

## Community Health and Environment Issue:

### Case on Sanitation and Stunting

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## MDGs: Millennium Development Goals

### Target 7C:

**Halve**, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation

## SDGs: Sustainable Development Goals

### Target 6.2:

**By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, ...**

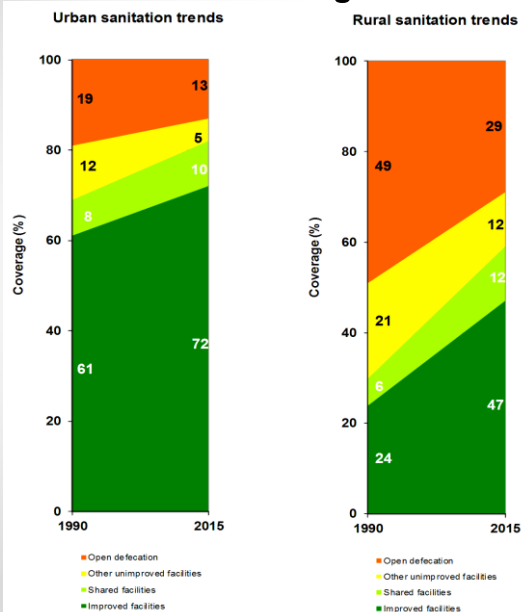
## SDGs: Sustainable Development Goals

### Target 6.2:

By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, ...

- Until 2016 access for the poor or vulnerable people to adequate sanitation facilities has reached 54.12%.
- The Indonesian government has set a target of 100% by 2019 for proper sanitation facilities.

### WHO/UNICEF, 2015: Sanitation coverage trend in Indonesia, 1990-2015



| Urban               | Rural |
|---------------------|-------|
| Open Defecation     |       |
| +                   | ++    |
| Unimproved fac.     |       |
| +                   | +     |
| Shared Facilities   |       |
| +                   | ++    |
| Improved facilities |       |
| +                   | ++    |

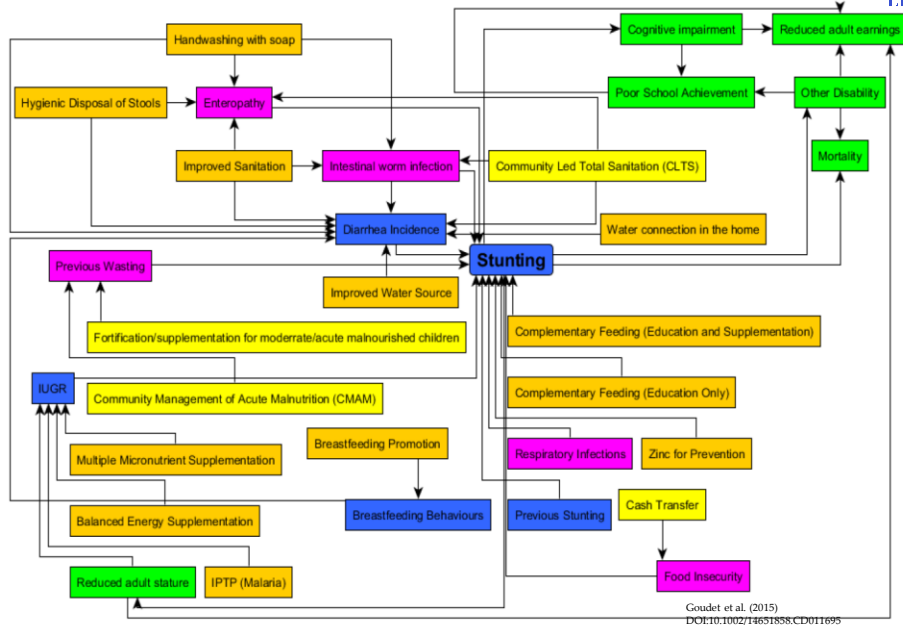
## The trend in rural vs urban in Indonesia:

- The improvement of sanitation facilities in rural area goes significantly better than urban
- Urban area played a significant role on river water pollutions → domestic wastewater (Nat. Geo. 2016: 68% rivers in Indonesia were highly polluted by domestic waste).
- Rural area → high env. carrying capacity
- Urban area → some restrictions: lack of spaces, over population, lack of infrastructures etc.
- From total population of 262 mio. (per Jan. 2017), 55% in urban area

In urban slums of developing country  
Over population without sufficient infrastructure



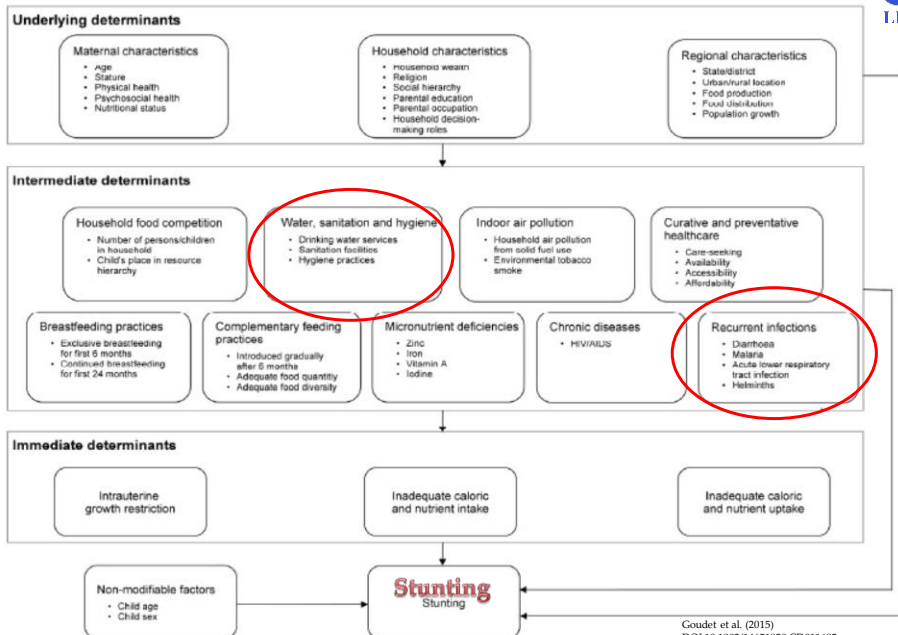
Logic model: Direct linkages between stunting risk factors ( ■ ■ ), interventions ( ■ ■ ) and mortality/disability ( ■ )



Goudet et al. (2015)  
DOI:10.1002/14651858.CD011695

## Causes of stunting

Lembaga Ilmu Pengetahuan Indonesia  
Loka Penelitian Teknologi Bersih



Goudet et al. (2015)  
DOI:10.1002/14651858.CD011695

1. NTB: All extreme to worst  $\rightarrow$  high percentage on malnutrition  $\infty$  skinny  $\infty$  stunting. No obesity
2. West Papua: in the average values, but the obesity is similar like Jakarta
3. Jakarta: still under weight/thin children (in the average value)  $\rightarrow$  trend, style??
4. West Java: obesity > \_\_\_\_\_



## Our Studies in an urban slum area

# Objectives

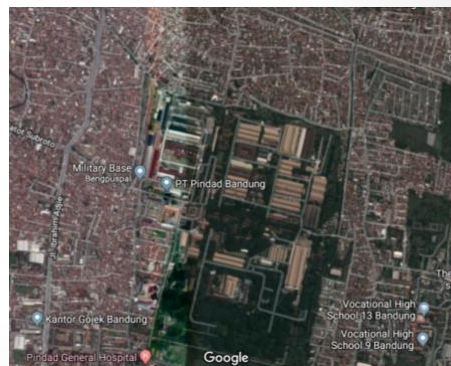
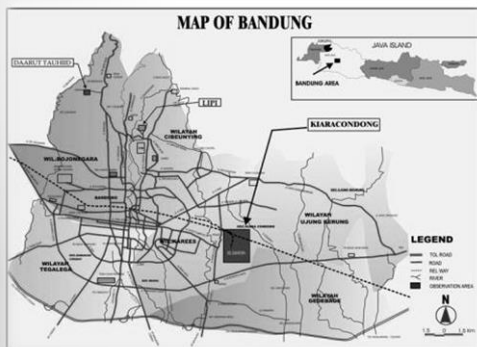
Research has been done in an urban slum of Bandung City, Indonesia:

- To evaluate **child health** and **nutritional status**.
  - To reveal the actual situation of **sanitary environment, personal awareness & behaviour**.
- ↓
- To examine the **relationship**

## Bandung City:

- Population ca. 2.4 million
- Has 30 districts
- Kiaracondong's population: 142,356 (2016) →  
the most populated district in 6.18 km<sup>2</sup>

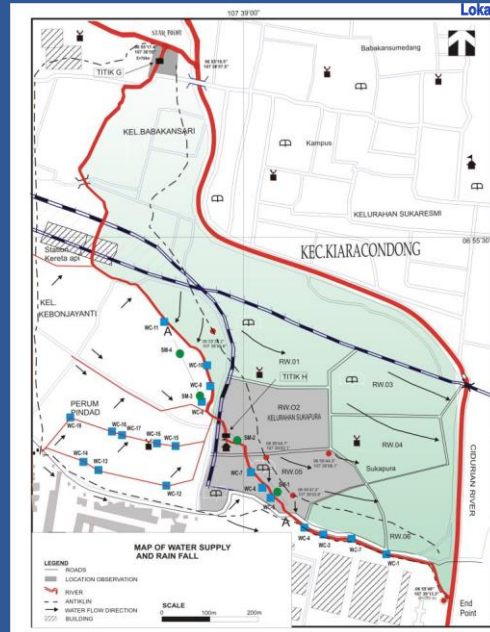
(<https://portal.bandung.go.id/pemerintahan/kecamatan/7GVA/kecamatan-kiara-condong>)



2005-2011

OD

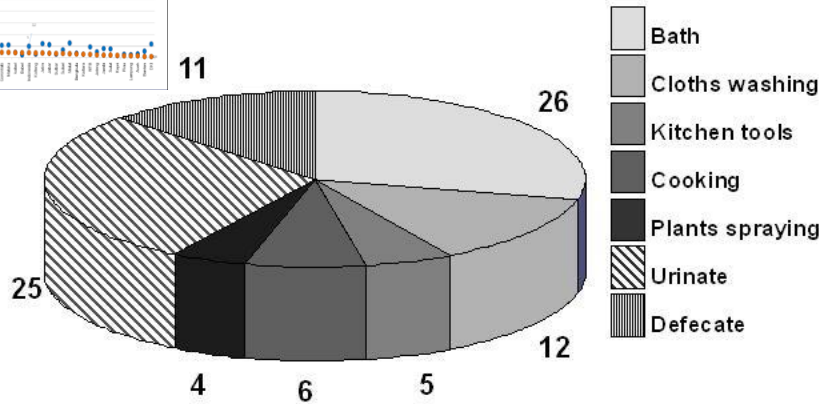
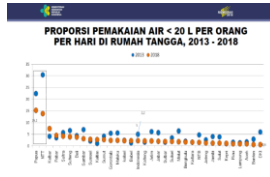
Lembaga Ilmu Pengetahuan Indonesia  
Loka Penelitian Teknologi Bersih



Interview of 62  
households (274  
persons)

Lembaga Ilmu Pengetahuan Indonesia  
Loka Penelitian Teknologi Bersih  
L.I.P.T.

### Average daily water usage (litre/person/day)



**Total<sub>average</sub> = 89 litre/person/day**

## Design and application of composting toilet (Bio-Toilet)

1. Problem solver for: reducing water consumption/usage, mobile, need no infrastructure, added value to compost.
2. **Cultural barriers of using waterless toilet**



Prototype Bio-toilet MFIS-15

# Further Development: one family composting toilet, good design, value chains (management and marketing of compost, urine etc.)

## 2016-2017 research on hygienic aspects

### ■ Participants

230 (Children <5 years old and the  
care takers/Mothers)

### ■ Data collection

#### ✓ Questionnaire

Mother's age, Water source, Toilet type

#### ✓ Interview

Water use, Sewer, Handwashing,  
Child health information (nutrition, diarrhea, etc.)



## ■ Participants

231 pairs (children & caretakers)

## ■ Data collection

- ✓ Body measurements
- ✓ Handwashing observation (WHO 2009)
- ✓ Hand bacteria sampling
- ✓ Questionnaire
- ✓ School attendance & performance (n = 60)



## Result from interviewing mothers:

- A **high level** of personal hygiene awareness
- **Low consideration** for appropriate wastewater treatment
- Child nutritional status seemed to be generally **good**

# 2017 Research

Measurements



Weight & Body fat



Height



✓ Handwashing observation



## 10 check points

1. Wet hands with water ☒
2. Apply enough soap... ☐
3. Rub hands palm to palm ☐
4. Right palm over left... ☐
5. Palm to palm with... ☐
6. Backs of fingers to... ☐
7. Rotational rubbing of... ☐
8. Rotational rubbing, ... ☐
9. Rinse hands with water ☐
10. Dry thoroughly with... ☐

Time record:

WHO procedure (2009) modified



✓ Hand bacteria sampling



Laboratory experiment



Bacteria results



## Risk Factors for Undernutrition and Diarrhea Prevalence in an Urban Slum in Indonesia: Focus on Water, Sanitation, and Hygiene

Yumiko Otsuka, Lina Agestika, Widyarani, Neni Sintawardani and Taro Yamauchi  
 Publisher: The American Society of Tropical Medicine and Hygiene

Doi:10.4269/atjmh.18-0063

BMI = Body Mass Index [kg/m<sup>2</sup>]  
 HAZ = Height for age z-scores  
 BMIAZ calculated using WHO software  
 HAZ < -2 = stunting  
 BMIAZ < -2 = thin  
 BMIAZ > +2 obese

| Characteristics                                                        | n         | Proportion (%) |
|------------------------------------------------------------------------|-----------|----------------|
| <b>Gender</b>                                                          |           |                |
| Boy                                                                    | 117       | 51.3           |
| Girl                                                                   | 111       | 48.7           |
| <b>Grade</b>                                                           |           |                |
| Preschool                                                              | 59        | 25.9           |
| Grade 2                                                                | 58        | 25.4           |
| Grade 4                                                                | 51        | 22.4           |
| Grade 6                                                                | 60        | 26.3           |
| <b>Disease symptoms*</b>                                               |           |                |
| Diarrhea                                                               | 32        | 14.0           |
| Respiratory illness                                                    | 91        | 39.9           |
| <b>Water, sanitation and hygiene knowledge and awareness (n = 169)</b> |           |                |
| Total score (median, range)                                            | 7 (2–8)   |                |
| Important time for handwashing                                         |           |                |
| After using the toilet                                                 | 73        | 43.2           |
| Before eating                                                          | 151       | 89.3           |
| After eating                                                           | 50        | 29.6           |
| <b>Handwashing behavior (n = 169)</b>                                  |           |                |
| Always handwashing with soap                                           | 47        | 27.8           |
| <b>Handwashing skills (n = 221)</b>                                    |           |                |
| Checklist total score (mean ± SD)                                      | 5.0 ± 1.8 |                |
| With water and soap                                                    | 210       | 95.0           |
| With water                                                             | 11        | 5.0            |
| Using towel                                                            | 158       | 71.5           |

\* Two-week period prevalence.

|                                              | Gender       |              |
|----------------------------------------------|--------------|--------------|
|                                              | Boy          | Girl         |
| Height-for-age z-scores (mean ± SD)          | -1.27 ± 0.99 | -1.04 ± 0.78 |
| Body mass index-for-age z-scores (mean ± SD) | -0.66 ± 1.39 | -0.49 ± 1.15 |
| Stunting (%)                                 | 27.4         | 9.0          |
| Thinness (%)                                 | 15.4         | 8.1          |
| Obesity (%)                                  | 7.7          | 1.8          |

## ■ Body measurements (Comparing with WHO standard using Z scores)

|                                                  | PAUD (n = 61)          |                        | SD (n = 170)            |                       |
|--------------------------------------------------|------------------------|------------------------|-------------------------|-----------------------|
|                                                  | Boy<br>(n = 31)        | Girl<br>(n = 30)       | Boy<br>(n = 87)         | Girl<br>(n = 83)      |
| <b>Stunting (%)</b><br>(HAZ <sup>a</sup> < -2)   | <b>29.0</b><br>(n = 9) | <b>10.0</b><br>(n = 3) | <b>25.3</b><br>(n = 22) | <b>9.6</b><br>(n = 8) |
| <b>Thinness (%)</b><br>(BMIAZ <sup>c</sup> < -2) | <b>3.2</b><br>(n = 1)  | <b>3.3</b><br>(n = 1)  | <b>18.4</b><br>(n = 16) | <b>9.6</b><br>(n = 8) |
| <b>Obesity (%)</b><br>(BMIAZ <sup>c</sup> > +2)  | <b>9.7</b><br>(n = 3)  | <b>3.3</b><br>(n = 1)  | <b>6.9</b><br>(n = 6)   | <b>2.4</b><br>(n = 2) |

<sup>a</sup> Height for age, <sup>b</sup> Weight for age, <sup>c</sup> Body mass index for age

## ■ Body measurements for Grade 6 (Indonesian vs. WHO standards using %tiles)

| <b>Grade 6</b><br>(n = 61)                | <b>Indonesian STD*</b> |                         | <b>WHO STD</b>          |                         |
|-------------------------------------------|------------------------|-------------------------|-------------------------|-------------------------|
|                                           | <b>Boy</b><br>(n = 34) | <b>Girl</b><br>(n = 27) | <b>Boy</b><br>(n = 34)  | <b>Girl</b><br>(n = 27) |
| <b>Stunting(%)</b><br>Height for age < 3P | <b>8.8</b><br>(n = 3)  | <b>0</b><br>(n = 0)     | <b>41.2</b><br>(n = 14) | <b>11.1</b><br>(n = 3)  |
| <b>Thinness (%)</b><br>BMI for age < 3P   | <b>23.5</b><br>(n = 8) | <b>0</b><br>(n = 0)     | <b>29.4</b><br>(n = 10) | <b>3.7</b><br>(n = 1)   |
| <b>Obesity (%)</b><br>BMI for age > 97P   | <b>14.7</b><br>(n = 5) | <b>7.4</b><br>(n = 2)   | <b>11.8</b><br>(n = 4)  | <b>3.7</b><br>(n = 1)   |

\*First Indonesian Growth Study, Jakarta 2002

## ■ Hand bacteria contamination before and after handwashing



| <b>Grade 6</b><br>(Age: 10-14 years old) | <b>Boy</b>              | <b>Girl</b>             | <b>All</b>              |
|------------------------------------------|-------------------------|-------------------------|-------------------------|
|                                          | (n = 29)                | (n = 22)                | (n = 51)                |
| <b>Reduction (%)</b>                     | <b>89.7</b><br>(n = 26) | <b>82.6</b><br>(n = 19) | <b>86.5</b><br>(n = 45) |
| <b>Before</b><br>(median: cfu/hand)      | <b>55</b>               | <b>30</b>               | <b>50</b>               |
| <b>After</b><br>(median: cfu/hand)       | <b>15</b>               | <b>4</b>                | <b>12</b>               |

ND: Before (n = 2), After (n = 4).

# Conclusions

- **Child health is influenced by:**
  - Household characteristics such as monthly income, drinking water management
  - Outdoor activities: school, community environment

**Acknowledgement:**

Our research is under the join co-operation between LPTB-LIPI and RIHN Kyoto Japan in "Sanitation Value Chain: Designing Sanitation Systems as Eco-Community Value System" Proj.No. 14200107.

