



ICMGP 2024
CAPE TOWN • SOUTH AFRICA • 21 - 26 JULY

Monitoring mercury impact on children living in ASGM Hotspots in Indonesia

Session 14: Human Exposure and Risk Assessment of Hg
23 July 2024 - 15:45-16:00

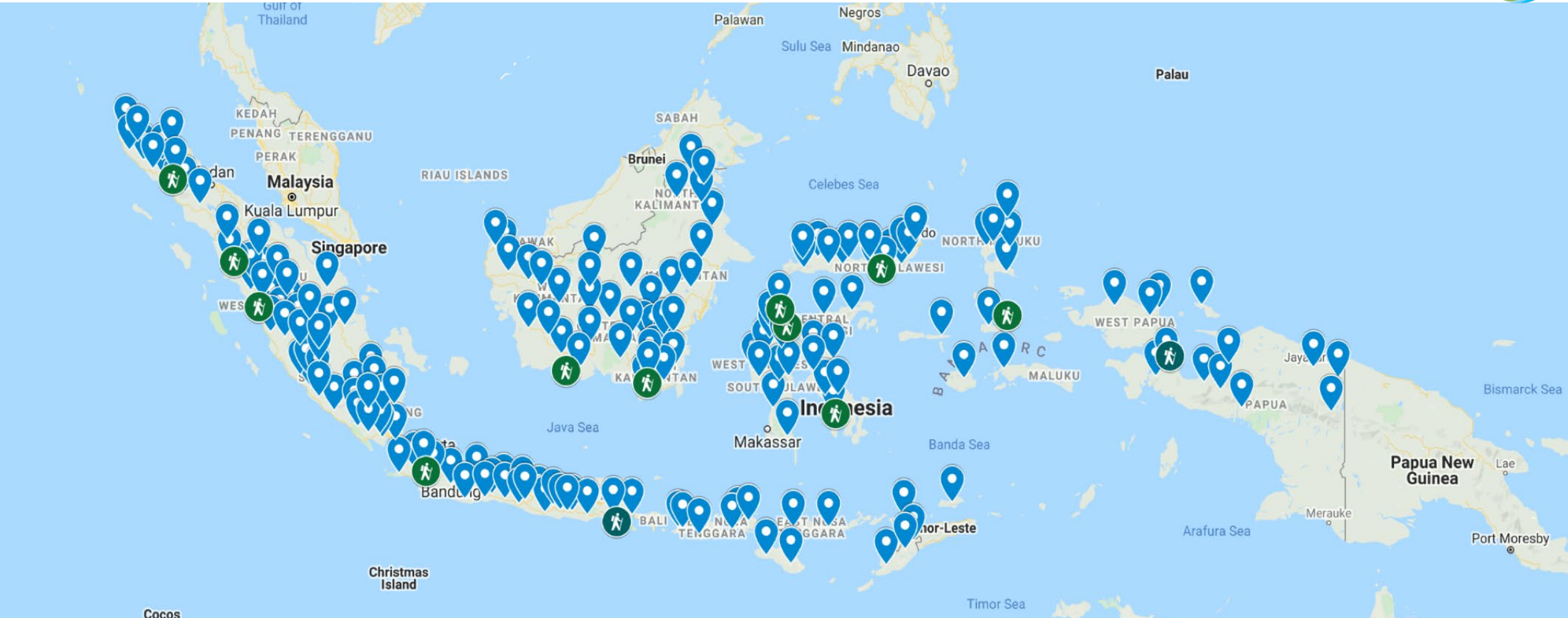
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Distribution of ASGM in Indonesia



>1,200,000 artisanal gold miners
>10,000,000 population at risk
Used 2,000-3,500 Ton Hg/year
Produced 100-175 T Au/year

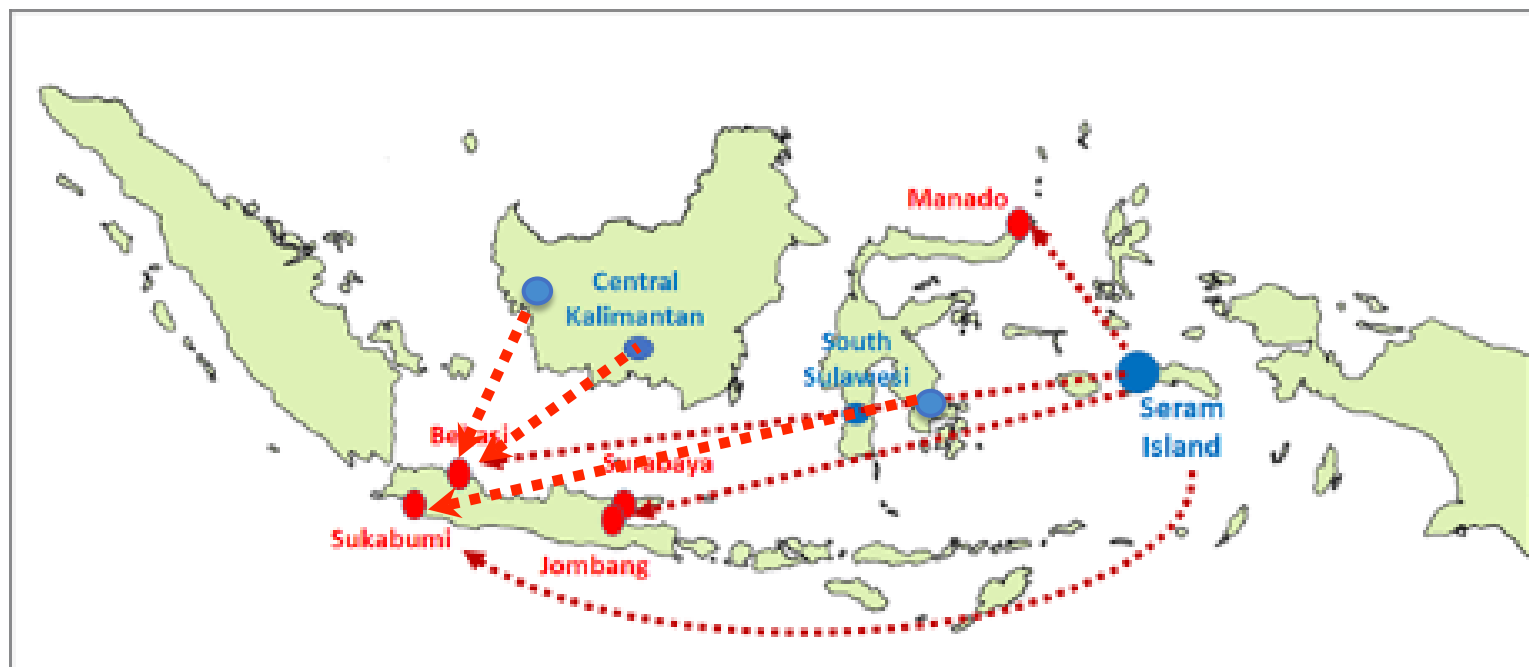
ASGM hotspots found in 34 Provinces out of 38 (90%)
190 Regencies/cities out of 514 (37%)
15 National Parks/Grand Forest/Protected Areas
≥125.000 Hectares degraded land (open access)



Sources of mercury in Indonesia



Cinnabar mines in Seram Island, West Kalimantan and Southeast Sulawesi

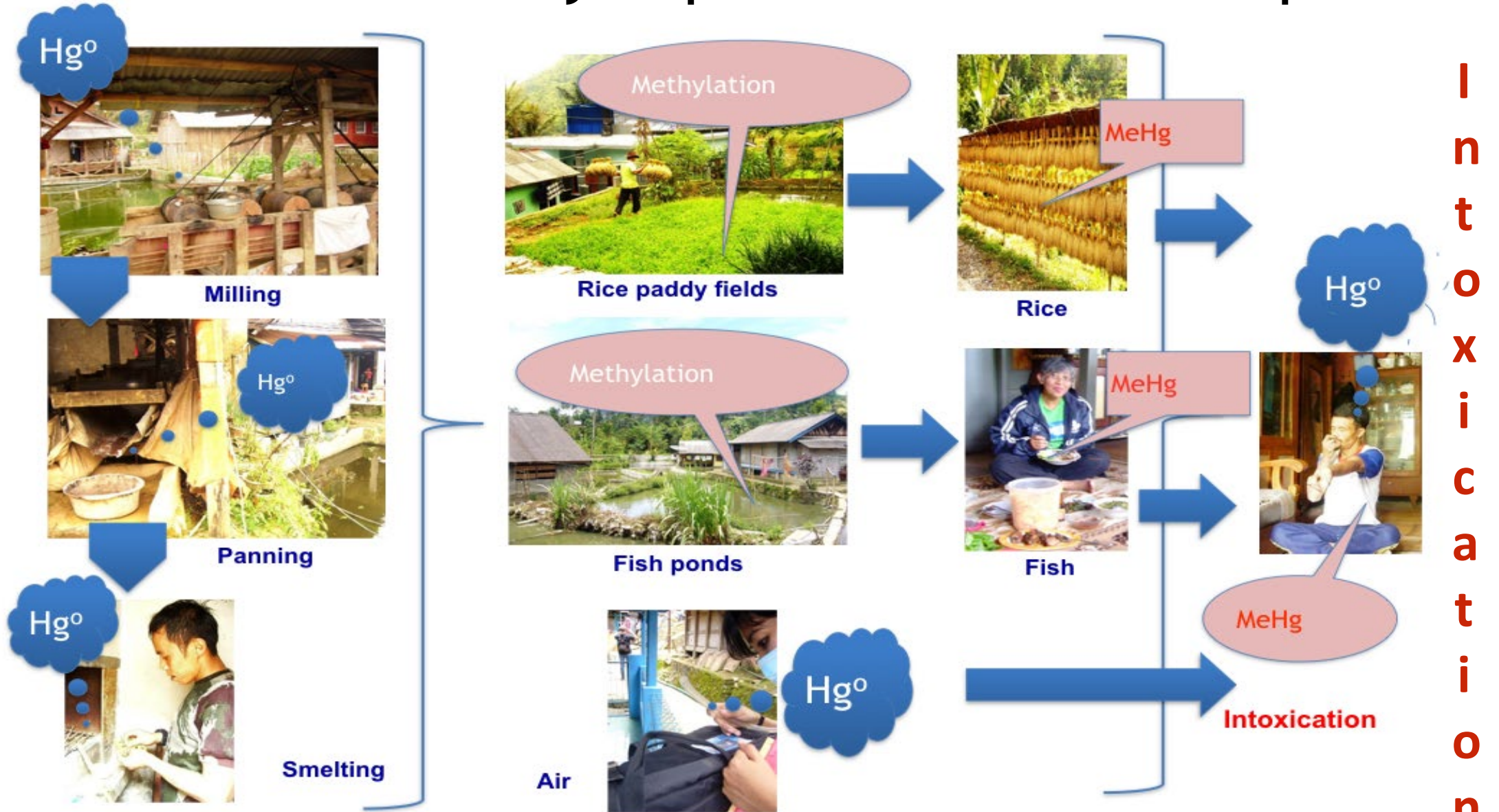


Mercury smelters in Ambon, West Java and East Java

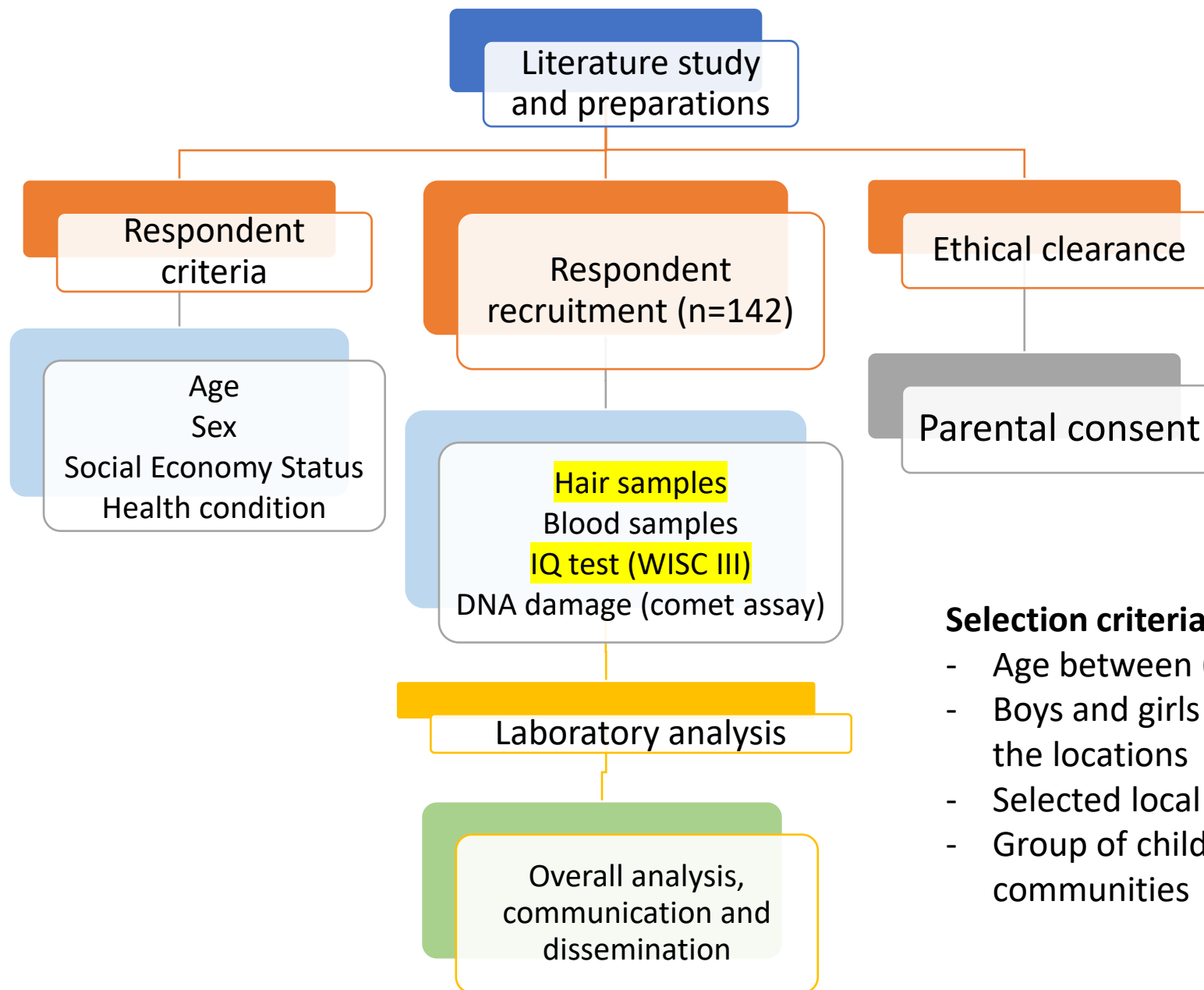




Routes of mercury exposure in ASGM hotspots



Study design

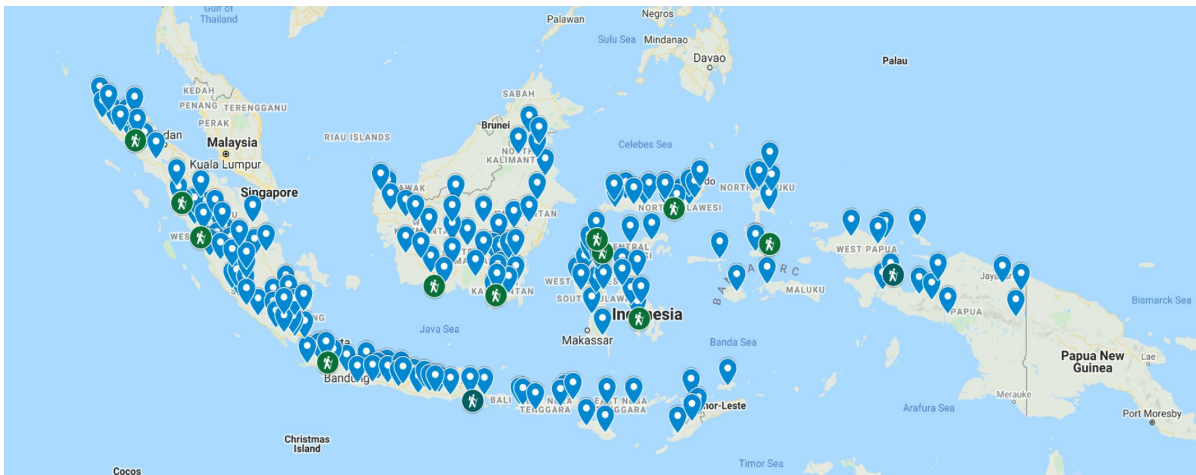


Selection criteria

- Age between 6-13
- Boys and girls born and raised in the locations
- Selected local schools
- Group of children in the communities



Study locations



North Lombok
(n=31)

West Lombok 1
(n=40)

West Lombok 2
(n=45)

West Sumbawa
(n=24)



Previous study: CHIME Program Rapid Assessment (2019)

Children's Health Interventions in Mercury-polluted Environment

1. Neighbourhood mapping

- Environmental sense of children
- Observing skill

Good:
0 - 1.00

Children in this area are in good health and social conditions.

2. Forum Group Discussion

- Health problems
- Vision, hearing and cognitive skills

Medium:
1.01 - 2.00

Children living in this area have started to feel the impact of mercury pollution, although the effect is not yet visible. Parents must stay alert.

3. Daily Calendar

- Time orientation

Poor:
2.01 - 3.00

Mercury pollution affects children living in this area, and its impact on children's health and social conditions is noticeable. Interventions need to be carried out to prevent worse adverse effects.

4. Snakes and ladders game

- Work in group concept
- Understand instruction

Severe:
3.01 - 4.00

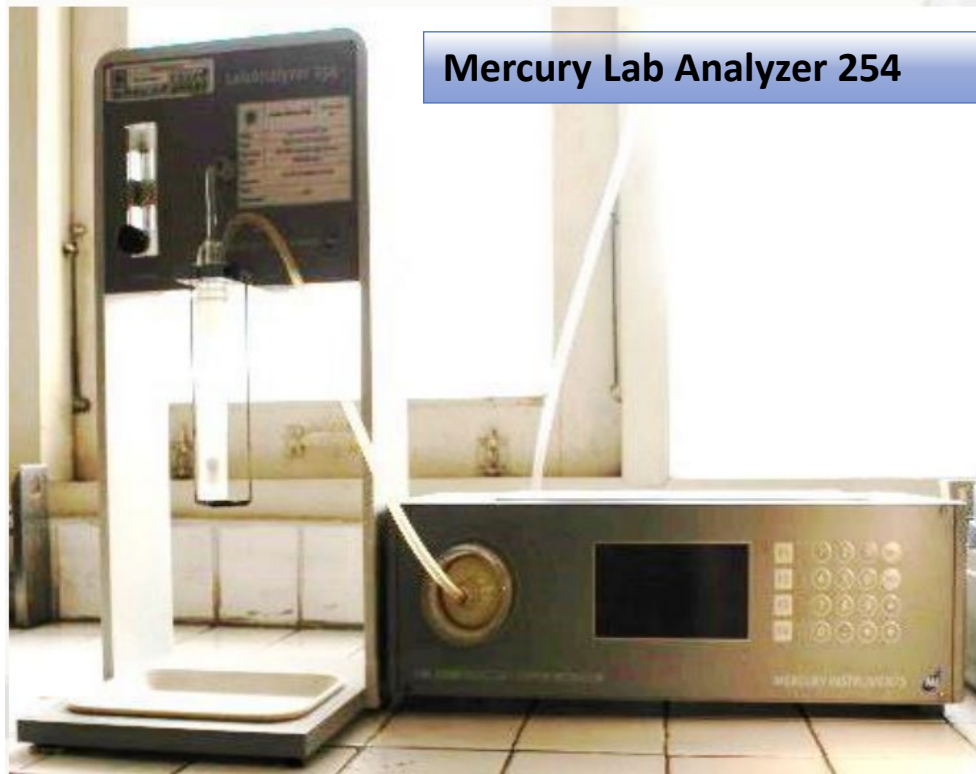
It is of utmost importance to conduct biomarker checks on children to assess the mercury content in their blood, which will be crucial in guiding the next steps.

Locations	#children	Final scores
W. Lombok 1	28	2.64
W. Lombok 2	29	2.69
W. Lombok 3	30	2.52
W. Lombok 4	29	2.32
W. Sumbawa	41	1.84
Total	157	Ave. 2.40

Followed up with the
next study

Materials and method

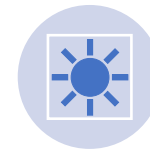
Hg-hair analysis



Measurement range
0.01 ppb – 10 ppb



Measurement at
253.7 nm

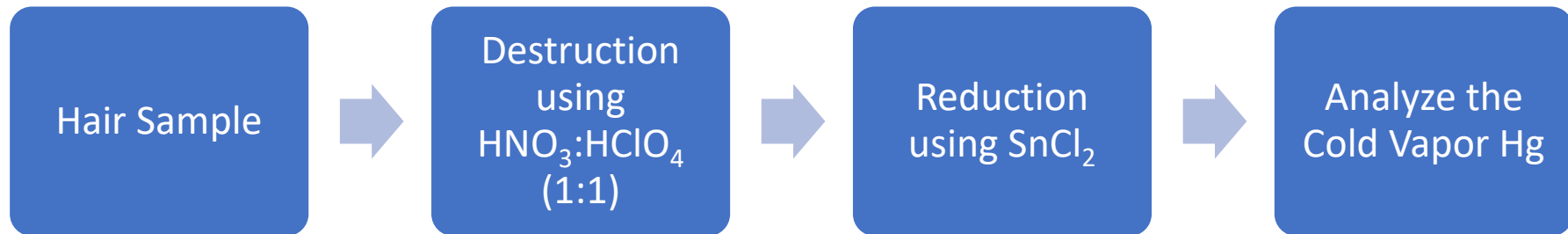


UV Detector
(CVAAS)



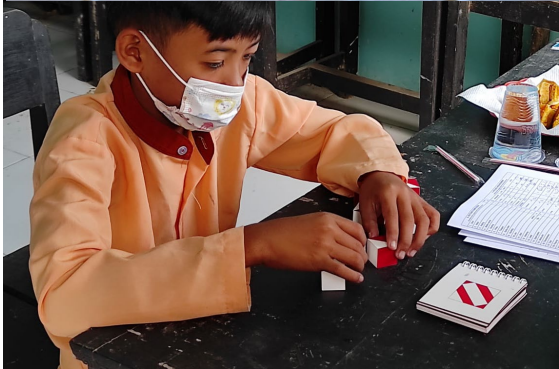
5ng/L sensitivity

Analysis Process



Materials and method

WISC III



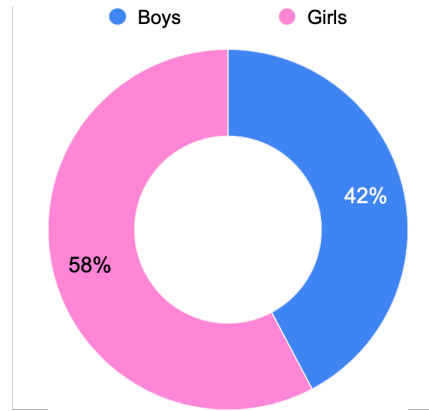
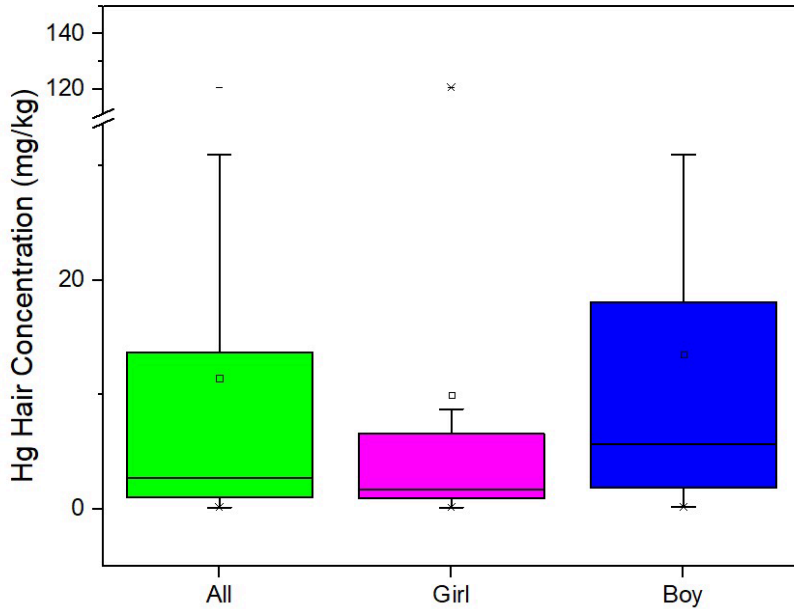
- The WISC-III is an intelligence test published in 1991, the third edition of Wechsler intelligence tests
- Intended for children from 6 to 16 years of age
- Composed of two scales: Verbal and Performance
- Verbal Scale:
 - Five Mandatory Subtests: Information, Similarities, Arithmetic, Vocabulary, Comprehension
 - One Supplementary Test: Digit Span (Kamphaus, 1993)
- Performance Scale:
 - Five Mandatory Subtests: Picture Completion, Picture Arrangement, Block Design, Object Assembly, Coding
 - Two Supplementary Subtests: Mazes, Symbol Search (Kamphaus, 1993)



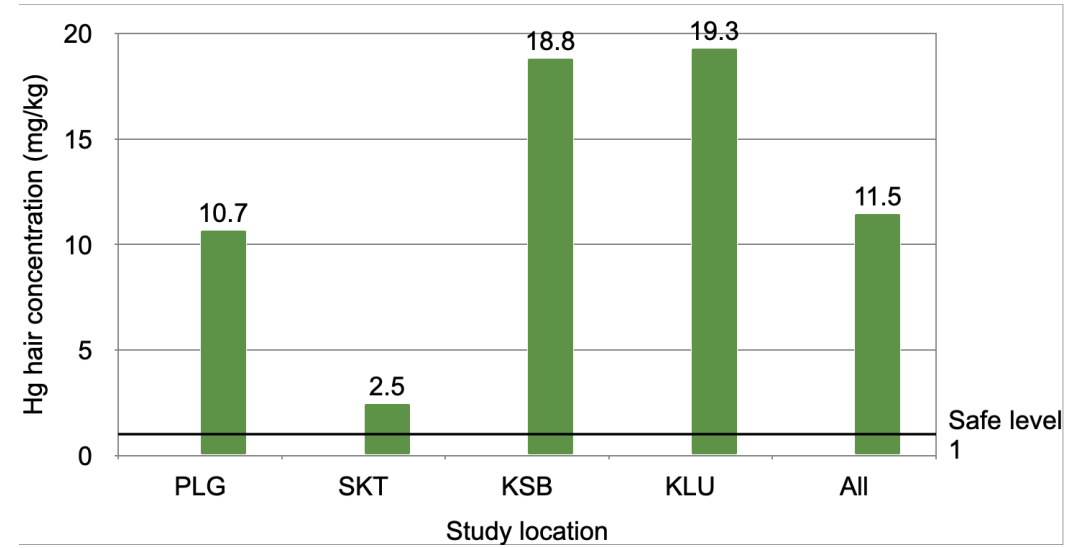
Results

- 76% of Hg-hair in children from four sites exceeding the safe level 1 ppm
- If we use proposed safe level 0.58 ppm, 85% of children have Hg-hair exceeded the safe level

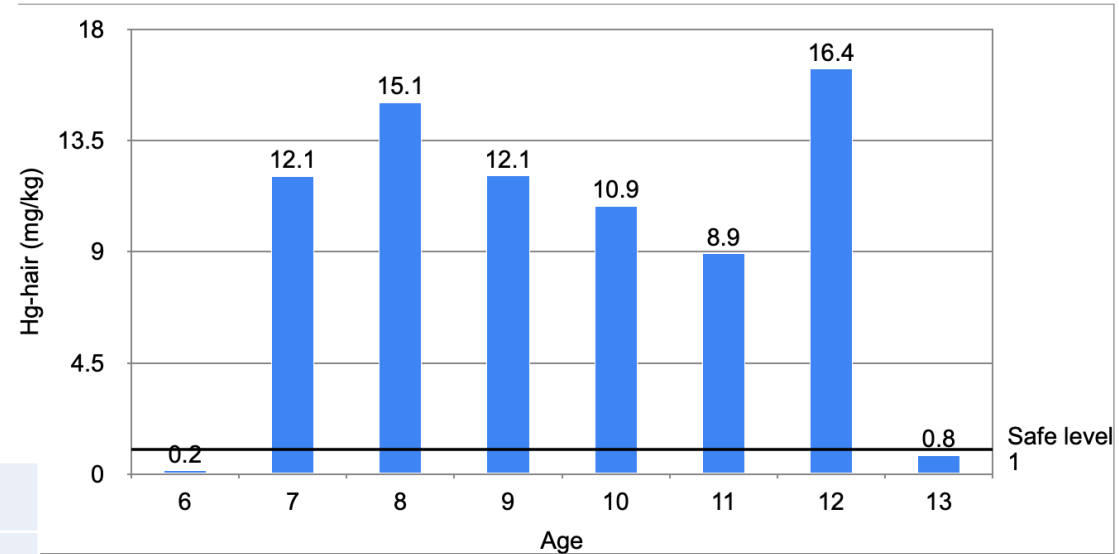
Hair Hg content in Children



Hg hair	Girls	Boys
<1ppm	29%	18%
>1ppm	71%	82%
<0.58ppm	16%	15%
>0.58ppm	84%	85%



Caption



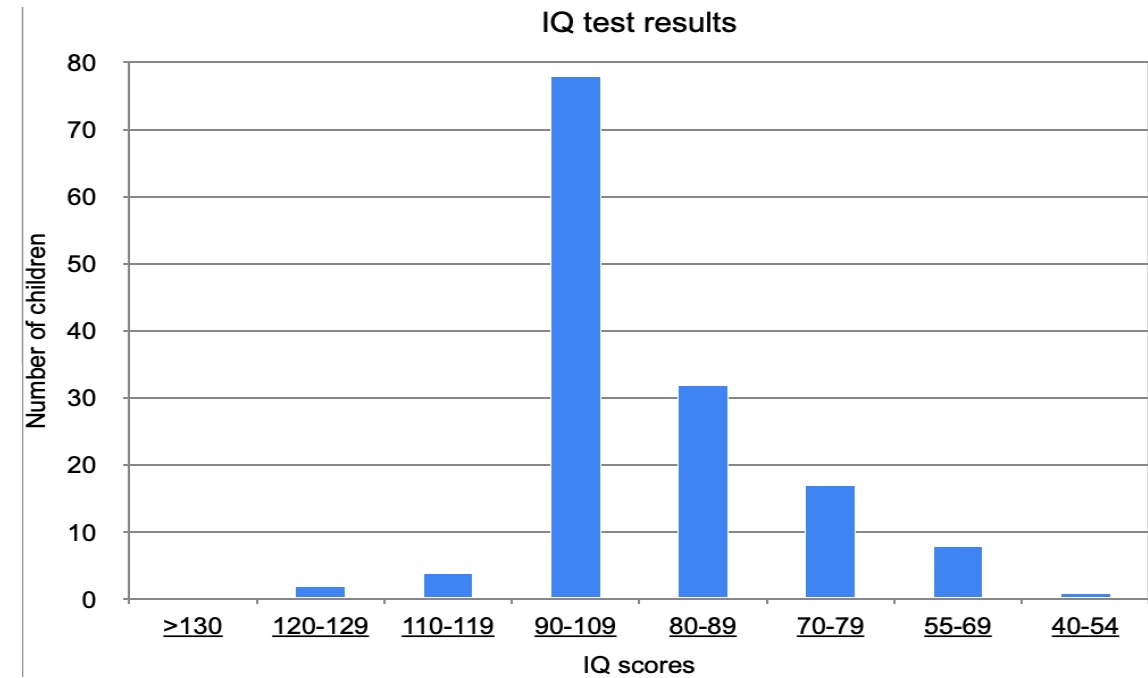
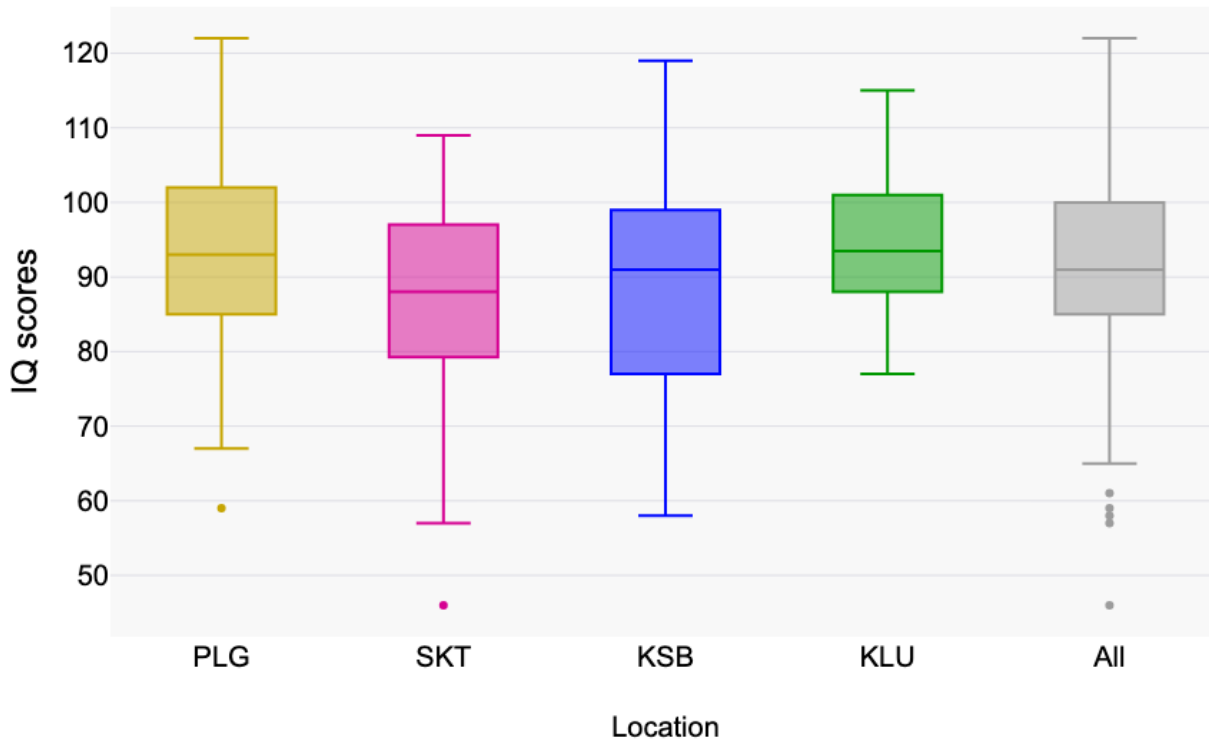
Hg-hair average vs age of participants



IQ test results

- 59% of children have IQ scores average to superior
- 41% of 142 children will need help

IQ scores in children live in ASGM hotspots in West Nusa Tenggara, Indonesia

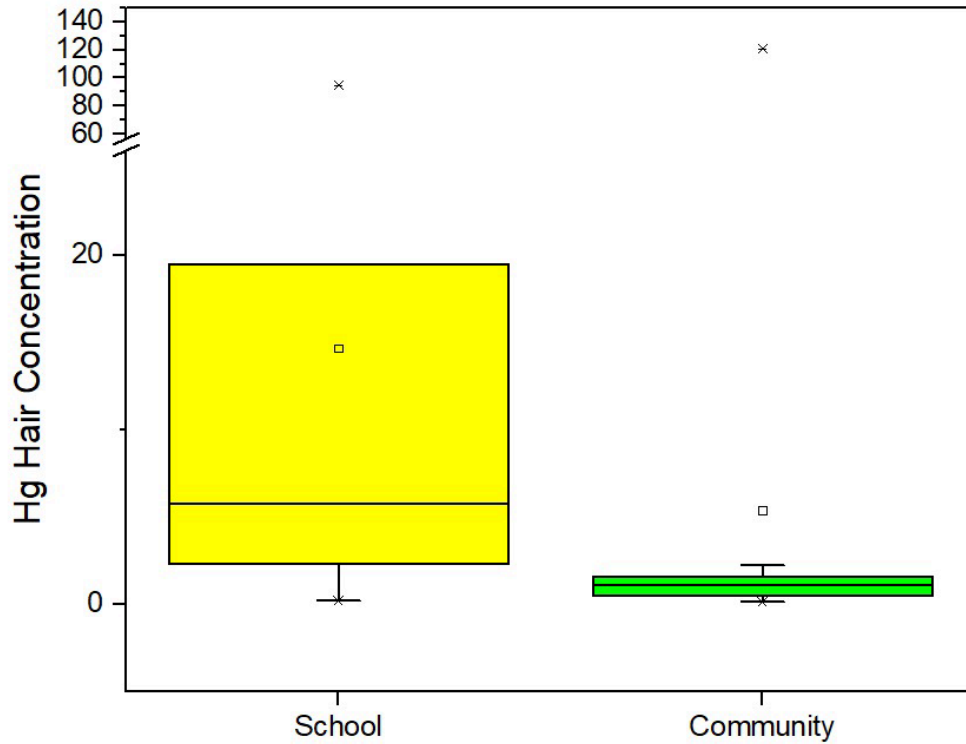


%	IQ score	Classification
0	130 and above	Very Superior
1%	120-129	Superior
3%	110-119	High Average
55%	90-109	Average
23%	80-89	Low Average
12%	70-79	Borderline
6%	55-69	Mild Mental Retardation
1%	40-54	Moderate Mental Retardation

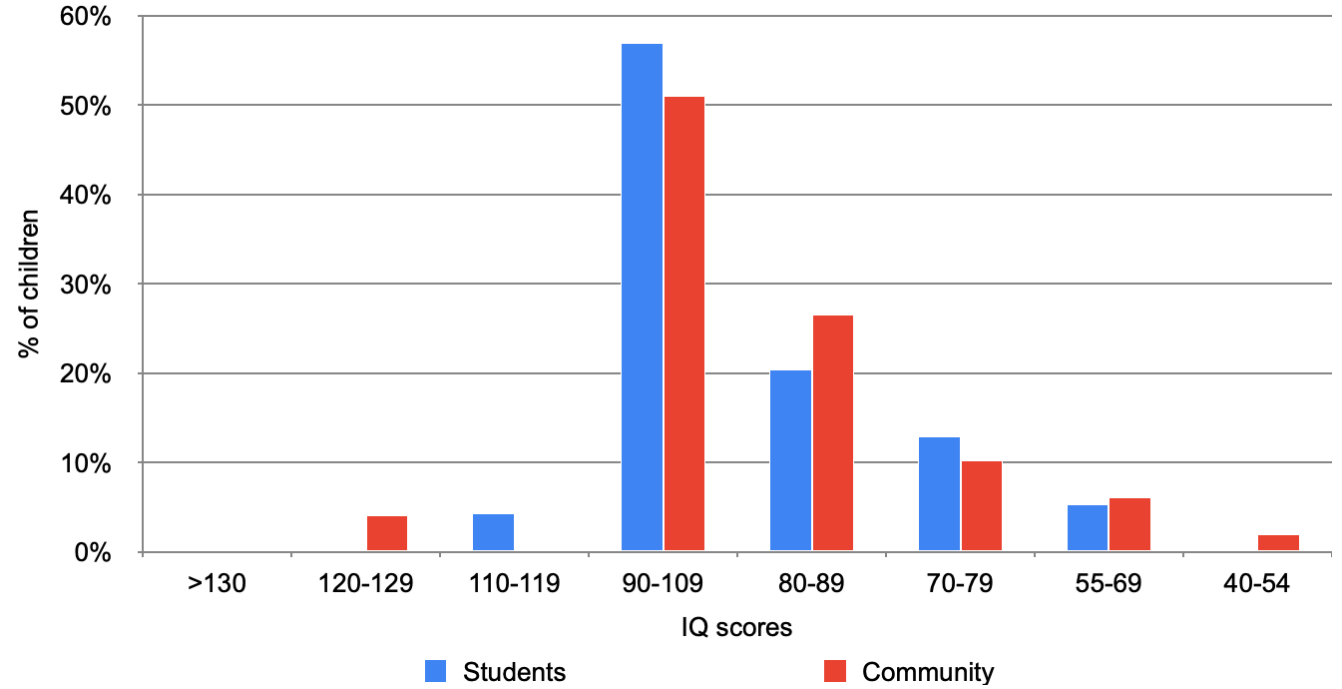


Hg-hair and IQ test results (cont.)

Hair Hg content in Student and Community Children



IQ scores comparison between students vs children in community



Students	Community	IQ scores
0%	0%	130 and above
0%	4%	120-129
4%	0%	110-119
57%	51%	90-109
20%	27%	80-89
13%	10%	70-79
5%	6%	55-69
0%	2%	40-54



Conclusions

- Students have higher IQ than children in the community
- Low-income family provided limited nutrition for children
- Although students have higher Hg-hair concentration compared to children in community, they have better stimulation and learning experience



Recommendations

- Education plays important role in development of cognitive behaviour
- Awareness raising for families to have variety of nutrition
- There is a need to have society support for children in the community to increase their cognitive behaviour development
- Children assessment should be integrated into the monitoring plan of Local Action Plan/NAP

Thank you

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