Kabwe 2017

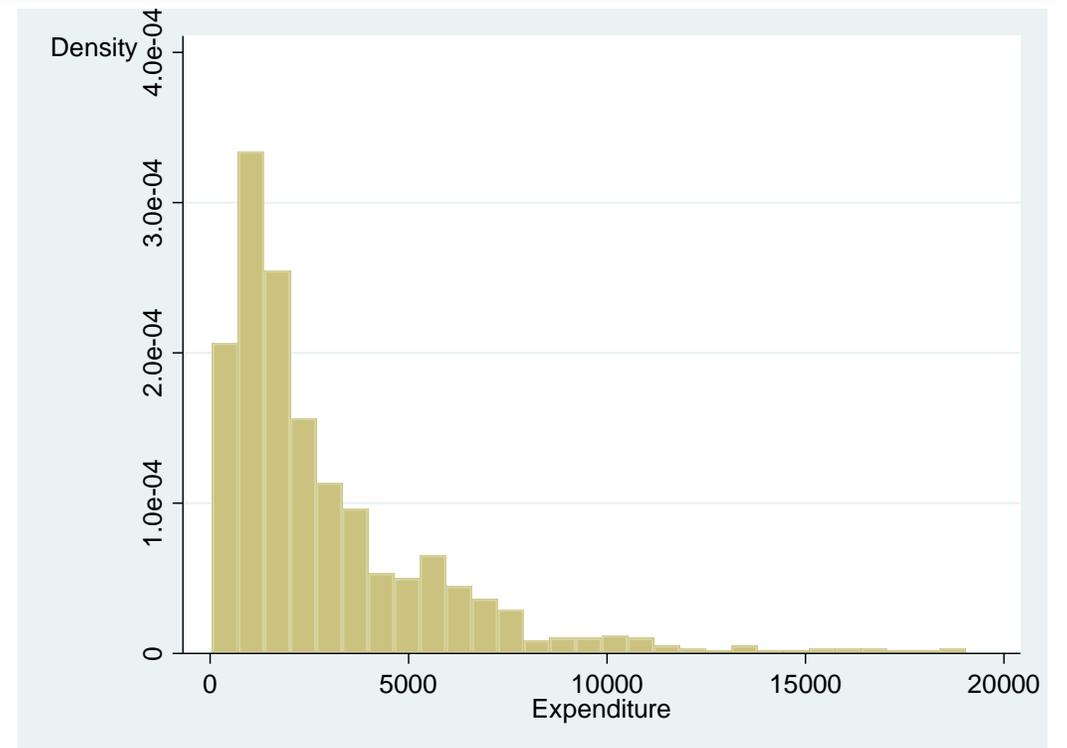
- Average: K 3,284
- Median : K 1,938

2015LCMS

- Average in Zambia: K1,588
- Average in Urban: K2,680

Household Expenditure, Monthly

	Mean	Std. Dev.	Proportion
Total Expenditure	3284.3	5110.5	100.0%
Education	182.8	418.7	5.6%
Self-Consumption of Agricultural Productio	41.1	131.8	1.3%
Housing Amenities (rent, electricity, etc.)	651.6	1028.1	19.8%
Food	1136.2	2257.9	34.6%
Non-Food	1236.5	3480.3	37.6%
Remittance	36.0	156.6	1.1%



Socioeconomic Status and Blood Lead Levels (BLL)

- BLL higher in children (29.4 for 0-9 years, 23.4 for 10-19 years, and 16.3 for older than 19)
- BLL negatively correlated with total consumption but relationship not significant
- BLL positively correlated with total income=>we need to control for occupation
- It appears BLL is negatively correlated with wage and business income while the correlation with farm income is positive, but these correlations are insignificant
- Those who lost more work days due to illness had significantly higher BLL level.

III. Prospects

i. Socioeconomic Conditions and Pb exposure

- We systematically examine how socioeconomic conditions are associated with exposure to Pb.
 - ✓ Low-income families may be more likely to dwell on polluted lands with poor housings and engage in jobs in polluted industries. → Negative association between income (expenditure) and Pb exposure.
 - ✓ On the other hand, people may prefer to live in a polluted area if they find more jobs with higher wages in that area. → Positive association between income and Pb exposure.

ii. Economic Costs of Pb exposure

- We estimate the negative costs of Pb Exposure on economic outcomes.
 - ✓ Various health risks can be attributable to Pb pollution, such as IQ loss, hypertension, anaemia, digestive problems, early deaths, disabilities, pain and discomfort, etc.
 - ✓ As a result, these effects may cause a decline in lifetime earnings, a loss of productivity, increased costs of medical care, an increased need for special education, etc.

iii. Impact Evaluation of Remediation Programs

- By using the information of possible interventions (e.g. soil replacement, medical treatment) taken from the project activities or other sources(e.g. World Bank), we will estimate the impacts of remediation programs.

iv. Cost-Benefit Analysis

- Combining the cost estimates of Pb pollution and the information of the impact evaluation of possible remediation programs, we conduct a cost-benefit assessment of possible interventions.

Suggestion & Request

- We would like to encourage the project members to utilize our survey data as baseline data to test the impacts of remediation programs or any other experimental trial.
- For rigorous impact evaluations of remediation programs by our project or the World Bank, we would like to share our information in the stage of designing the programs. Particularly, we have a keen interest in sampling of target population for any program.
- The detailed map information of pollution(soils, water, air, vegetation etc.) will be useful for our analysis to identify the casual effects of BLL on economic outcomes.