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A Stacistical Approach to Portray the Poverty of Jaffna People by Housing Environment

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1. Introduction

The general objective of 'Jaffna Socio-Economic Health Study (JSEHS) - 1999' (Elankumaran, 2001) was to find quantitative relationships between socio-economic status and health conditions of the people of Jaffna peninsula in relation to exodus 1995. The present study is related to JSEHS-1999 using its database and followed up to update the relevant information. That is, in this paper, we concentrate on describing some selected socio-economic factors such as housing conditions and environmental sanitation and attempt to portray their relationship with poverty. Earlier studies of poverty in Jaffna region with the analysis of socio-economic status by 'food consumption patterns' (Elankumaran, 2002) and by 'socioeconomic class stratification' (Elankumaran, 2003) were useful to explain the status of poverty in the respective approaches. The approach in this paper deals with housing conditions and environmental sanitation.

Numerous studies have documented that the quality of housing and environmental hygienic conditions, i.e. the status of poverty, are positively related to personal health behavior of the parents of the families and their general health status (McCathy et. al., 1985; Segovia, et. al., 1989, 1991; Thorlindsson et., al., 1990; Kim et. al., 1991; Pill, et. al, 1993). There is a need for the exploration of how housing conditions and environmental sanitation are related to the status of poverty and the general health of the people of Jaffna region. This is because, there is a hope of political settlement on the ethnic crisis and the cessation of prolonged war and hence the possible rehabilitation of the people and reconstruction of the Jaffna region.

We selected 'Housing conditions' and 'Environmental sanitation' as parameters

or independent dimensions determining the socioeconomic status of the people. The following issues motivate the present study. Describing the conditions of present housing environment and environmental sanitation may highlight some characteristics of the standard of living.

2. Housing and Environmental Sanitation in Jaffna Region

Environmental pollution due to industrial waste and other wastage from developmental activities is becoming a serious problem in the other parts of the country. Major developments have taken place in the past decade in some areas and hence adverse side-effects of these activities are concerned by the people and society (Ponnambalam, 1992). But, in Jaffna peninsula no such developmental activities have taken place due to the political unrest and consequent military conflicts. Further, the natural atmosphere and hygienic conditions were collapsed. Housing conditions, environmental sanitation, and health practices of the people of Jaffna peninsula have adversely changed through out the last two decades due to the war and destruction.

The people of Jaffna peninsula have been dynamic due to the war and almost all the people have displaced from their dwellings during the last two decades. Hence, the housing conditions and living facilities were changed time to time. No economic development was possible in the region and no building materials were available for reconstruction of destructed houses until the opening of A9 highway connecting the Jaffna region with the rest of the country. Even though most of the people had reasonable financial background, they were unable to make the facilities on their own. Most of the rich families who have very good houses had to move to safer area and live in a house with inadequate facilities. Density per room is also an important factor affecting the health of the people (Zaidi, 1988). Hence the floor space of the dwellings and average sleeping space per person are becoming contributory factors due to the displacements of the people and temporary stay in the relative houses and refugee camps.

Environmental sanitation is another important aspect, which determines the health. Since the people moved from place to place in short periods and since the dwellings are temporary in some sense, they were not concern about the sanitary conditions of the dwellings. The faecally-related and faecally-transmitted diseases are derived from

contaminated food, water, and soil. Further, if water is lacking or is not safe for drinking, diarrhoeal diseases will spread easily. The public health inspectors are short in Jaffna peninsula and hence no remedial measures were taken to safeguard the sanitary conditions of the housing environment and in the village neighborhoods.

The quality of drinking water in Jaffna peninsula is not good in general, and there is much variation in the chloride and hardness concentration in the underground drinking water (Elankumaran, 1995). People of most of the villages have to go to some places away from their dwellings to fetch and bring safe drinking water. Some of the sources of drinking water are also polluted and not safe due to improper maintenance of common wells. Pipe supply is only available in Jaffna municipal council area. Hence, safe drinking water is a daily problem to most of the families in the peninsula, which causes a number of health problems among the poor people of the region. Further, many people do not have their own wells. Wastage disposal types and maintaining sewerage conditions are also a few neglected hygienic problems by the people due to the collapsed socio-political atmosphere.

The behavior of individuals has also changed due to the new socio-cultural, socio-economic and socio-political atmosphere. Smoking and alcohol drinking habits changed time to time due to the supply and non-supply of cigarettes and liquor from other parts of the country to the Jaffna peninsula. The daily health behaviors such as adequate sleeping hours, drinking boiled water, etc have also changed. There is increasing and justifiable concern about the social, economic, and environmental determinants of health as described above ever since the total war broke out in 1990. There are many more such problems, which are not discussed here, should be addressed to rehabilitate the people of this region.

3. Methods of the present study

The method of this present study is a follow-up study conducted in 2002, in connection to the previous 'Jaffna Socio-Economic Health Study 1999'. The original sample of 1172 families were followed-up and fresh questionnaires were issued to collect the current information about housing conditions and environmental sanitation of the dwellings of the families currently living. The sampling method of selecting the families was a two-stage cluster sampling to draw 1172 families in the six DS

divisions of the Valikamam sector of the peninsula. The data used in the study are obtained from the questionnaires of the 1121 responded families. The measurements used in this study are as follows:

(1) Housing Conditions	(HouCo)
(2) Kitchen Conditions	(KitCo)
(3) Latrine Conditions	(LatCo)
(4) Average sleeping space per person	(ASlSP)
(5) Total Floor Space of House	(ToFlS)
(6) Wastage disposal type	(WasDT)
(7) Availability of Drinking Water	(PHDWa)
(8) Availability of Water for Bathing and Washing	(PrCWa)

The first variable 'Housing Condition' was measured by the combination of the major components 'Floor', 'Side-Wall', and 'Roof' of any house. The categories and their scores of the components are given in the following table.

Table 3.1: Scores given to the Floor, Side-wall, and Roof of a house.

Floor			Side Wall			Roof		
Type	Name	Score	Type	Name	Score	Type	Name	Score
1	Sand	1	1	Cadjan	1	1	Cadjan	1
2	Clay	3	2	Clay	3	2	Sheet	3
3	Cement	5	3	Cement	5	3	Tiles	5

The 27 possible triplets given above were used to define an overall score for the condition of a house. A multiplicative model seemed most suitable to discriminate each type of house from the other. That is, (Score of House) = (Score of Floor)x(Score of Side wall)x(Score of Roof). Table 3.2 describes the categories of all the 27

combinations and the overall scores. Practically some of the combinations described in this table were not relevant in the 1110 houses studied.

Table 3.2 : Conditions of houses, Combinations of portions, and Scores of houses

Condition of House	Combinations of Scores	Score of House
Poor Condition	{1,1,1}	1
	{3,1,1}, {1,3,1}, {1,1,3}	3
	{5,1,1}, {1,5,1}, {1,1,5}	5
	{3,3,1}, {3,1,3}, {1,3,3}	9
Average Condition	{5,3,1},{5,1,3},{3,5,1}, {3,1,5}, {1,5,3}, {1,3,5}	15
	{5,5,1}, {5,1,5}, {1,5,5}	25
	{3,3,3}	27
	{5,3,3}, {3,5,3}, {3,3,5}	45
	{5,5,3}, {5,3,5}, {3,5,5}	75
Good Condition	{5,5,5)	125

The second variable 'Kitchen Condition' in the houses were categorized and scored by observing the type, space and place allocated for cooking and the storage facilities available for storing the food items. Table 3.3 describes these categories and their scores.

Table 3.3 : Different types of Kitchen facilities, descriptions and their scores.

Category	Name of the category	Score
1	No separate place for Cooking	1
2	Separate place available, but no proper facilities	2
3	Separate room available, but no adequate facilities	3
4	Separate room available with complete facilities	4

The third variable 'Latrine Condition' is categorized and scored as follows. The status of latrines in the houses were observed first by the 'availability of latrine' and then by 'type of latrine' if it was available. If the latrine was available then its usage by the family under study alone (private) or sharing with another family (common) was also observed. Table 3.4 describes the different categories of latrines and their scores.

Table 3.4 : Different types of latrine conditions and facilities and their scores.

Availability	Type of Latrine pit	Condition	Score
Not available	——	Very Poor	1
Common Latrine	No water seal	Poor	2
	With water seal	Moderate	3
Private Latrine	No water seal	Good	4
	With water seal	Very Good	5

The fourth and fifth variables are described as follows. The sleeping space per person was calculated as an average sleeping space within the house. The bedrooms or sleeping places were identified and the total space (square feet) was measured. Total sleeping space divided by the total number of persons sleeping in the house was defined as the 'average sleeping space per person'. The 'total floor space of the house' was measured in square feet. In the cases of shared houses or rented houses, we excluded the space of the rooms, which were not used by the families under study.

The sixth variable 'wastage disposal type' considers the appearance of housing environment on all types of unused goods and wastage stored in and around the house. It is categorized and scored as shown in Table 3.5.

Seventh and eighth variables on water availability are described as follows. The scoring methods to study the conditions of water availability is less developed. Sivarajah (1988) has used the indicators 'source by types of well' and 'distance of the source' for both drinking water and water for washing purpose. We modified

those measures with more quantitative meaning and are described below. The water availability and its access to the family under study in the environment of the house were recorded. This considers two sub-indicators, which are 'Source of Drinking water' and 'Source of Water for bathing and washing'. Source of Drinking Water, is indicated by its Proximity to the house and its hygienic status. The proximity is categorized and scored depending on the distance from the house and given in Table 3.6 with the scores. The hygienic status of the source is categorized and scored depending on the type of well used to supply the drinking water. Table 3.7 describes the categories and scores.

Table 3.5 : Categories and scores for wastage disposal type in the house

Category	Name of the category	Score
1	Waste is seen inside the house	1
2	Waste is seen outside the house, but very close to kitchen	2
3	Waste is seen outside the house, but heaped away from the house	3
4	Waste is not seen in the compound and environment is clean	4

Table 3.6 : Categories and scores of proximity to the source of drinking water.

Category	Name of the category	Score
1	Beyond 500 meters from the house	1
2	Between 200 and 500 meters from the house	2
3	Less than 200 meters, but outside the compound	3
4	Within the compound of the house	4

A combined scale was constructed to categorize the Drinking Water availability of the houses. By considering the proximity and hygienic status of the source of drinking water from the scores given in the above two tables, we categorized the

conditions of safe drinking water availability. Table 3.8 describes the categories of status or conditions of drinking water availability and their scores.

Table 3.7 : Categories and scores of hygienic status of the source of drinking water.

Category	Type of well	Score
1	Un-Protected Well / Well within 50 feet of a Latrine	1
2	Semi-Protected Well	2
3	Fully Protected Well / Pipe Supply by Government	3

Table 3.8 : Categories and scores for the Conditions of availability of Drinking water

Condition for Drinking Water (Score)		Score of Hygienic Condition of Source of Drinking Water		
		1	2	3
Score of Proximity of Drinking water	1	Extremely Poor (1)	Very Poor (2)	Moderate (4)
	2	Extermely Poor (1)	Poor (3)	Good (5)
	3	Very Poor (2)	Moderate (4)	Very Good (6)
	4	Poor (3)	Good (5)	Extermely Good (7)

Source of Water for Bathing and Washing, is indicated by its proximity from the house. The proximity is categorized and scored depending on the distance from the house and given in Table 3.9 with the scores.

Table 3.9 : Categories and scores for the availability of water for bathing and washing

Category	Name of the category	Score
1	Beyond 200 meters from the house	1
2	Less than 200 meters, but outside the compound	2
3	Within the compound of the house	3

The first variable is discrete, the fourth and fifth variables are continuous and all the other five variables are ordinal. In the first step of our analysis we employed *'Exploratory Data Analysis'* (EDA) to describe 'Housing conditions and Environmental sanitation'. In the next stage of the analysis we applied *Cluster Analysis* and attempted to find some homogeneous clusters of housing and environmental conditions. *Canonical Discriminant Analysis* was then used to characterize the clusters.

4 Results and Discussions

4.1 Description of Housing Environment

Eleven responded families refused to disclose the information related housing conditions. We first consider the 'Housing Condition', which is measured by the combination of the statuses of 'Floor', 'Side-wall' and 'Roof'. This is categorized and scored as shown in Table 3.2. Every family in our study had been living in a single house. Some of them were living with another family, which is not studied. Table 4.1 describes the frequency distributions of 'Housing conditions'. HouCo is a discrete variable.

Score	1	3	5	9	15	25	27	45	75	125	Total
No of Houses	16	36	2	97	15	16	27	32	205	664	1110
Percentage	1.4	3.2	0.2	8.7	1.4	1.5	2.4	2.8	18.5	59.8	100.0

The houses related to the scores {1, 3, 5, 9} were classified as **"Poor Condition Houses"**. Similarly the houses with scores {15, 25, 27, 45, 75} were classified as **"Average Condition Houses"** and the houses with score {125} only relates to **"Good Condition Houses"**. The above table reveals that about 13.5 per cent of the houses are poor condition houses. Further, 26.6 per cent are average condition houses and the majority (59.8 per cent) are in good condition. The extent of the economically interpreted conditions "poor", "average", and "good" are elaborated below with 'average sleeping space per person' and 'total floor space of the house'.

Kitchen conditions and Latrine conditions are described and scored in the Tables 3.3 and 3.4. The table 4.2 describes the frequency distributions of 'Latrine conditions', and 'Kitchen conditions'.

Table 4.2 : Frequency Distributions of Latrine conditions and Kitchen conditions.

Score		1	2	3	4	5	Total
Latrine Conditions	No of Houses	183	14	119	34	760	1110
	Percentage	16.5	1.3	10.7	3.1	68.4	100.0
Kitchen Condition	No of Houses	71	339	471	229	-	1110
	Percentage	6.4	30.5	42.5	20.6	-	100.0

The scores of latrine conditions from 1 to 5 explains the conditions as "Very Poor", "Poor", "Moderate", "Good", and "Very Good". The above table reveals that about 17.8 per cent of the families do not have any proper latrine facilities. Further about 13.8 per cent of the families have only average latrine facilities. However, only 68.4 per cent of the families seem to have proper latrine facilities. The scores of kitchen conditions from 1 to 4 explain the kitchen conditions as "Poor", "Moderate", "Good", "Very Good". The above table gives evidence that about 36.9 per cent of the families do not have proper kitchen facilities.

Now we shall describe the variables 'Sleeping space per person' and 'Total floor space' of the houses. These two variables are continuous. Average sleeping space per person in the houses is an important measure, which indicate the status of poverty and also related to health conditions of the members of the family in the house. Table 4.3 describes the descriptive statistics of these variables for the six zones of the study area.

The above table reveals that a person occupies approximately 61 square feet for sleeping in the entire region. It is also clear from this table that there is much variation

in sleeping space from one house to another. Zone wise results on sleeping space per person also indicate that there are houses in all the zones with very small sleeping space, which shows a clear indication of incidence of poverty. Average total floor space of the houses in the region seems to be 953 square feet. The floor space also varies highly from house to house and zone to zone. Further, it is also clear that there are small houses (Probably cottages with sand floor, cadjan wall, and cadjan roof) with very small floor space. The average sleeping space 1.09 square feet per person and total floor space 35 square feet show that the housing conditions of some families are very poor.

Table 4.3 : Descriptive statistics of Sleeping space per person and Total floor space.

Variable		JAFF	NALL	VASW	VAWE	VASO	VOEA	Region
ASISP	Mean	62.14	60.85	63.91	69.81	56.58	57.08	61.35
	StErr	2.12	1.98	2.96	4.09	2.66	2.15	1.09
	Min	20.00	2.00	12.80	10.00	8.57	10.00	2.00
	Max	187.50	183.33	236.67	300.00	211.25	175.00	300.00
FISpH	Mean	1067.0	989.7	881.4	1067.1	814.8	911.4	953.2
	StErr	47.2	34.1	45.0	58.9	38.5	42.9	18.2
	Min	100.0	100.0	80.0	60.0	56.0	35.0	35.0
	Max	3300.0	3200.0	3200.0	3400.0	3120.0	3500.0	3500.0
No of Families		166	222	156	164	183	219	1110

(StErr – Standard Error of mean, Max – Maximum, Min - Minimum)

The wastage disposal type in the surroundings of the house shows how the members of the family keep their housing environment clean. Improper disposal type may cause sanitary problems, which will lead to create health problems to the family. The wastage disposal type has been described and scored in Table 3.5. Table 4.4 describes the frequency distribution of these scores. This table reveals that about 20 per cent of the families have never been interested in keeping their housing surroundings clean and in maintaining a hygienic kitchen. Further, about 60 per cent of the families have taken some measures and hence the housing and kitchen

surroundings were clean, but the compounds were not clean. That is, no proper disposal measures were taken. However, only the balance 20 per cent of the families seemed to have very good practice of keeping housing environment very clean and the compounds were clear without any wastage

Table 4.4 : Frequency distribution of wastage disposal types

Score	1	2	3	4	Total
No of Houses	17	204	670	230	1121
Percentage	1.52	18.20	59.77	20.52	100.00

We shall now describe the availability of water. We have defined the availability of water in categories, 'Drinking water' and 'Water for Bathing–Washing'. The types of drinking water and water for bathing and washing basically differ on the basis of its salinity and hardness. The salinity and hardness of the ground water of Jaffana peninsula significantly vary from locality to locality and villages to village (Elankumaran, 1995). As defined and described in the Tables 3.6 and 3.7, we have scored the availability of 'Drinking water' by the proximity and hygienic status of its source, but the availability of common water for bathing and washing is described and scored only on the basis of the proximity of its source, as shown by Table 3.9.

The proximities of 'Drinking water' and 'Common water' are described by the frequency distributions given in Table 4.5. The scores 4 of drinking water and 3 of common water indicate that both waters are available within the compound. Similarly, the scores 3 and 2 indicate of both types of waters not available within the compound, but available within 200 meters from the house, that is, within the limits of the neighboring four houses. The score 2 of drinking water indicates that the drinking water is available beyond the limits of four houses but within the limit of ten houses and score 1 of drinking water indicates the proximity is beyond ten houses. The score 1 of common water indicates that it is available beyond the limits of four houses.

The above table reveals that about 49 per cent of the families do not have drinking water source within their compounds and about 23 per cent of the families do not have both drinking water source and common water source. Further, about 22 per

cent of the families have to go for long distance to bring drinking water. Among them it seems that about 8 per cent of the families have to go more than a half-kilometer to get drinking water. This situation reveals that a considerable number of people have greater difficulties in the accessibility to drinking water.

Table 4.5 : Frequency distributions of the proximities of drinking water and other water

Score	Drinking Water		Score	Water for Bathing - Washing	
	No of Families	Percentage		No of families	Percentage
1	93	08.30			
2	155	13.83	1	35	03.12
3	305	27.21	2	221	19.71
4	568	50.67	3	865	77.16
Total	1121	100.00	Total	1121	100.00

We shall further elaborate the above results with the hygienic conditions of the source of drinking water. The sources, mostly the wells, were classified in to three categories and scored as shown in Table 3.7. We found that about 10 per cent of the sources are unprotected wells and about 70 per cent of the sources are semi-protected wells which show that the sanitary conditions for drinking water are unsatisfied. Only about 20 per cent of the families have said their drinking water sources are protected. Hence, we constructed a combined score for the accessibility for safe drinking water on the basis of proximity and hygienic status of drinking water as shown in Table 3.8.

Table 4.6 describes the frequency distribution of combined scores. This table reveals that about 23 per cent of the families have higher risk on getting drinking water and about 21 per cent of the families have moderate risk on getting drinking water. Only about 13 per cent of the families have no risk on getting drinking water, while about 43 percent of them have little risk that can be neglected.

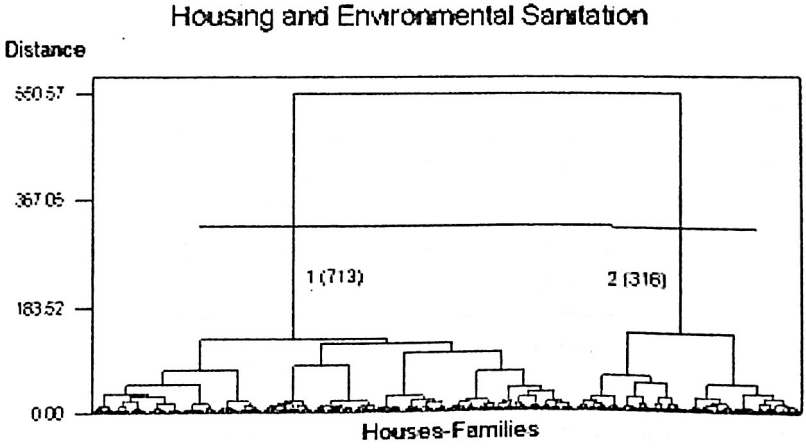
Table 4.6 : Frequency distribution of accessibility for safe drinking water.

Category	Score	No of families	Percentage
Extremely Poor	1	11	0.98
Very Poor	2	108	9.63
Poor	3	144	12.85
Moderate	4	235	20.96
Good	5	478	42.64
Very Good	6	53	4.73
Extremely Good	7	92	8.21
Total	---	1121	100.00

4.2 Patterns of Housing Environment

We have defined eight important variables to portray the status of poverty in this study. Individual analyses on the variables have explored the status of poverty only with the particular characteristic concerned. However, these eight univariate analyses will not give the interaction effects of the variables on the status of poverty, which is the reality.

Figure 4.1 : Dendrogram showing the clusters of houses of the families or couples with different housing conditions and environmental anitation.



Hence, we go for multivariate approach to identify or classify the families differentiating the status of poverty. We employed clustering procedure on the basis of these eight variables included under housing and environmental sanitation. The Figure 4.1 shows the dendrogram of the results of clustering. Altogether 1029 families were subjected to clustering as the sample was adjusted after removing the subjects with missing values and with extreme cases unsuitable to the procedure. This figure clearly reveals that there are two distinct clusters for houses or families, which have different housing and environmental sanitation. We confirmed by Linear Discriminant Analysis (LDA) that the correct classification of the two groups is 94.8%.

We applied Canonical Discriminant Analysis (CDA) on the two-cluster grouping with the eight variables to characterize the two clusters. The score plot of the two canonical variates was examined. This plot revealed that the first cluster was clearly discriminated by the higher values of the principal axis Can1 of the plot, which alone explains 100% of the variation. We inspected the pooled within class standardized canonical coefficients for comparison of both clusters, which are given by Table 4.7.

Table 4.7 : Pooled within class standardized canonical coefficients for the clusters of Housing and Environmental sanitation

Variable	Can 1 (100%)
HOUCO	0.4827631692
LATCO	0.5793341315
STKIT	0.3379685380
ASLSP	0.2058882460
FLSPH	0.1964953443
WASDT	0.0989576866
PHDWA	0.0185071647
PRCWA	0.1108432318

The above table highlights the key variables discriminating one cluster from the other. We found that the first cluster is highly influenced by the status of houses, latrine conditions, and kitchen conditions. Hence, we can conclude that the low values

of the housing, latrine and kitchen conditions make the discrimination of poor families from the rich families. We can also infer from the canonical coefficients of this table that the wastage disposal type and access to drinking water and common water have no influence on the discrimination of families to explain the status of poverty. The sleeping space per person and floor space of the houses have some common influence on the discrimination.

Further, the cluster wise descriptive statistics of the variables, given by the table in Appendix, reveals that all the variables take higher values in the first cluster and low values in the second cluster. Specifically we noticed that the variables we found in the cluster analysis discriminating the clusters have higher differences in means. That is we can conclude that the housing conditions or statuses are determining the status of poverty, while the environmental conditions have less effects on poverty. The summary of our results from these two analyses is given in Table 4.8.

Table 4.8 : Characteristics of the clusters of Housing and environmental sanitation.

Cluster (Size%)	Housing Condition	Latrine Kitchen	Floor Space	Environ-ment	Water Avail	Overall Status (Rank Score)
1 (69.3%)	Good	Good	Good	Good	Good	Good (2)
2 (30.7%)	Average	Poor	Poor	Poor	Poor	Poor (1)

Hence, we found from the multivariate approach that about 70 percent of the families are comfortable in living with their housing and environmental conditions. But, about 30 percent of the families are living without proper facilities on housing and environment. This result portray that the incidence of relative poverty is about 30 percent families.

5. Findings and Conclusions

Housing conditions', 'latrine conditions', 'kitchen conditions', 'average sleeping space per person', and 'total floor space of the house' were considered to describe the status of dwellings and thereby to portray poverty.

The 'Housing Conditions', is measured by the combination of the statuses of 'Floor', 'Side-wall' and 'Roof'. We found that about 13.5 per cent of the houses are 'Poor' condition houses. Further, 26.6 per cent are 'Average' condition houses and the rest are in good condition. Analysis of 'Latrine Conditions' revealed that about 17.8 per cent of the families do not have any proper latrine facilities. Further about 13.8 per cent of the families have only average latrine facilities. However, only 68.4 per cent of the families seem to have proper latrine facilities. We also found from the analysis of 'Kitchen Conditions' that about 36.9 per cent of the families do not have proper kitchen facilities.

'Sleeping space per person' and 'Total floor space' of the houses were considered as supplementary variables to describe the status of dwellings and to explain the housing environment. Average sleeping space per person in the houses is not only indicates the status of poverty but also related to health conditions of the members of the family. We found that a person occupies approximately 61 square feet for sleeping in the entire region. It is also clear that there is much variation in sleeping space. Zone wise results on sleeping space per person also indicate that there are houses in all the zones with very small sleeping space, which shows a clear indication of incidence of poverty. Average total floor space of the houses in the region seems to be 953 square feet. Further, it is also clear that there are small houses (Cottages with sand floor, cadjan wall, and cadjan roof) with very small floor space. This clearly reveals that a considerable number of families are living with unsatisfactory housing environment and inadequate facilities to maintain satisfactory sanitary conditions.

'Wastage disposal type' in the surroundings of the house shows how the members of the family keep their housing environment clean. We found that about 20 per cent of the families have never been interested in keeping their housing surroundings clean and in maintaining a hygienic kitchen. Further, about 60 per cent of the families have taken some measures and hence the housing and kitchen surroundings were clean, but the compounds were not clean. That is, no proper disposal measures were taken. Improper disposal type may cause sanitary problems, which will lead to create health problems to the family. Only about 20 per cent of the families have very good practice of keeping housing environment very clean and the compounds were clear without any wastage

Access to 'Safe drinking water' and 'Water for common use' were analyzed. The types of drinking water and water for bathing and washing basically differ on the basis of its salinity and hardness. The availability of 'Safe drinking water' was measured by the proximity and hygienic status of its source, but the availability of common water for bathing and washing is described only by the proximity of its source. We found that about 49 per cent of the families do not have drinking water source within their compounds and about 23 per cent of the families do not have both drinking water source and common water source. Further, about 22 per cent of the families have to go for long distance to bring drinking water. Among them it seems that about 8 per cent of the families have to go more than a half-kilometer to get drinking water. This situation reveals that a considerable number of people have greater difficulties in the accessibility to safe drinking water.

We further elaborated the access to 'Safe drinking water'. The sources, mostly the wells, were classified in to three categories which are 'Un-protected, Semi-protected, and Protected' sources. We found that about 10 per cent of the sources are unprotected wells and about 70 per cent of the sources are semi-protected wells which show that the sanitary conditions for drinking water are unsatisfied. We analyzed a combined score for its accessibility on the basis of proximity and hygienic status. We found that about 23 per cent of the families have higher risk on getting drinking water and about 21 per cent of the families have moderate risk on getting drinking water. Only about 13 per cent of the families have no risk on getting drinking water, while about 43 percent of them have little risk that can be neglected.

We performed a multivariate analysis to classify the families differentiating the status of poverty on the basis of the individual and combined effects of the aspects considered for the poverty. We found that there are two distinct clusters of families or houses, which have different housing and environmental sanitation. We further found that the first cluster was clearly discriminated by the higher values of the three key variables 'Housing Condition', 'Kitchen Conditions', and 'Latrine Conditions'. Hence, we conclude that the low values of the housing, latrine and kitchen conditions make the discrimination of poor families from the other. We also infer that the wastage disposal type and access to water have no influence on the discrimination of families

on the status of poverty. The sleeping space per person and floor space of the houses have some influence in this regard.

The cluster wise statistics revealed that all the characteristics take higher values in the first cluster. Specifically we noticed that the variables discriminating the clusters have higher differences in means. That is, we can conclude that the housing conditions or statuses are determining the status of poverty, while the environmental conditions have less effects on poverty. We found that only about 70 percent of the families are living with satisfactory housing and environmental conditions, hence we conclude that about 30 percent of the families are living under poverty in terms of their housing environment.

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Appendix

Table : Cluster-wise Statistics of the variables of Housing and Environmental sanitation.

Descriptive Statistics

Vari	Cluster	N	Mean	Median	StDev
HouCo	1	713	112.75	125.00	23.51
	2	316	44.97	25.00	46.77
LatCo	1	713	4.7560	5.0000	0.7658
	2	316	2.4810	1.5000	1.6512
StKit	1	713	3.1108	3.0000	0.6872
	2	316	2.0127	2.0000	0.6171
AslSP	1	713	72.43	65.00	36.02
	2	316	35.146	31.429	16.869
FlSpH	1	713	1181.1	1150.0	581.0
	2	316	446.4	400.0	275.9
WasDT	1	713	3.1108	3.0000	0.6115
	2	316	2.7152	3.0000	0.7091
PHDWa	1	713	4.6367	5.0000	1.2491
	2	316	3.8892	4.0000	1.3997
PrCWa	1	713	2.8864	3.0000	0.3389
	2	316	2.4241	3.0000	0.6404