

Mapping of Water, Sanitation, Hygiene and Child Health in an Urban Slum of Indonesia

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Abstract

Globally, access to improved water, sanitation and hygiene could prevent 58% of diarrheal deaths among under 5 children per year. In the urban slums of developing countries, overpopulation remains a contributing factor of limited access to clean drinking water and sanitary living conditions. This study examined the current situation of water use, sanitation, child health, nutritional status, and women's hygiene awareness in an urban slum of Indonesia. The study was conducted in the densely populated area of Bandung, West Java Province, Indonesia. Questionnaires which probed for information regarding household socioeconomic status, condition of drinking water, toilet facilities, and understanding of child health were administered to 30 women. A group of 15 caretakers living with children aged below five years were interviewed regarding their procurement and use of domestic water, sewer system, health status of their children and awareness of good hygiene practices. In addition, researchers observed and photographed the household situation regarding the family's drinking water, toilet facilities, and sewer during home visits. The study found the majority of participants used water in a safe and appropriate manner with respect to its source and purpose. No participants were found to use groundwater as drinking water. In conclusion, women living in the study area paid careful attention to the safety of drinking water. Although each house had a toilet facility, untreated wastewater was found to flow into a nearby river, which suggested that the people of the community had a low level of concern for appropriate wastewater treatment. Caretakers demonstrated excellent recognition of the importance of handwashing and the majority of participants displayed a high level of interest in maintaining good child health and nutritional status. Lastly, results from the sample of caretakers who were interviewed indicated that the health and nutritional status of the children studied were generally good.

Keywords: drinking water, water use, toilet, child health, hygiene

Introduction

According to the recent estimates, access to improved water, sanitation and hygiene could prevent 58% of diarrheal deaths among children under 5 years of age worldwide per year (WHO, UNICEF and USAID 2015), emphasizing the importance of safe water and good hygiene for child health. In the urban slums of certain developing countries, over population is a contributing factor limiting access to clean drinking water and sanitary living conditions. In Indonesia, previous studies focusing on drinking water and sanitation have found that

these factors are associated with an increased prevalence of diarrheal illness and stunted growth among children (Richard et al. 2011; Harriet et al. 2016; Ahmad et al. 2017). This study examined the current situation of water use, sanitation, child health, nutritional status, and women's awareness of hygiene in the densely-populated area of Bandung, West Java Province, Indonesia.

1. Subjects and Methods

1.1. Research area and subjects

A field study was conducted from August to September, 2016 in an RW (*Rukun Warga*: hereafter Indonesian is italicized) area of Bandung city, West Java Province, Indonesia. The RW is located in a subdistrict which is a densely populated area (around 20,000 people/km²). "Slums are densely populated urban areas characterized by poor-quality housing, a lack of adequate living space and public services, and accommodating large numbers of informal residents with generally insecure tenure" (Benjamin et al. 2013: 187). Therefore, this area was classified as a slum based on its challenges of overcrowding, inadequate living space, limited infrastructure and generally low household income, though it is a legal and seemingly planned settlement. The area is divided into eight sub-areas (*Rukun Tetangga*: RT). There is one educational facility (*Pendidikan Anak Usia Dini*: PAUD) for children aged between three and six years and one clinic operated by midwives.

Participants in the study were 16 attendants at a women's community (*Pembinaan Kesejahteraan Keluarga*: PKK) meeting that was held on September 2, 2016, and 15 women living with children under five years of age who were recruited by the leader of child health activity (*Posyandu*). Of the 31 participants, one was excluded because she had never borne a child (nulliparous). Overall, 30 women ranging from 26 to 67 years of age participated in the study. The purpose of the study was explained to all participants and questionnaires were administered. Of the 30 participants, interviews were conducted with 15 caretakers living with children under five years of age and home visits were performed for six caretakers who were open to receiving a home visit.

1.2. Measurements

Study 1: Questionnaire (n = 30)

A self-reported questionnaire was used to gather data, which was translated into Indonesian (*Bahasa Indonesia*). The questionnaire was developed for this study referencing various previous studies and considering local situations. Questions asked probed for information regarding:

- 1) Family size, socioeconomic status (educational background, occupation, and monthly income).
- 2) Drinking water: water source and related problems.
- 3) Toilet: type and related problems.
- 4) Interest in child health (children 12 years of age and below): 15 of the 30 women with children 12 years of age and below were asked about any health problems their child had experienced and points of concern. The other 15 women who had children 13 years and older were asked the same questions related to when their children were 12 years old and below.

Study 2: Interview (n = 15)

A self-reported questionnaire was used, which was translated into Indonesian (*Bahasa Indonesia*). After completing the questionnaire, interviews were conducted around each question. The questionnaire was prepared in the same way as Study 1. Questions asked probed for information regarding:

- 1) Living sub-area (RT), residence.

- 2) Number of children, children's age, and children's educational background.
- 3) Source and procurement of domestic water.
- 4) Use of water storage.
- 5) Treatment applied to drinking water.
- 6) Drainage of used water.
- 7) Method of garbage disposal.
- 8) Handwashing practices.
- 9) Cleaning methods for child's feeding utensils.
- 10) Attention given to child's handwashing.
- 11) Child health status (diarrhea, nutritional status, parasitic infection, breastfeeding, vaccination, use of vitamin A supplement).

Study 3: Household visit (n = 6)

Caretakers who had children below five years of age and were open to having home visits were recruited. During home visits, further observations of living conditions were made and photographs of the household environment (drinking water, toilet, and drainage) and house surroundings were taken.

2. Results and Discussion

2.1. Participant characteristics

Participant characteristics are shown in Table 1. Results showed that 80% of women were housewives and approximately 80% of women had middle and higher educational levels. These rates were high compared with the national statistics of Bandung city in 2015 and 2016; women's housewife rate, and middle and higher educational level rate were approximately 40% and 70%, respectively (BPS-Statistics of Bandung Municipality 2017). Household monthly income ranged between < 1,000,000 Rupiah (3%) and \geq 3,000,000 Rupiah (43%), with \geq 3,000,000 Rupiah being the highest level of income reported (1 Indonesian Rupiah = 0.00008 United States Dollar as of 2016).

Table 1. Characteristics of participants (n = 30).

Characteristics	mean	range
Participant's age (year)	44	26-67
Family members	5	3-10
Characteristics	n	%
Wife's occupation		
housewife	24	80
working	5	17
no answer	1	3
Husband's occupation		
working	27	90
no answer	3	10
Wife's education background		
Primary	5	17
Middle	9	30
Secondary/ High school	10	33
Tertiary/ University and higher	5	17
no answer	1	3
Husband's education background		
Primary	3	10
Middle	5	17
Secondary/ High school	17	57
Tertiary/ University and higher	1	3
no answer	4	13
Characteristics	n	%
Monthly income (unit = 1,000 rupiah)		
<1,000	1	3
1,000-1,499	4	13
1,500-1,999	2	7
2,000-2,499	6	20
2,500-2,999	3	10
3,000≤	13	43
no answer	1	3

2.2. Water use and drinking water

In the area studied, tap water (private or shared), groundwater, and tank water were used for drinking and domestic water use (Figure 1). Families who did not have a private tap or groundwater pumping equipment had to purchase water. Water was purchased from shared taps, water sellers (Figure 2) and tank water shops (either newly purchased or refilled). Private tap users purchased in the same manner if the private tap did not work efficiently.

Some caretakers were found to use water from exclusive vessels or tanks for drinking and cooking, whilst others used plastic drums and buckets (Figure 3) for temporary water storage. Almost every caretaker interviewed reported cleaning water receptacles regularly (four reported cleaning once a day, five reported cleaning every two to three days, four reported cleaning once a week and one reported cleaning once a month).

The majority of caretakers used water appropriately in accordance to its source and purpose (Table 2). The proportion of households with access to improved drinking water sources in urban Indonesia was 64.3% (NIHRD 2013). Contrary to the national report, all participants in the study had access to improved drinking water sources;

16 (54%) used tap water (private or shared) and 14 (46%) used tank water (either newly purchased or refilled) (Figure 4). None of the participants reported using groundwater for drinking (Figure 4). When tap water was used for drinking, it was always boiled (Table 2). In terms of groundwater usage, caretakers interviewed stated that they did not use it for drinking because they felt uneasy about the quality of this water due to its close proximity to the septic tank. They were equally careful while providing drinking water to their children. In general, women living in this area paid careful attention to the safety of drinking water.

Of those questioned, seven out of 30 participants reported that they had encountered drinking water problems at least once. Out of these seven, two reported encountering three problems, and one reported encountering two problems. The problems reported related to accessibility, color, smell, etc. (Figure 5). Five participants commented on accessibility as a problem. These included one shared tap user, two tank water users, and two private tap users. Problems with accessibility among the shared tap users and tank water users were presumed to involve distance to procurement sites and difficulties with transportation. This differed from the private tap users whose problems with accessibility related to a daily shortage of water supply because, according to residents of the area, the private tap worked only once (at midnight) every two days.



Figure 1. Sources of domestic water.
(a) Tap (private), (b) Tap (shared), (c) Ground water, (d) Tank water



Figure 2. Water seller.



Figure 3. Water storage (drum: left, bucket: right).

Table 2. Water use pattern (n=15).

Pattern (n)	Drinking	Cooking	Others
1 (6)	Tp*	Tp	Tp
2 (1)	Tk (N)	Tp	Tp
3 (2)	Tk (N or R)	Tp	Gw
4 (2)	Tk (R)	Tk (R)	Gw
5 (1)	Tp*	Tp	Gw
6 (1)	Tp*	Gw	Gw
7 (2)	Tk (N or R)	Gw	Gw

Tp: Tap.

Tk: Tank (N: New, R: Refill).

Gw: Ground water.

*Boil.

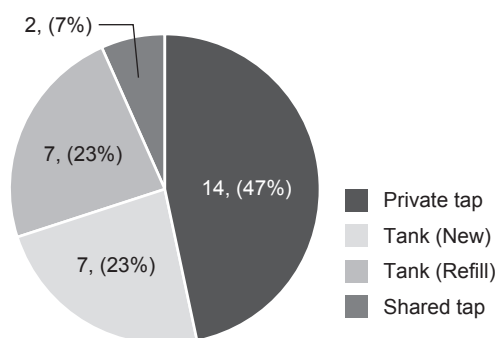


Figure 4. Drinking water sources.

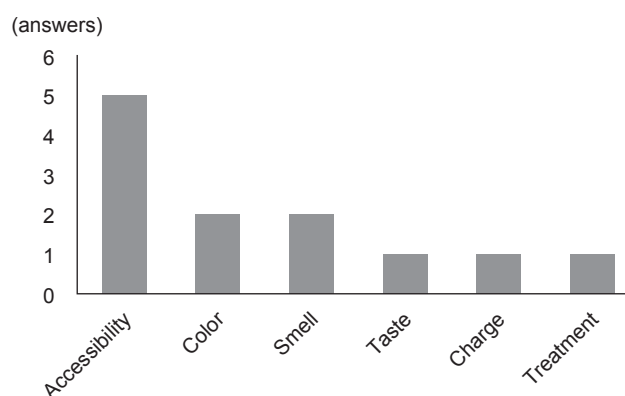


Figure 5. Drinking water problems (multiple answers).

2.3. Toilet, drainage and garbage

There were four types of toilets identified in this study. Of the 30 households studied, toilet hole only (Figure 6), hole with step, sitting ceramic and squatting ceramic toilets (Figure 7) were found in 1 (3.3%), 1 (3.3%), 1 (3.3%) and 27 (90%) households, respectively. Six out of 15 households had septic tanks installed near the toilet for underground drainage. This result indicated that toilet drainage was untreated among 60% of the households studied. Compared to the results of national statistics (79.4%: NIHRD 2013), the proportion of households installing septic tanks was low. Toilet problems were reported by five out of 30 respondents with the most frequently reported being smell (Figure 8).

Toilet drainage was found to flow into sewers (*gorong-gorong*: Figure 9) or ditches (*selokan*: Figure 10) among 14 out of 15 households (93%). The drainage of some households flowed directly into the river (Figure 11). Still, even the *gorong-gorong* and *selokan* drainage flowed indirectly into the river. These findings suggest that, although each house was found to have toilet facilities in place, low consideration was given to the drainage and treatment of toilet waste.

In terms of garbage disposal methods, most households disposed via the RW garbage collector which is a formal system in the community (Figure 12). Garbage was placed in a temporary dumping station for collection (*Tempat Penampungan Sampah*: TPS). This was located directly behind a children's playing yard (Figure 13).



Figure 6. Toilet type: hole only.



Figure 7. Toilet type: squatting ceramic.

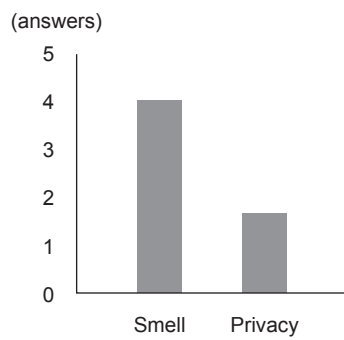


Figure 8. Toilet problems (multiple answers).



Figure 9. Underground sewer (*gorong-gorong*).



Figure 10. Ditch (*selokan*).



Figure 11. Drainages flowed directly into a river.

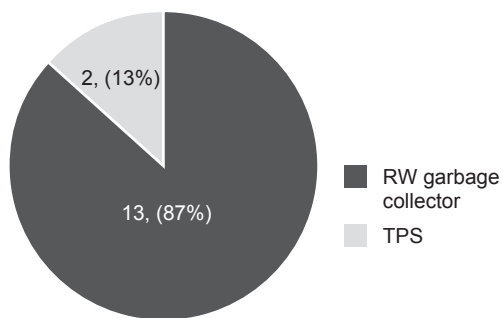


Figure 12. Method of garbage disposal.

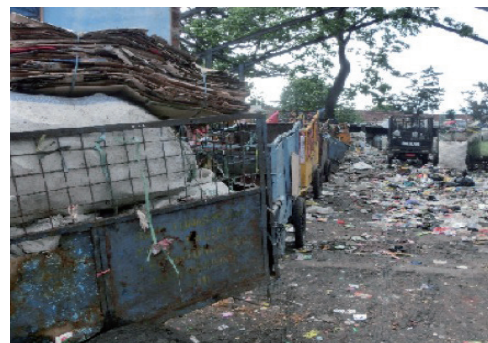


Figure 13. Temporary dumping station (*Tempat Penampungan Sampah:TPS*).

2.4. Hygiene

Table 3 shows the characteristics of participants (15 caretakers: A to O) who participated in Study 2. All caretakers were living with one child less than five years of age. More than half of the caretakers were living with two or more children less than 12 years of age.

The results of the caretakers' own handwashing practices are shown in Table 4. Missed timings (times that caretakers didn't wash their hands) are indicated by the blank spaces within the table (15/195, 8%); however, all caretakers reported performing regular handwashing. According to the national report, the nationwide average rate of appropriate handwashing habit was 47% (NIHRD 2013). All caretakers stated performing handwashing after using the toilet, but four caretakers reported not washing their hands after changing their child's diaper. For one of reasons, the local assistant involved in the study explained that the urine of an exclusively breastfed infant (up to six months old) is not regarded as unclean (*mukahffafah*) as per Islamic custom in Indonesia.

All caretakers included in the study demonstrated an awareness on the importance of their child engaging in appropriate handwashing practices, stating that they advise their children on handwashing. These findings indicated high recognition of the importance on good handwashing habits. Caretakers reported emphasizing the importance of handwashing to their children in particular, before eating (9), after playing outside (3), after using the toilet (2), after returning home (2), before going to bed (2) and when their hands were visibly dirty (1). When asked about practices related to the sanitization of children's belongings, five out of 15 caretakers reported boiling items and one out of 15 reported hanging items outside.

Table 3. Characteristics of Study 2 participants (n = 15).

Characteristics	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Living area (RT)	1	6	2	6	8	1	6	8	8	7	2	3	1	5	4
Residence (year)	64	14	28	33	9	6	10	12	11	6	10	3	12	29	13
Children	2	2	1	2	2	1	2	2	1	1	2	1	2	1	3
Children (≤ 5 years old)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 4. Handwashing practices (n = 15).

Timing	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Before cooking*	W	W	S	S	S	S	W		W	D	W	S	W	W	W
After cooking*	W	W	S	S	S	S	W	D	W	D	W	S	W	S	W
Before serving	W	W	S	W	S	S	W	D	W	D	W	W	W	W	W
Before eating*	W	W	S	S	S	S	W	D	W	D		S		W	W
After eating	W	W	S	S	S	S	W	D	D	D	W	S		S	W
After own defecation*	S	S	S	S	W	S	D	D	W	D	W	S	W	S	W
After changing diaper*	S	S			S	S	W		D	D	W	S	W	S	
After cleaning house	W	W	S	S	W	W	W	D	D	D	W	S	W	S	W
After washing dishes	W	W	S	S	D	D	W	D	W	D	W	W	W	W	W
After laundry	W	W	S	W	D	W	W	D	W	D	W	W	W	S	W
After returning home	W	S	S		W	S	W	D	D	D	D	S	D	S	W
Before breastfeeding		S		S	O	O	W	D	W	D	W	S	W	W	
Before handling baby		S		S	W	W	W	D	W	D	W	S	W	W	

*CDCP 2016.

W: water only S: with soap D: with detergent O: others (wet tissue, hand sanitizer).

2.5. Child health and nutritional status

Responses pertaining to health problems among their children are shown in Table 5. Respiratory illnesses such as coughs and colds were most reported within the sample, followed by diarrhea, which is generally agreed to be the main symptom of sanitation-related illnesses. Indonesian Ministry of Health reported that acute upper respiratory infections and diarrhea prevalence of under five children were 25.8% and 6.7%, respectively (NIHRD 2013). It is shown to a breakdown of the key points about concerns regarding child health in Table 6. Many participants reported concern regarding diet and hygiene, including handwashing. Among the 15 children of participants, two had diarrhea and one was underweight. The rate of underweight for under five children in Indonesia has increased from 17.9% in 2010 to 19.6% in 2013 (NIHRD 2013). According to caretakers' responses and consideration, health and nutritional status were generally good among 80% of the children, although the sample size is relatively small and the results are entirely self-reported by interview. Caretakers appeared to understand the growth record card (*Kartu Menuju Sehat*, KMS: Figure 14) and judged their children's nutritional status accordingly. The records of the anthropometric measurements performed at *Posyandu* are kept by KMS.

With regards to parasitic infections of children, 11 out of 15 caretakers said their children were not presently infected and four said they did not know. Caretaker's decisions related to parasitic infection were based upon the child's appetite, activity level and the absence of a swollen abdomen. Two caretakers said that they had administered anthelmintic to their children. On the question about breastfeeding practices, two out of 15 caretakers responded that they did not breastfeed their children because the main caregiver was the child's grandmother and the mother had a problem with inadequate supply of breast milk. In addition, one caretaker reported giving her child infant formula during Ramadan. Vaccination and supplementation with vitamin A were carried out at *Posyandu* and the records were kept in KMS. All caretakers included in the study attended *Posyandu* regularly with their children.

Table 5. Child health problem: multiple answers (n = 30).

Category (n)	Specific contents
Disease (23)	cough (18), cold (11), diarrhea (10), fever (6), urinary tract infection, convulsion, sore throat
Nutrition (1)	under weight
Diet (1)	unbalanced diet
Sleep (3)	insufficient sleep
Nothing (3)	—
No answer (1)	—

Table 6. Careful contents on child health: multiple answers (n = 30).

Category (n)	Specific contents
Diet (24)	balanced diet (24), give vitamins
Hygiene (19)	handwashing (18), brush teeth (11), body cleaning (3)
Sleep (16)	enough sleep time
Exercise (4)	play outside (3), expose to sun
Daily rhythm (3)	early to bed and early to rise (2), set bed time
Others (2)	clean playing space, buy appropriate snack
No answer (1)	—

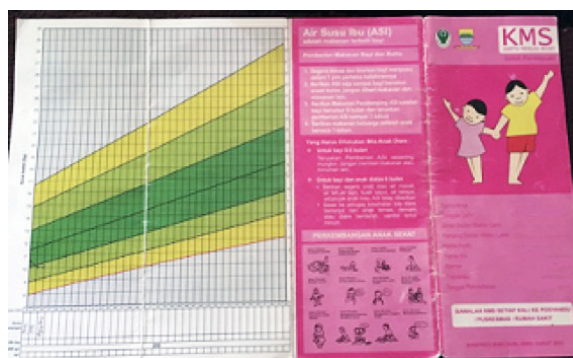


Figure 14. Growth record card (*Kartu Menuju Sehat: KMS*).

Summary

Within the area included in the study, no family was found to use groundwater for drinking due to concerns on regarding the appropriateness of its quality for this purpose. Furthermore, the results show that tap water users always use boiling water for drinking. In general, women paid considerable attention to the safety of drinking water. Flushable toilets were installed in most households. Although only few households had septic tanks installed, it is mean that untreated toilet waste was primarily drained into the nearby river. According to this study, it was concluded that maintenance of drainage facilities was inadequate for optimal hygiene. These findings suggested that, although each house had toilet facilities in place, limited attention was given to appropriate drainage and treatment of toilet wastewater. The apparent recognition about the importance on good handwashing practices demonstrated that the women included in the study were highly aware of issues related to child health and hygiene. Health and nutritional status of their children were generally good, although a relatively small sample size was used and results obtained were entirely self-reported by interview. Further studies on child health and nutritional status in the context of their sanitary environment are necessary in order to clarify factors that negatively affect child health and nutritional status. In addition, health messages focused on understanding the relationship between child health and sanitation will increase caretaker's attention towards sanitation and motivate them towards success and sustainability of sanitation value chain.

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