CHAPTER 3

PRELIMINARY DATA ANALYSIS

The preliminary data analyses of characteristics of water consumption and the larval distribution of Dengue vectors are presented in this chapter. These analyses consist of three sections. First, summaries of all variables measured in this study are described. Second, an analysis of water consumption characteristics including the association between the outcome variable and each determinant of interest is depicted. Finally, the larval distribution of the dengue vectors index for each stratification variable of interest is described.

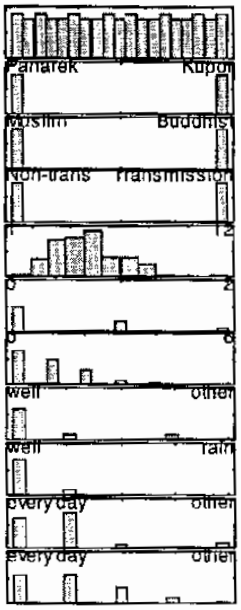
Distributions of Variables

The sample comprised 160 houses, giving a total of 1201 water containers. As described in Chapter 2, the variables are most conveniently classified into two groups. The first group consists of variables that describe the households, and the second group comprises the variables that describe the individual containers within the households. The households are identified using an index ranging from 1 to 160, and the other variables describing the households are coded as follows. The term *carafe* refers to water bought from a bottled water supplier.

District	1 = Panarehk, 2 = Kok Pho
Religion	1 = Islamic, 2 = Buddhist
Transmission	0 = Non-transmission, 1 = Transmission
Drinking water source	1 = Well, 2 = Tap water, 3 = Rain, 4 = Carafe, 5 = Others
Washing water source	1 = Well, 2 = Tap water, 3 = Rain, 4 = Carafe, 5 = Others
Drinking water Renewal	1 = Every day, 2 = 2-3 days, 3 = 4-6 days, 4 = Every week, 5 = Others
Washing water Renewal	1 = Every day, 2 = 2-3 days, 3 = 4-6 days, 4 = Every week, 5 = Others

Figure 3.1 shows histograms and basic numerical summaries of these variables, together with the distributions of the number of household members and the proportions aged 0-5 and 6-15 years (The numerical summaries for house ID are not meaningful, but are useful for data checking purposes).

Figure 3.1 Histograms and numerical summaries of house variables



col	variable	size	mean	st dev	min	max
1	house id	160	80.5	46.332	1	160
2	district	160	1.5	0.502	1	2
3	religion	160	1.5	0.502	1	2
4	transmission	160	0.5	0.502	0	1
5	member	160	4.656	1.833	1	12
6	age 0-5 years	160	0.456	0.671	0	2
7	age 6-15 years	160	0.988	1.144	0	6
8	drink water source	160	1.513	1.028	1	5
9	wash water source	160	1.144	0.446	1	5
10	drink water renewal	160	1.894	1.056	1	5
11	wash water renewal	160	2.038	1.002	1	5

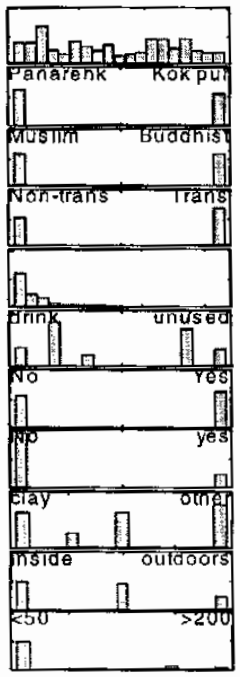
Study of dengue haemorrhagic fever risk factors

For the variables describing the water containers, the data are coded as follows.

Container type	1 = Drink, 2 = Wash, 3 = Ant Trap, 4 = Plant, 5 = Flowerpot, 6 = Others, 7 = Unused
Larvae	0 = No, 1= Yes
Lid	0 = No, 1= Yes
Material	1 = Clay, 2 = Cement, 3 = Plastic, 4 = Aluminum, 5 = Others
Place	1= Indoors, 2 = under eaves, 3 = Outdoors
Container size	1 = <50 liter, 2 = 51-100 liter, 3 = 101-150 liter, 4 = 151-200 liter, 5 = >200 liter

Figure 3.2 presents the size, mean, standard deviation, minimum and maximum of each variable together with frequency plots for this sample of 1201 containers.

Figure 3.2 Histograms and numerical summaries variable classified by containers



col	variable	size	mean	st dev	min	max
1	house id	1201	75.594	46.706	1	160
2	District	1201	1.462	0.499	1	2
3	Religion	1201	1.501	0.5	1	2
4	Transmission	1201	0.572	0.495	0	1
5	Container id	1201	7.588	9.346	1	66
6	Container type	1201	3.761	2.252	1	7
7	Larvae?	1201	0.537	0.499	0	1
8	Lid?	1201	0.19	0.392	0	1
9	Material	1201	3.007	1.6	1	5
10	Place	1201	1.774	0.756	1	3
11	Container size	1201	1.439	1.083	1	5

Study of dengue haemorrhagic fever risk factors

Table 3.1 shows the distributions of water determinants over households. Seventy-five percent of houses got their drinking water from wells, and twelve percent from tap water and carafe water. Very few used rainwater for drinking (0.6%). Nearly all of the villagers have no containers for storage because they use water directly from the wells and drinking water is stored in small containers for a short period of time. Most washing water was obtained from wells (87.5%). Twelve percent used tap water for washing. Similarly, the washing water was brought from the well directly and put in the small containers day by day or for a short period of time. Ninety percent of households changed drinking water in the container within 3 days, with forty-four percent changing drinking water every day and forty-six percent between 2 and 3 days. Only three percent changed drinking water every week. The remaining six percent took longer than a week to change drinking water. Thirty-five

The distributions of containers by each determinant are shown in Table 3.2.

Table 3.2 Distributions of determinant variables over containers

Determinant	Category	Count	Percentage
Container type	Drink	174	14.48
	Wash	415	34.55
	Ant trap	104	8.65
	Plant	4	0.33
	Flowerpot	2	0.16
	Others	339	28.22
	Unused	163	13.57
Larvae	No	556	46.29
	Yes	645	53.71
Lid	No	973	81.02
	Yes	228	18.98
Material of container	Clay	331	27.56
	Cement	137	11.41
	Plastic	326	27.14
	Aluminum	6	0.49
	Others	401	33.40
Place of container	Indoors	501	42.46
	Under eaves	453	37.72
	Outdoors	238	19.82
Size of container	< 50 liter	1014	84.43
	51 – 100 liter	25	2.08
	101-150 liter	22	1.83
	151 – 200 liter	104	8.49
	>200 liter	38	3.17

From the total of 1201 containers surveyed, 54 percent contained larvae. By type of use, 34 percent of the containers were used for washing water, 14 percent for drinking water, and 8 percent for ant traps, with only very small percentages used for

plants (0.3%) or flowers (0.2%), and 28 percent for others uses (such as receptacles for coconuts and rubber). Some containers (13 percent) were unused.

Most containers (81 percent) had no lids. Most containers were made of clay (28%) or plastic (27%), with 7 percent made from cement, and a few from aluminum (0.5%). Others materials (not specified on the data collection form and consequently not accurately recorded) included iron, coconut shell, and rubber.

Most containers (42%) were located inside the house, 38 percent were under an overhanging roof or elevated house, and 20 percent in the open, outside the house. The majority of containers (84%) were of capacity less than 50 liters, with a few more (2%) of size 51-100 liters. The rest were classified as 101-150 liters (2%), 151-200 liters (8%), and more than 200 liters (3%).

As can be seen from the table, data for some categories had very few numbers and thus contained little information. To simplify further analysis, these categories are grouped as follows. The categories 'rain' and 'carafe' are grouped with 'others' for drinking water source. For washing water source, 'rain', 'carafe', and 'others' are grouped with 'tap'. Similarly, 'every week' and 'others' are combined for the frequency of changing drinking water, and 'every week' and 'others' are combined for the frequency of changing washing water. Finally, 'ant trap', 'plant' and 'flowerpot' are combined with 'others' for container type, and 'aluminum' is grouped with 'others' for material.

Associations between the Outcome and each Determinant

In this section the following comparisons for each determinant were investigated.

1. Between container characteristics (type, material, size) and location with and without lid.
2. Between transmission (i.e., having dengue haemorrhagic fever) villages and non-transmission villages.
3. Between Buddhist and Muslim villages.

In this study used odds ratios with 95 percent confidence intervals to compare proportions.

Table 3.3 shows a crosstabulation of the type of containers used by their location and presence or absence of lid. The majority of drinking water containers had lids and were placed inside the house. All 'other' and 'unused' containers found inside, under eaves and outdoors had no lids. The washing water containers with no lids were mostly found inside the house.

Tables 3.3 Crosstabulation of container type by location and lid (presence/absence)

Container type	Place					
	Inside		Under eaves		Outdoors	
	Lid	Non-lid	Lid	Non-lid	Lid	Non-lid
Drink	159	4	6	3	2	0
Wash	32	201	20	123	9	30
Others	0	108	0	274	0	67
Unused	0	6	0	27	0	130
Total	191	319	26	427	11	227

Table 3.4 shows a crosstabulation of the material of the containers used by their location and presence or absence of lid.

Tables 3.4 Crosstabulation of container material by location and lid (presence/absence)

Material	Place					
	Inside		Under eaves		Outdoors	
	Lid	Non-lid	Lid	Non-lid	Lid	Non-lid
Clay	75	58	14	158	6	20
Cement	3	72	8	17	4	33
Plastic	111	116	4	79	1	15
Others	2	73	0	173	0	159
Total	191	319	26	427	11	227

Among the containers placed inside the household, plastic containers were the most popular in this study, and about 50% were containers with no lid. Most of the clay containers were placed inside and under eaves, while most of the cement containers were placed inside the household.

Table 3.5 shows a crosstabulation of the size of the containers by their location and presence or absence of lid.

Tables 3.5 Crosstabulation of container size by location and lid (presence/absence)

Container size	Place					
	Inside		Under eaves		Outdoors	
	Lid	Non-lid	Lid	Non-lid	Lid	Non-lid
< 50 liters	175	250	16	378	5	190
50 -100 liters	3	10	0	8	2	2
101-150 liters	1	14	1	3	2	1
151-200 liters	12	35	5	33	0	17
> 200 liters	0	10	4	5	2	17
Total	191	319	26	427	11	227

From Table 3.5, about 80% of containers had lids. The majority of containers were less capacity than 50 liters. The numbers of containers without lids were higher than those with lids, and these distribution patterns are more or less the same in even the three categories.

The frequencies for the various categories of the household-specific determinants in the transmission and non-transmission DHF villages, together with corresponding odds ratios and their 95% confidence intervals are shown in Table 3.6. As explained in Chapter 2, these odds ratios are computed for each specified category of the determinant from a 2×2 table obtained by aggregating the other categories.

Table 3.6 Associations between household determinants and DHF transmission

Determinant	Category	Trans-Mission	Non-Trans mission	Odds ratio (95% Confidence interval)
Drinking Water Source	Well	68	52	3.05 (1.42 - 6.57)
	Tap water	3	16	0.16 (0.04 - 0.56)
	Others	9	12	0.72 (0.28 - 1.81)
Washing Water Source	Well	75	65	3.46 (1.19 - 10.0)
	Tap water	4	15	0.22 (0.07 - 0.72)
Drinking Water Renewal	Every day	32	32	1 (0.53 - 1.88)
	2 - 3 days	33	40	0.7 (0.38 – 1.31)
	4 - 6 days	5	4	1.27 (0.33 - 4.90)
	Others	10	4	2.71 (0.81 - 9.05)
Washing Water Renewal	Every day	28	28	1 (0.52 - 1.91)
	2 - 3 days	27	32	0.76 (0.40 - 1.45)
	4 - 6 days	17	15	1.17 (0.54 - 2.54)
	Others	8	5	1.67 (0.52 - 5.33)

Some associations are statistically significant. We see that drinking well water (rather than not drinking well water) is associated with DHF transmission, since the crude odds ratio for this association has confidence interval (95% CI: 1.42 – 6.57), whereas drinking tap water is protective (95% CI: 0.04 – 0.56). Similarly, washing with well water is associated with DHF transmission (95% CI: 1.19 – 10.0), whereas washing with tap water is protective (95% CI: 0.07 – 0.72). However, none of the others determinants are statistically significant risk factors, since the remaining 95% confidence intervals include 1.

Tables 3.7 shows the frequencies for the various categories of the container-specific determinants in the transmission and non-transmission DHF villages, together with corresponding odds ratios and their 95% confidence intervals. Container type has four categories, drink, wash, other and unused; and these have odds ratios of 0.75, 0.71, 1.49, and 1.18, respectively. The containers used for washing have reduced DHF

risk (95% CI: 0.56-0.91), whereas those with 'other' uses have increased risk (95% CI: 1.17-1.89). It is interesting to note that there is no evidence of any increase or decease in risk associated with the containers used for drinking. This result could be due to an increased risk associated with drinking, compensated by a reduced risk associated with using a drinking container (which is likely to be protected from disease exposure).

Table 3.7 Associations between container determinants and DHF transmission

Determinant	Category	Trans Mission	Non-Trans Mission	Odds ratio (95% Confidence interval)
Container Type	Drink	89	85	0.75 (0.54 – 1.04)
	Wash	215	200	0.71 (0.56 – 0.91)
	Others	284	165	1.49 (1.17 – 1.89)
	Unused	99	64	1.18 (0.84 – 1.66)
Larvae	Yes	412	233	1.81 (1.43 – 2.78)
Lid	Yes	117	111	0.75 (0.56 – 0.99)
Material	Clay	184	147	0.91 (0.71 – 1.18)
	Cement	88	49	1.39 (0.96 – 2.08)
	Plastic	197	129	1.20 (0.93 – 1.55)
	Others	218	189	0.80 (0.63 – 1.02)
Place	Indoors	295	215	1.05 (0.83 – 1.32)
	Under eaves	260	193	1.01 (0.80 – 1.28)
	Outdoors	132	106	0.92 (0.69 – 1.22)
Size	< 50 liter	575	439	0.88 (0.64 – 1.21)
	51-100 liter	10	15	0.49 (0.22 – 1.10)
	100-151 liter	12	10	0.90 (0.38 – 2.09)
	151 – 200 liter	65	37	1.35 (0.88 – 2.05)
	>200 liter	25	13	1.46 (0.74 – 2.87)

The containers containing larvae have increased risk (95% CI: 1.43 – 2.78), as do those without lids (95% CI: 1-1.79). The container material has four categories, clay, cement, plastic and others materials. These have odds ratios 0.91, 1.39,1.2 and

0.8, respectively, but none of these values is statistically significant. Nor is the location or the size of the container a statistically significant risk factor.

Table 3.8 compares the frequencies for the various categories of the household-specific determinants in the Buddhist and Muslim villages, and shows the corresponding odds ratios and their 95% confidence intervals.

Table 3.8 Associations between household determinants and villages

Determinant	Category	Buddhist	Muslim	Odds ratio (95% Confidence interval)
Drinking water source	Well	53	67	0.38 (0.18 – 0.81)
	Tap water	8	11	0.70 (0.26 – 1.84)
	Others	19	2	12.15 (2.72 – 54.1)
Washing water source	Well	71	69	1.26 (0.49 – 3.22)
	Tap water	9	10	0.89 (0.34 – 2.32)
Drinking water renewal	Every day	24	40	0.43 (0.22 – 0.82)
	2 - 3 days	38	35	1.16 (0.62 – 2.17)
	4 – 6 days	5	4	1.27 (0.33 – 4.90)
	Others	13	1	15.33 (1.95 – 120.2)
Washing water renewal	Every day	26	30	0.80 (0.42 – 1.54)
	2 – 3 days	25	34	0.62 (0.32 – 1.18)
	4 – 6 days	17	15	1.17 (0.54 – 2.54)
	Others	12	1	13.94 (1.77 – 110.00)

Some associations are statistically significant. In the Buddhist villages the people drink well water less than those in the Muslim villages, since the crude odds ratio for this association has confidence interval of 0.18 – 0.81. People in the Buddhist villages prefer to drink the water from 'others' (carafe) compared to the Muslim villages (95% CI: 2.72 – 54.1). The proportion of changing of drinking water 'every day' in the Buddhist villages is significantly less than that in the Muslim villages (95% CI: 0.22-0.82). And the 'others' category of drinking water changing (more than one-week period or never to change) is greater in the Buddhist villages (95% CI:

1.95-120.2). However, none of the others determinants is statistically significant, since the remaining 95% confidence intervals include 1.

The frequencies for the various categories of the container-specific determinants in the Buddhist and Muslim villages, together with corresponding odds ratios and their 95% confidence intervals, are shown in Tables 3.9.

Table 3.9 Associations between container determinants and villages

Determinant	Category	Buddhist	Muslim	Odds ratio (95% confidence interval)
Container Type	Drink	90	84	1.08 (0.78 – 1.49)
	Wash	234	181	1.47 (1.16 – 1.87)
	Others	162	287	0.40 (0.31 – 0.51)
	Unused	116	47	2.80 (1.96 – 4.02)
Larvae	Yes	330	315	1.09 (0.87 – 1.37)
Lid	Yes	121	107	1.16 (0.87 – 1.54)
Material	Clay	145	186	0.70 (0.55 – 0.91)
	Cement	94	43	2.39 (1.64 – 3.50)
	Plastic	144	182	0.72 (0.56 – 0.93)
	Others	219	188	1.25 (0.98 – 1.59)
Place	Indoors	302	208	1.89 (1.50 – 2.39)
	Under eaves	125	328	0.22 (0.17 – 0.28)
	Outdoors	175	63	3.49 (2.55 – 4.78)
Size	< 50 liter	475	539	0.42 (0.30 – 0.58)
	51-100 liter	14	11	1.27 (0.57 – 2.83)
	100-151 liter	11	11	0.99 (0.43 – 2.31)
	151 – 200 liter	75	27	3.02 (1.91 – 4.75)
	>200 liter	27	11	2.51 (1.23 – 5.11)

Container type has four categories, drink, wash, others and unused having the odds ratios of 1.08, 1.47, 0.4, and 2.8, respectively (Table 3.9).

The containers of 'wash' and 'unused' in the Buddhist villages were found to be significantly more prevalent than those in Muslim villages (95% CI: 1.16-1.87 and

1.96-4.02, respectively), whereas those with 'others' in Buddhist villages were less prevalent than those in Muslim villages (95% CI: 0.31-0.51) (Table 3.9). The container materials 'clay' and 'plastic' found in Buddhist villages were less prevalent than those found in Muslim villages (95% CI: 0.55-0.91 and 0.56-0.93, respectively), whereas those with 'cement' were more prevalent than those in Muslim villages (95% CI: 1.64-3.5). The containers found 'indoors' and 'outdoors' in Buddhist villages were more prevalent than those of Muslim villages (95% CI: 1.5-2.39 and 2.55-4.78, respectively), whereas those 'under eaves' were less than those in Muslim villages (95% CI: 0.17-0.28). In addition, the containers of 151-200 liter and more than 200 liter were found in greater quantities in Buddhist villages compared to those in Muslim villages (95% CI: 1.91-4.75 and 1.23-5.11, respectively), while those of less than 50 liter in Buddhist villages were lower (95% CI: 0.30-0.58). However, none of the other determinants are statistically significant variables, since the remaining 95% confidence intervals include 1.

Distribution of Dengue Vector

Larval indices are used to compare the distribution of the Dengue vector. The common larval indices are as follows:

House index is the percentage of infected houses in total inspected houses. If the index is high, transmission occurs easily to neighbouring houses.

Container index, which is the percentage of infected containers in total inspected containers, is useful for evaluation of control larvae measures being carried out.

Breteau index, which is the percentage of infected containers in total inspected houses, combines dwellings and containers and is more qualitative and of more epidemiological significance.

Stegomyia index is the number of infected containers per 1000 people in totally inspected houses.

Table 3.10 shows the index of dengue vectors in this area of survey. The house indices of all determinants are similar.

Container Index, Breteau Index , and Stegomyia Index in the transmission DHF area were found to be higher than those in the non-transmission DHF area. The Breteau Index and Stegomyia Index values in the non-transmission area were about half of that in the transmission area, these indicate that people in transmission villages have higher risk of being bitten by mosquito than those in non-transmission villages.

All of the larval indices except Stegomyia Index in the Buddhist area are similar to those in the Muslim area (Table 3.10).

Table 3.10 Distribution of dengue vector indices

Area	Larvae Indices			
	House Index	Container Index	Breteau Index	Stegomyia Index
All area of study	80.62	53.70	403	403.13
Non Transmission DHF area	78.75	45.33	291	609.94
Transmission DHF area	82.50	59.97	515	1134.98
Muslim area	80	52.54	393.75	759.03
Buddhist area	81.25	54.81	412	1000