

HEALTH EFFECTS ON CHILDREN DUE TO SANITARY CONDITIONS AND PRACTICES IN A LOW-INCOME URBAN SLUM AREA

*with the compliments  
of the journal manager  
F. TANNING.*

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ABSTRACT

Thailand faces the double problems of i) the ever growing accumulation of toxic chemical wastes due to its accelerated economic growth as a potential newly industrialized country and ii) being the dumping ground for hazardous waste shipped from other industrialized countries and dumped in Klong Toey's Port. This area is also the location of Klong Toey slum settlement area where recently we have undertaken a study aiming at surveying the impact of existing sanitation practices and facilities on the health of the squatters and at assessing the direct impact of toxic and wastewater disposal sites and systems in Klong Toey's area.

The first part deals with the surveying of hygienic and sanitation practices through household to household interviewing and on the field observation techniques, and through examination of the frequency of occurrence of water and wastewater related diseases such as: diarrhoea, typhoid fever, helminthiasis, etc.. This part is mainly carried out on children of schools in the area and through data analysis and follow-up data from 3 clinics files. It was observed that the highest number of patients reported disease are Upper Respiratory and Bacterial Enteritis infections. Cases of roundworm and bacillary dysentery and scabies are alarming. A significant statistic correlation relates high disease incidence areas to high health risk zones, where fecal solids are exposed and where wastewater disposal system is absent.

A photographical documentation showed the accumulation of toxic waste chemicals in the port storage areas. Fumes from certain volatile toxic substances incommode children and adults living closest to the concerned areas. A systematic statistical analysis carried out with the utilization of Subroutine Package for Social Sciences Computer Program has allowed to segregate the most significantly affecting factors.

Remedial solutions center around: health education of the population, improvement of hygienic practices, improvement of existing wastewater treatment facilities and monitoring of diffuse airborne pollution due to stock piling of toxic wastes.

INTRODUCTION

Urban squatting and slum dwelling are common phenomena in cities of developing countries. The two terms are not synonymous. There is a clear distinction between them. While urban squatting is the encroachment on private or public land, buildings or other space in a city or urban area without the consent of the owner(s), slum dwelling is living in an area characterized by dilapidated buildings and other deteriorated physical features, extreme

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crowdedness, shortage of urban services and facilities, lack of privacy and high rates of social deviation such as crime, juvenile delinquency, prostitution, and drug-pushing (Laquian, 1979). Both urban squatting and slum dwelling occur in inner city areas as well as on outskirts of cities. Sometimes, both occur within the inner city and, as a result, there may be squatter/slum areas or slum/squatting settlements.

The extent to which urban squatting and slum dwelling takes place varies from country to country and from city to city, depending on a wide range of physical, economic, social and political conditions surrounding the urban environment of that country. It is estimated that in most developing countries the proportion of urban dwellers living in slums and squatter settlements ranges from 20 percent to over 50 percent. In Asia, the proportionate city population in squatter/slum settlements ranges from a low of 15 percent to as high as 50 percent. Surprisingly, the more urbanized a country is, the lower is its proportionate city population living in squatter/slum settlements (United Nations, 1976). Formation and existence of slums decrease as a country urbanizes; the reason being the lesser urban-rural polarization and consequently less force of attraction (refer Table 1). In Bangkok, out of the city's population of 5.7 million (1985)/its slum population equalled about 15 percent. There were some 480 slum areas in which approximately 850,000 persons or about 15.3% of metropolitan population were living.

Table 1. Slum Population and Degree of Urbanization in Selected Developing Countries

| City      | Country     | Year | Population<br>City*000<br>1000 | Urban Proportion<br>of Country<br>Population<br>% | Proportion<br>of Slum<br>Population<br>in the City<br>% |
|-----------|-------------|------|--------------------------------|---|---|
| Bangkok   | Thailand    | 1985 | 5.5                            | 17.8  | 15.0  |
| Karachi   | Pakistan    | 1988 | 7.0                            | 24.0  | 33.0  |
| Manila    | Philippines | 1980 | 5.9                            | 21.1  | 20.0  |
| Jakarta   | Indonesia   | 1985 | 21.5                           | 25.4  | 26.0  |
| Hong Kong | Hong Kong   | 1976 | 4.0                            | 100.0   | 17.0  |
| Seoul     | Korea       | 1973 | 7.3                            | 32.1  | 29.0  |
| Dacca     | Bangladesh  | 1977 | 1.6                            | 15.2  | 50.0  |
| Colombo   | Sri Lanka   | 1980 | 3.2                            | 27.0  | 44.0  |

Source: (Mansoor, 1989)

#### THE KLONG TOEY SQUATTER/SLUM SETTLEMENT

The Klong Toey squatter/slum settlement is a collection of slum squatters and shacks built on about 510 acres (128 hectares) of swampy marsh land owned by the Port Authority of Thailand. Klong Toey is the port of Bangkok located on the south side of the city. The slum had its inception in 1955. Over the last 35 years, rural migrants from the interior of Thailand have continued to pour into Klong Toey (Maier, 1981). Almost all the household heads there are said to have come from the rural areas in the North East. Harsh farming conditions and lack of job opportunities have compelled farmers to relinquish

their farms and move to the primate city. Among the squatter slums scattered across Bangkok, the Klong Toey squatter/slum is the largest one. It has nearly 50,000 people, almost half of whom are below the age of fifteen. In fact, the slum population size is bigger than that of most provincial cities in the country. The slum population density is about 250 persons per hectare.

The Klong Toey slum area is easily accessible by car, as it is adjacent to the main roads leading to the port. It is located just off Rava IV Road, not too far from Lumpini Park and the Polo Club. Actually, its proximity to the city and work is the primary reason for squatters' choice. Through a survey conducted by the Asian Institute of Technology in 1973, it was found that 22 percent of the heads of household in Klong Toey walked to work and that 50.3 percent took the bus. The time spent getting to work was relatively short. Out of some 30 percent of those employed in the Klong Toey area, 12.5 percent worked with the Port Authority of Thailand (Hongladaromp, 1973).

As one enters the Klong Toey area, the first thing that strikes a visitor are the old, decrepit and dilapidated structures. Most of the houses are made of wooden boards and metal sheets. Many of them are about to fall apart and need repair or replacement. The age of the structures ranges from ten to over twenty years. The houses are cramped together, separated only by narrow walkways of wooden boards balanced rather precariously over the foul swamp below. The offensive odor of the stagnant swamp is overpowering and pervasive. The water separating the squatter houses is still and polluted—full of debris, garbage, plastic bags, syringes and sewage; there are no cesspools or septic tanks; the water rises to the ground floor level of the houses during the monsoon season and then recedes slightly during the dry season.

One of the most striking features in the Klong Toey slum settlement is the apparent lack of services and facilities. Although there is plenty of water underfoot, very little of it is suitable for drinking or for washing. Most of the drinking and washing water is collected in jars (earthenware pots) or empty old oil barrels during rainfall. Only 20 percent of the households have piped water supply. Those who could afford usually buy their water from water vendors.

The general lack of services and facilities is a perennial problem. The Bangkok Municipal Administration (BMA) does not provide any services or facilities, as the squatter settlement is considered an unregistered housing area. Thus, there is no or poorly organized garbage collection, too few public health center or clinic, no fire protection, no government day-care center and no police protection or supervision. The absence of police supervision is not a serious deficiency, since the crime rate in the slum is relatively low compared with the rest of the primate city. The BMA is unwilling to provide facilities as this would be considered an admission of the squatters' right to stay. Squatters, by definition—and by city ordinance—are regarded as illegal occupants on someone's property, whether private or public (Anthony, 1979).

In the Klong Toey area, the average household size was five persons. The number of persons in a family was quite comparable to that in Colombo. There is great disparity in material possession and comfort among the Klong Toey squatter dwellers. While some people have radio, TV sets, and video recorders, others have hardly even a roof over their head. On the whole, the

average houses are small, about half of them having only one room, with about 25 square meter of floor space for five persons. The walls and floor are usually of wood, bought either new or used from a wholesaler, while most of the roofs are zinc metal sheet or galvanized tin metal cover. There are, moreover, still a few thatched roofs visible.

The majority of the squatter houses have electricity supply either through direct connection to public power lines (legal or otherwise) or through lines extending from a neighbor's house by paying a small charge of about 40 Baht per month (US\$1.75) to the neighbor. Electricity is mainly used for lighting. As for cooking, this is done on clay charcoal stoves behind or near the house.

Many households in the Klong Toey area supplement their income by operating small "front porch" enterprises such as making coconut candies, rice flour cookies and fried bananas for sale to other residents or to the corner stores nearby. Usually, an adult will cook while the children go around selling. Other "front porch" businesses include hair dressing, dress-making, rice and noodle shops for local customers as well as jasmine garland, paper flower and paper bag making for sale outside the slum. Some slum dwellers would go to the public dump to salvage used plastic bags, wash them by the water, dry them and sell them at a rate of 10 Baht per kilo.

Although household incomes are low, the people of Klong Toey are by no means unemployed. About two thirds of the adults work a seven-day week. Nearly one third of all persons in Klong Toey, men, women and children are working and earning some income, though irregular. The men are usually construction workers, port coolies or transport laborers earning between 65 and 100 Baht per day (US\$2.50 to 4.00). The women are either engaged in household based enterprises mentioned above or are peddlers, vendors, hawkers and factory workers outside the slum area. Some young and attractive girls work in night clubs, bars or massage parlors. They sleep during the day and work at night outside Klong Toey. The children, when not working in and around the house, may sell newspapers and flower garlands at street corners or along the main highways. On a good day, they may make as much as 50 Baht (US\$2.00) per day. The average monthly income of a household from all this work is about 2,000 Baht or US\$80.00.

#### ENVIRONMENTAL HAZARDS IN KLONG TOEY

Klong Toey does not have any wastewater disposal system. Its population density is very high. Refuse collection is almost absent. Hence, one should assume that Klong Toey is in an environmental hazard situation. No reliable systematic survey data is available which can prove that Klong Toey's population is afflicted with water borne diseases. Data available from the Delft University Inventory states that the prevalent waterborne diseases are acute Diarrhoea, Typhoid fever, Hemorrhagic fever and infectious Hepatitis. In addition, the rate of Helminthiasis is also high. The prevalent rates and causative environmental factors of these diseases are summarized in Table 2.

During previous laboratory testings 50 out of 835 cases showed positive results for protozoal infections. Entamoeba Coli and Guardia Lambia were the two major groups of protozoa identified. As for the helminthic examination, the prevalent rate was as high as 214 per 1000. Approximately 37 percent and

30 percent of the identified cases were infected with Ascariasis and Hookworms, respectively. Most of the infected persons were children. The 1975 survey also covered the aspect of environmental awareness and health. It concluded that the majority of slum dwellers had poor health knowledge on nutrition, gastro intestinal and parasitic diseases. Only twelve percent of the sampled respondents realized that the improvement of environmental sanitation is important to health. Since 1975 a numerous changes have taken place in various slums. Water supply has become more widely available, and also health services as well as education have had good impacts. These changed conditions justified to carry out another survey. It has become evident, indeed, is survey that the main cause of diseases relate to water and wastewater.

Table 2. Prevalence of Diseases Related to Environmental Sanitation

| Disease       | Rate/100,000 Pop | Causative Environmental Factors                  |
|---------------|------------------|--|
| Hepatitis     | 246.9            | Sewage Disposal, Carrier                         |
| Dengue        | 217.9            | Drainage, Overcrowdedness                        |
| Typhoid       | 159.8            | Disposal of Human Excreta and Toilet Papers      |
| Helminthiasis | 116.0            | Anal Cleansing, Human Excreta Disposal, Drainage |
| Cholera       | 43.60            | Disposal of Human Excreta, Water Supply          |
| Diarrhoea     | 798.60           | Disposal of Human Excreta, Water Supply          |

Source: (Delf, 1982)

#### RESEARCH DESIGN AND DEMARCATION OF THE AREA EXPOSED TO SEVERE ENVIRONMENTAL HAZARDS

As the first step of the study and to divide the area into strata of different levels of environmental hazards, an "environmental stratification survey" was conducted. This stratification also serves for the stratified sampling of the households. Five parameters were considered related to environmental health risk directly or indirectly:

- A - Latrine Waste
- B - Lane Surface
- C - Solid Waste
- D - Water Supply
- E - Wastewater

Ratings were allotted to each parameter as shown in Table 3, based on a relative rating of the overall quality of the lane environment. Each lane was carefully inspected. Observations were jotted down in a structured format as shown in Annex A. A total of 186 lanes was surveyed in the area under study. The number of lanes visited and average scores are shown in Table 4.

As shown in Table 3, environmental health risk and exposure were highest in Lock Nos. 5 to 12, whereas conditions were much better in the upgraded area. The overall average is 20 out of a maximum of 28. No ideal lane was found; solid waste was exposed in all the lanes studied.

Table 3. Basic Rating Score for Various Environmental Factors

| Sample | Criteria                             | Rating |
|--------|--------------------------------------|--------|
| A      | LATRINE WASTE:                       |        |
|        | Fecal Solids Exposed                 | 0      |
|        | Exposed Beneath the Houses           | 2      |
|        | Overflowing Wastewater in Lanes      | 4      |
|        | No Exposure                          | 6      |
| B      | LANE SURFACE:                        |        |
|        | Mud Lanes                            | 4      |
|        | Wooden Lanes                         | 5      |
|        | Concrete Lanes                       | 6      |
| C      | SOLID WASTES:                        |        |
|        | All Along the Lane                   | 2      |
|        | Collected at Some Points but Exposed | 4      |
|        | None in the Lane                     | 4      |
| D      | WATER SUPPLY:                        |        |
|        | Leaking Water Supply                 | 4      |
|        | No Leaks/Dry                         | 6      |
| E      | WASTEWATER:                          |        |
|        | Uncontrolled Flow in Lanes           | 0      |
|        | Exposed Beneath Houses               | 2      |
|        | Restricted Flow in Drains            | 4      |
|        | Efficient Flow in Drains             | 5      |
|        | No Wastewater                        | 6      |

Table 4. Total Number of Lanes Surveyed in Each Lock and Their Average Scores

| Lock                            | No. of Lanes Surveyed | Average Score |
|---------------------------------|-----------------------|---------------|
| Upgraded                        | 56                    | 23.50         |
| Between flats and upgraded area | 9                     | 19.80         |
| Lock No. 1                      | 43                    | 19.40         |
| Lock No. 2                      | 15                    | 19.40         |
| Lock No. 3                      | 9                     | 19.60         |
| Lock No. 4                      | 8                     | 20.00         |
| Lock Nos. 5&6                   | 13                    | 16.80         |
| Lock No. 7                      | 11                    | 18.40         |
| Lock Nos. 8,9,10,11,12          | 22                    | 17.80         |

#### HOUSEHOLD SURVEY METHOD

Based on the results of environmental stratification, samples were drawn from the area to as certain representativeness, suitable for comparison and with

line chances of sampling error.

Three areas were selected for the household survey: the area with the lowest score according to the environmental stratification survey, the area with the highest score, and the area with an average score. Thus, samples were drawn from 70 rai of upgraded area, from Locks 9 to 12 (as single strata) and from Lock no. 1. The strata, with their average rating score, number of houses and sample sizes are given in Table 5.

Table 5. Sample Size and Total Number of Households Covered in the Household Survey

| Strata            | Average Score | Total Number of Households | Sample Size |
|-------------------|---------------|----------------------------|-------------|
| Lock No. 1        | 19.40         | 500                        | 50          |
| Lock Nos. 8 to 12 | 17.80         | 600                        | 70          |
| Upgraded Area     | 23.40         | 1,085                      | 110         |
| Total             |               | 2,185                      | 230         |

In Lock Nos. 8 to 12, the total number of houses as reported by the National Housing Authority site office is 600. Most of the houses were locked or occupied by a single person. In the 70 rai of upgraded area, a proper system of house numbering existed. A random number table was used to draw samples. In Lock Nos. 1 and 8 to 12, houses were not numbered. Interviews were done on the basis of presence of adult members and their consent. The questionnaire was translated into Thai and interviews were conducted by students from Chulalongkorn University. The questionnaire is attached as Annex B.

#### CLINICAL DATA COLLECTION

Three medical doctors volunteered to help to monitor the age, sex and type of disease in the study-area. A standard simple format was prepared and handed over to the selected clinics. The centers which participated in the study include:

- Human Development Center Clinic-Lock 9,
- B.M.A. Clinic (near Lock 1), and
- Dr. Somporn Surarith Clinic at Klong Toey Market.

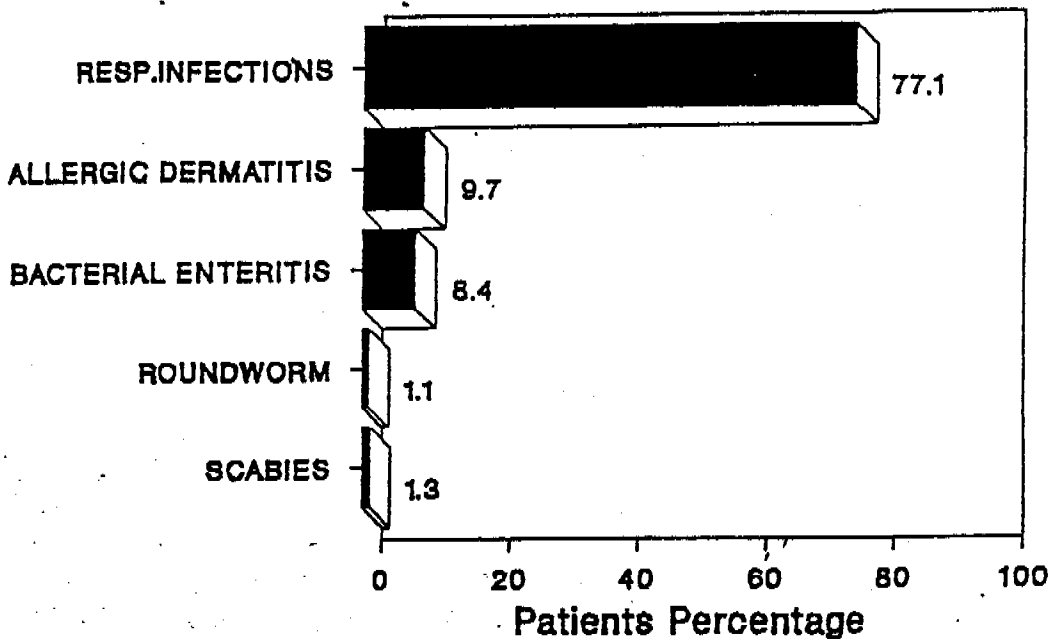
Doctors recorded age and sex using a given disease code. A total of 16 diseases related to water and wastewater were under scrutiny. Completed forms were collected from the clinics weekly.

#### WATER AND WASTEWATER DISEASES

The total number of patients visiting each clinic is recorded in Table 6, and disease distribution in Fig. 1.

In total, 636 cases were reported at the three clinics during a period of 6 weeks starting from 1st September 1989.

**Name of Disease**



**Figure 1. Disease Distribution in Klong Toey (Patients Reported During 100 Days)**

**Table 6. Occurrence of Water and Waste Diseases in Klong Toey**

| Disease             | Reported Cases |
|---------------------|----------------|
| Amoebic Dysentary   | 1              |
| Bacillary Dysentary | 3              |
| Bacterial Enteritis | 61             |
| Cholera             | 0              |
| Dengue              | 0              |
| Hepatitis A         | 0              |
| Hepatitis B         | 0              |
| Filariasis          | 0              |
| Hookworm            | 1              |
| Malaria             | 1              |
| Roundworm           | 9              |
| Scabies             | 7              |
| Schistomiasis       | 0              |
| Typhoid             | 0              |
| Upper Resp. Infec.  | 474            |
| Allergic Dermatitis | 64             |
| Others              | 15             |
| <b>Total Cases</b>  | <b>636</b>     |
| Missing             | 1              |

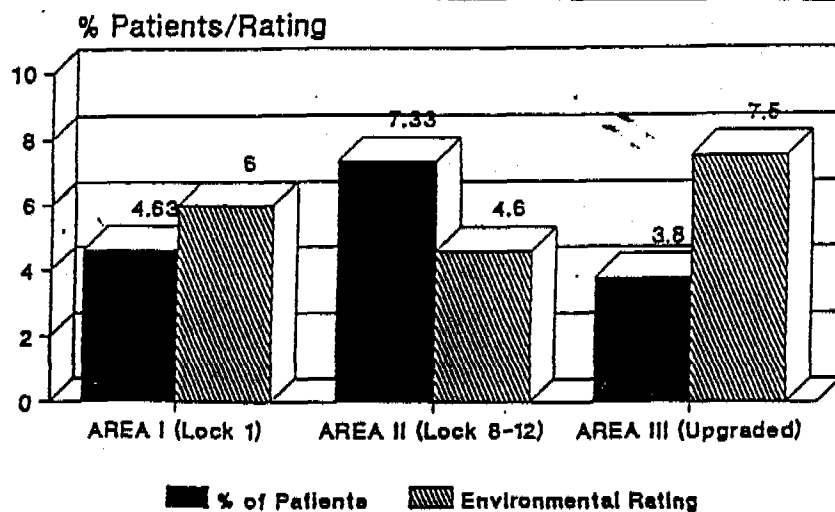


The frequency of each disease is reported in Table 6. It was observed that the highest number of cases is related to Upper Respiratory. Allergic Dermatitis and Bacterial Enteritis were the second and third most frequently reported diseases. Some cases of Roundworm, Bacillary Dysentery and Scabies were alarming. An alarmingly high number of Roundworm (9) may be attributed to the habit of not wearing shoes. The high level of Scabies can be associated with low water consumption.

Table 7 and Fig. 2 shows the number of patients reporting from each area in Klong Toey. A significant correlation seems to relate high disease incidence areas to high health risk zones, where fecal solids are exposed and where wastewater disposal is absent.

Table 7. Number of Patients Reported from Klong Toey

| Area          | Number of Patients |
|---------------|--------------------|
| Lock No. 1    | 139                |
| Lock No. 2    | 24                 |
| Lock No. 3    | 13                 |
| Lock No. 4    | 39                 |
| Lock No. 5    | 4                  |
| Lock No. 6    | 108                |
| Lock No. 7    | 19                 |
| Lock No. 8    | 10                 |
| Lock No. 9    | 62                 |
| Lock No. 10   | 39                 |
| Lock No. 11   | 12                 |
| Lock No. 12   | 20                 |
| Upgraded Area | 114                |
| Adjacent Area | 34                 |
| <b>Total</b>  | <b>636</b>         |



Patients, as % of Population of Area

Fig. 2 Relationship Between Proportion of Patients and Environmental Rating

The environmental conditions of each area in terms of average score and number of patients reporting is shown in Table 8 and Fig. 3.

Table 8. Areawise Distribution of Water and Waste Related Diseases in Klong Toey

| Rating*               | Upgraded   | Lock 1     | Lock 2    | Lock 3    | Lock 4    | Lock 5&6   | Lock 7    | Lock 8-12  | Vicinity  | Total      |
|-----------------------|------------|------------|-----------|-----------|-----------|------------|-----------|------------|-----------|------------|
|                       | 23.5       | 19.4       | 19.4      | 19.6      | 20.0      | 16.8       | 18.4      | 17.80      |           |            |
| Disease Type          |            |            |           |           |           |            |           |            |           |            |
| Amoebic Dysentery     |            |            |           |           |           |            |           |            | 1         | 1          |
| Bacillary Dysentery   | 1          | 1          |           |           | 1         | 1          |           |            |           | 4          |
| Bacterial Enteritis   | 11         | 14         | 4         |           | 3         | 15         | 1         | 9          | 4         | 61         |
| Hookworm              |            |            |           |           |           | 1          |           |            |           | 1          |
| Roundworm             |            | 1          |           |           | 1         | 2          |           | 3          | 2         | 9          |
| Scabies               | 1          | 1          |           | 1         |           | 1          |           | 3          |           | 7          |
| Upper Resp. Infection | 90         | 102        | 15        | 8         | 30        | 82         | 14        | 110        | 23        | 474        |
| Allergic Dermatitis   | 10         | 18         |           | 4         | 5         | 6          |           | 17         | 4         | 64         |
| Others                | 1          | 2          | 4         |           |           | 1          | 4         | 1          | 2         | 15         |
| <b>Total</b>          | <b>114</b> | <b>139</b> | <b>24</b> | <b>13</b> | <b>39</b> | <b>109</b> | <b>19</b> | <b>143</b> | <b>34</b> | <b>636</b> |

\* Refer to Table 4

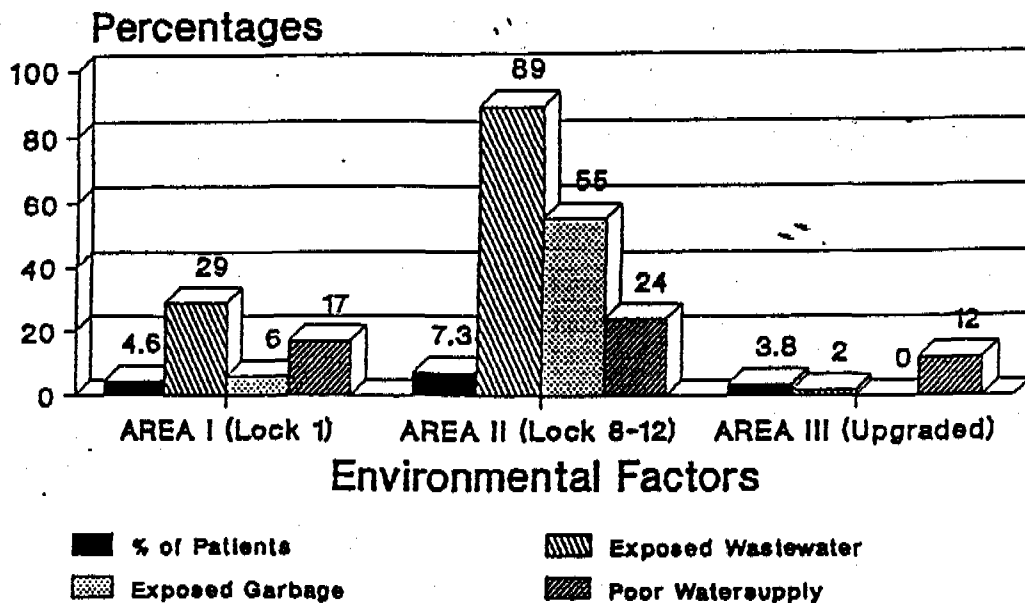


Fig. 3 Relationship Between Proportion % of Patients and Environmental Factors

Upper respiratory infections were recurrent with five to ten percent of the population in Locks 6, 8-12 and Lock 1. The high number of cases in the upgraded area represented less than two percent of the population. As for Bacterial enteritis, affections seemed to concentrate again in the zones of Lock 5-6 and 8-12, where the scabies were also most frequent.

An attempt to bread down the reported cases according to their age shows a high infantile frequency level. Patients reporting at the clinics are mostly women and children. Working adults, unless severely affected, contented themselves with fast and temporary relief medicines bought at the corner store. Taking into account these reserves, Table 9 and 10 show net high incidence of disease among children upto nine years old. This remains inconclusive, however, as it should be assumed and stand to reason that adults would be particularly concerned about children's health and take them to see the doctor.

Table 9. Age Distribution of Reported Disease Cases in Klong Toey

| Age Group |       | No. of Cases | Percentage |
|-----------|-------|--------------|------------|
| upto-4    | Years | 288          | 45.3       |
| 5-9       | Years | 104          | 16.3       |
| 10-14     | Years | 32           | 5.0        |
| 15-19     | Years | 19           | 3.0        |
| 20-24     | Years | 31           | 4.9        |
| 25-29     | Years | 32           | 5.0        |
| 30-34     | Years | 18           | 2.8        |
| 35-39     | Years | 10           | 1.6        |
| 40-44     | Years | 17           | 2.7        |
| 45-49     | Years | 22           | 3.4        |
| 50-54     | Years | 22           | 3.4        |
| above 54  | Years | 41           | 6.4        |
| Total     |       | 636          | 100.00     |

Table 10. Age Distribution of Bacterial Enteritis Cases in Klong Toey

| Age Group |       | Cases | Percentage of f=61 | Cummulative Percentage |
|-----------|-------|-------|--------------------|------------------------|
| upto-4    | Years | 27    | 44.3               | 44.26                  |
| 5-9       | Years | 7     | 11.5               | 55.74                  |
| 10-14     | Years | 3     | 4.9                | 60.66                  |
| 15-19     | Years | 2     | 3.3                | 63.94                  |
| 20-24     | Years | 4     | 6.5                | 70.5                   |
| 25-29     | Years | 5     | 8.2                | 78.7                   |
| 30-34     | Years | 3     | 4.9                | 83.6                   |
| 35-39     | Years | -     | -                  | -                      |
| 40-44     | Years | 3     | 4.9                | 88.54                  |
| 45-49     | Years | 1     | 1.6                | 90.18                  |
| 50-54     | Years | -     | -                  | -                      |
| above 54  | Years | 6     | 9.8                | 100.00                 |
| Total     |       | 61    | 100.00             | -                      |

Table 11 clearly demonstrates that the worst affected areas are Lock nos. 6, 4, 1, and 10. With the exception of Lock no. 4, these display also the lowest average scoring obtained through rating the criteria (Table 4). Incidentally, Lock no. 6 stands out also as the zone with the highest incidence of Bacterial enteritis and pulmonary diseases.

Table 11. Relationship Between Population, Environmental Conditions and Number of Patients

| Area          | Average Score |      | No. of Patients | Population | % of Population |      |
|---------------|---------------|------|-----------------|------------|-----------------|------|
|               |               | Rank |                 |            |                 | Rank |
| Lock No. 1    | 19.4          | 4    | 139             | 2750       | 5.05            | 3    |
| Lock No. 2    | 19.4          | 4    | 24              | 1250       | 1.92            | 7    |
| Lock No. 3    | 19.6          | 3    | 13              | 600        | 2.17            | 6    |
| Lock No. 4    | 20.0          | 2    | 39              | 600        | 6.5             | 2    |
| Lock No. 5    | 16.8          | 12   | 4               | 450        | 0.89            | 9    |
| Lock No. 6    | 16.8          | 12   | 108             | 1000       | 10.8            | 1    |
| Lock No. 7    | 18.4          | 6    | 19              | 700        | 2.71            | 5    |
| Lock No. 8    | 17.8          | 7    | 10              | -          | -               | -    |
| Lock No. 9    | 17.8          | 7    | 62              | -          | -               | -    |
| Lock No. 10   | 17.8          | 7    | 39              | 3000       | 4.76            | 4    |
| Lock No. 11   | 17.8          | 7    | 12              | -          | -               | -    |
| Lock No. 12   | 17.8          | 7    | 20              | -          | -               | -    |
| Upgraded Area | 23.5          | 1    | 114             | 5968       | 1.91            | 8    |
| Adjacent Area | -             | -    | 34              | -          | -               | -    |

#### CONCLUSIONS

The partial results from this recent survey on health risk assessment in the Klong Toey port area slums have allowed us to pinpoint five most frequent diseases related to hygienic and environmental conditions. Table 12 identifies these conditions for each disease and suggests most immediate remedies to improve the current urgent situation. Most of these remedial solutions center around:

- health education of the population
- improvement of hygienic practices (e.g., children must wear shoes)
- improvement of existing hygienic facilities
- improvement of existing wastewater treatment facilities
- monitoring of diffuse air pollution due to stock piling of toxic wastes.

Table 12. Common Water and Waste Related Diseases in Klong Toey and Suggested Improvements

| S.No. | Disease                     | Number of Cases | Cousative Conditions   | Suggested Improvements  |
|-------|-----------------------------|-----------------|--|---|
| 1.    | Bacterial Enteritis         | 61              | Fecal-oral transmission. Man to Man, animal to man. Poor Hygiene drinking water contamination poor excreta disposal. | Excreta treatment prior to discharge, provision of toilets improved housing, hygiene education.     |
| 2.    | Roundworm                   | 09              | Soil transmitted helminths. Mostly yard contamination, ground contamination due to exposed excreta etc.              | Better arrangements for excreta disposal. Children should wear shoes. Health and hygiene education. |
| 3.    | Scabies                     | 07              | Poor personal hygiene. Low water usage. Quantity of water is important.  | Improve hygiene and habits of people.   |
| 4.    | Bacillary Dysentery         | 03              | Fecal-oral transmission. Man to man. Poor personal hygiene, food and drinking water contamination.                   | Improve domestic water supply. Health education and treatment of excreta.                           |
| 5.    | Upper Respiratory Infection | 474             | Both environmental and non environmental. Congested housing; dust and air pollution.                                 | Improve housing and monitoring of pollution levels.   |

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