Chapter 3

Preliminary Data Analysis

In this chapter we describe the preliminary analysis of the incidence rates in 2003 and 2004 in the 58 subdistricts of Yala Province for the seven fever-symptomatic diseases, based on cases reported to the Yala Public Health Provincial Office. The chapter has three sections. In the first section we show frequency distributions of the variables. In Section 2, we analyse and depict the correlations between the seven disease rates. Finally, we show schematic maps of the geographic distribution of the disease incidence rates for the two years 2002 and 2003.

3.1 Distribution of Incidence Rates

Figure 3.1 shows the means, standard deviations, minimum and maximum values of the incidence rates per 1000 residents in the 58 subdistricts of Yala Province in 2002, for dengue fever, diarrhoea, pyrexia of unknown origin, haemorrhagic conjunctivitis, pneumonia, and dengue haemorrhagic fever.

Variable name	Size	Graph	Minimum	Maximum	Mean	StDev	Skewness	Kurtosis
DHFRate02	58		0	6.664	2.160	1.494	0.943	0.537
dengueFeverRate02	58		.122	16.795	3.295	2.916	3.148	12.712
conjunctivitisRate02	58		0	79.776	10.282	12.577	3.206	15.607
diarrheaRate02	58		0	133.660	31.965	24.504	1.382	3.607
pyrexiaRate02	58		0	41.358	9.530	9.758	1.785	2.872
pneumoniaRate02	58		0	16.255	5.928	3.981	0.916	0.323
malariaRate02	58		0	17.337	1.941	3.700	2.786	7.082

Figure 3.1: Distribution of incidence rates of diseases in 2002 for Yala subdistricts.

For dengue fever the mean incidence rate in 2002 was 3.30 per 1000, with standard deviation 2.92. The minimum incidence rate was 0.12 (in Ba Ro subdistrict), showing that cases were recorded in every subdistrict. The distribution is positively skewed, as disease incidence rates usually are, but two subdistricts (Ku Ta Ba Ru with 16.8 and Ka Yu Bo Ko with 15.9 cases per thousand) had unusually high incidence rates.

Diarrhoea was the most prevalent disease in Yala in 2002, with average 32.0 cases per thousand, followed by haemorrhagic conjunctivitis (average 10.3 cases per thousand), pyrexia of unknown origin (average 9.5 cases per thousand), pneumonia (average 5.9 cases per thousand), dengue fever (average 3.3 cases per thousand), dengue haemorrhagic fever (average 2.2 cases per thousand) and malaria (average 1.9 cases per thousand).

Figure 3.2 shows the distributions of the disease rates after taking logarithms. Since some incidence rates were 0, we used the transformation ln(rate/1000+1), so that 0s remain 0s after the transformation. Except for malaria, the skewnesses in Figure 3.1 are largely removed, although the diarrhoea distribution is now negatively skewed.

Variable name	Size	Graph	Minimum	Maximum	Mean	StDev	Skewness	Kurtosis
DHFLog	58		0	2.036	1.044	0.471	-0.062	-0.509
DengueLog	58		.115	2.879	1.308	0.527	0.442	1.118
conjunctLog	58		0	4.392	1.876	1.139	-0.245	-0.969
DiarrhoeaLog	58		0	4.903	3.163	0.936	-0.988	1.320
pyrexiaLog	58		0	3.746	1.980	0.891	-0.013	-0.582
pneumoniaLog	58		0	2.848	1.758	0.639	-0.643	0.567
malariaLog	58		0	2.909	0.603	0.795	1.397	1.006

Figure 3.2: Distributions of log-transformed incidence rates

3.2 Correlations between Disease Rates

The left panel of Figure 3.3 shows the relations between the incidence rates for DHF, dengue fever, and diarrhoea in the subdistricts.

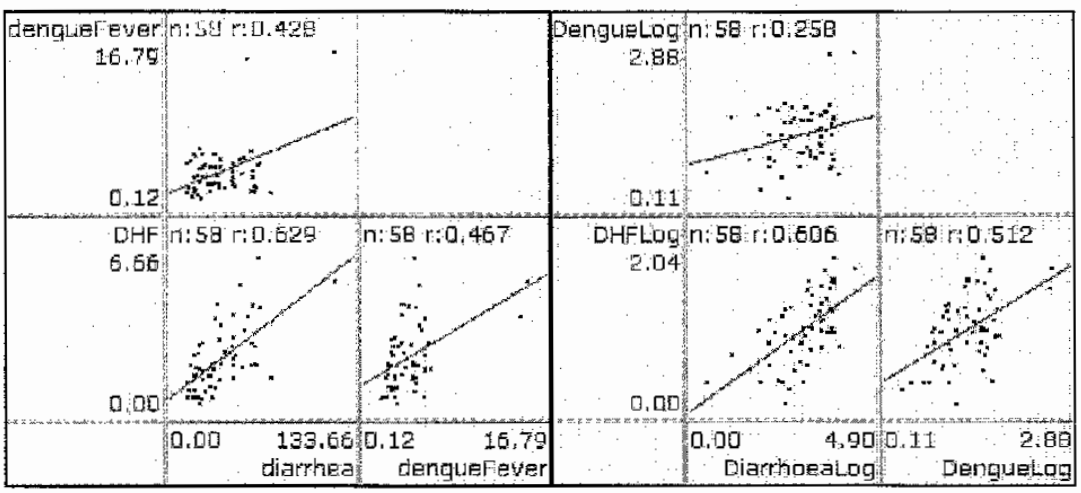

Figure 3.3: Scatterplot matrix showing correlations between DHF, dengue fever and diarrhoea, before (left panel) and after (right panel) log transformation

Two outliers are evident in the scatter plot relating the dengue fever rates to the diarrhoea incidence rates. These have unusually high rates of dengue fever, namely, 16.8 cases per 1000 in KuTaBaRu and 15.9 cases per 1000 in Ka Yu Bo Ko. Outliers can distort the correlation coefficient between two variables, and the right panel of Figure 3.3 shows the scatter plots after taking the log transformation ln(rate/1000+1). The fit of the straight line is improved by analysing the log-transformed rates.

Figure 3.4 shows a scatterplot matrix depicting the relations between the other four diseases and diarrhoea, again using the log transformed rates. The highest correlations are between conjunctivitis and diarrhoea (0.80), pneumonia and diarrhoea (0.80), and pneumonia and conjunctivitis (0.58).

The other correlations are not graphed because they are all relatively small, with the exception of that relating DHF to haemorrhagic conjunctivitis (0.46).

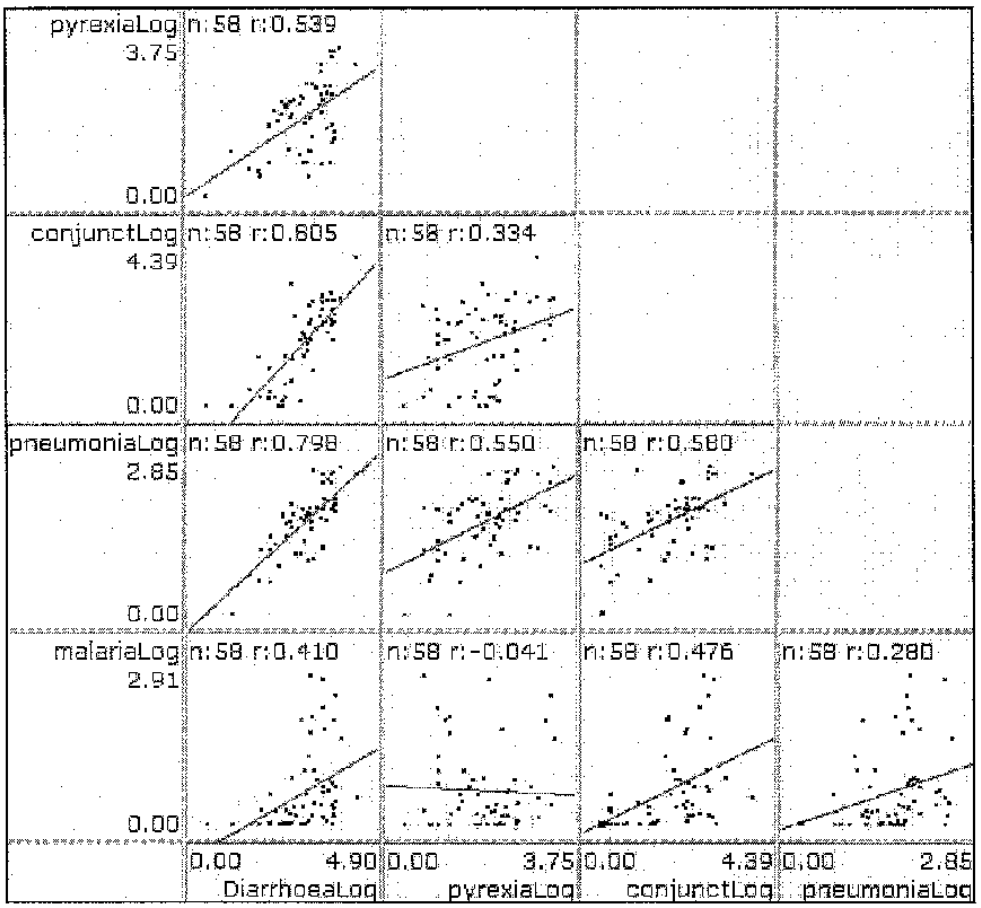

Figure 3.4: Scatterplot matrix showing correlations between malaria, pneumonia, haemorrhagic conjunctivitis, pyrexia and diarrhoea, after log transformation

Figure 3.5 gives a schematic map of the correlation structure in the diseases.

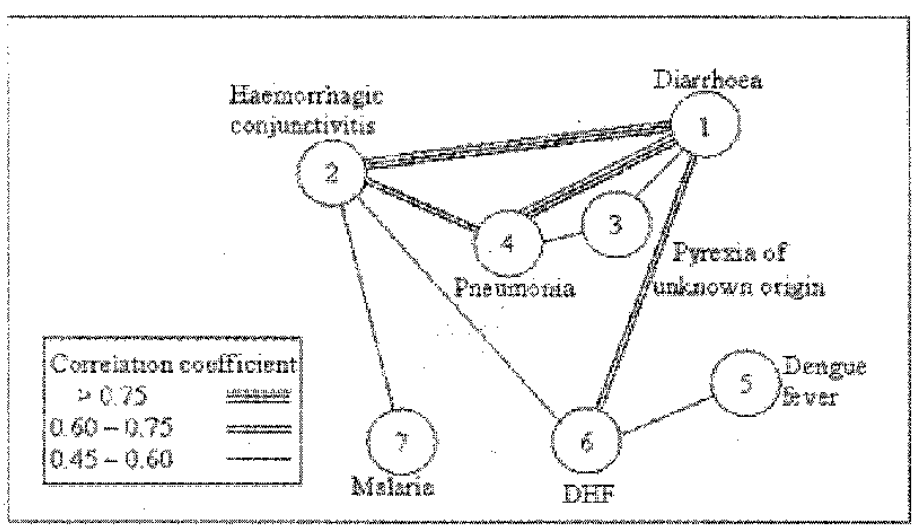

Figure 3.5: Correlation Structure of Diseases

3.3 Map Comparisons

In this section we describe the geographic distribution of the diseases and use maps to identify areas of high risk in subdistricts of Yala province in years 2002 and 2003. We can do this using the morbidity rates and the methods for mapping such data routinely provided by geographical information systems (GIS).

For each disease we construct schematic range maps showing how the morbidity rate varies over the 58 subdistricts in Yala province from 2002 to 2003. The morbidity rates are grouped into five colour bands as follows.

Light Yellow: Very Low

Yellow: Low

Dark Yellow: Middle

Orange: High

Red: Very high

For each disease, the morbidity rates for 2002 are used as a basis for this classification, so that the 58 subdistricts are allocated to five groups each containing approximately 20% of the data, and the same group boundaries are used for the allocation in the following year. These maps can thus be used to see how the disease incidence changed from 2002 to 2003.

Figures 3.6 and 3.7 show these range maps for Dengue haemorrhagic fever and Dengue fever, respectively. For DHF, Figure 3.6 shows (a) that the locations of high morbidity in 2002 were around Yala city and in the western and southern regions of the province, and (b) that the disease incidence dropped substantially from 2002 to 2003. Of the 21 subdistricts classified as having high or very high morbidity in 2002, none were in these

categories in 2003, and the number of subdistricts in the middle category dropped from 13 in 2002 to 3 in 2003.

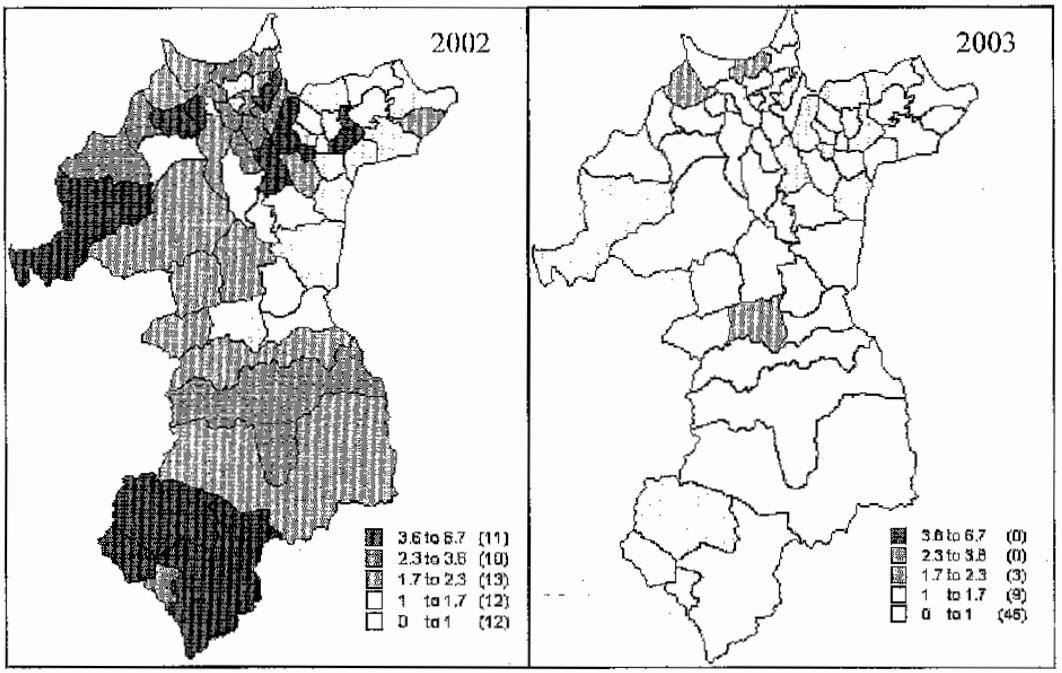

Figure 3.6: Range Map of the DHF from 2002 to 2003 in Yala Province

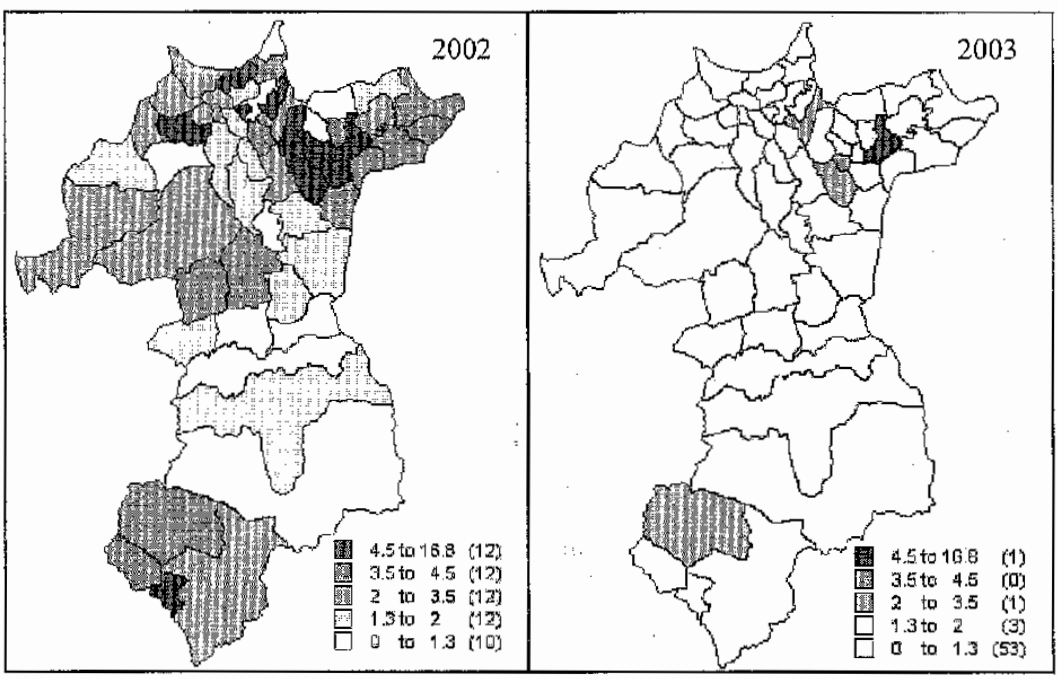

Figure 3.7: Range Map of the Dengue Fever from 2002 to 2003 in Yala Province

For Dengue fever, Figure 3.7 shows (a) that the locations of high morbidity in 2002 were around Yala city with just three subdistricts having high morbidity in the south, and (b) that the disease incidence again dropped substantially from 2002 to 2003.

Figures 3.8 and 3.9 show the corresponding range maps for haemorrhagic conjunctivitis and diarrhoea, respectively. For haemorrhagic conjunctivitis, Figure 3.8 shows (a) that locations of high morbidity in 2002 were in the western mountains with some also scattered around the north, and (b) that the disease incidence decreased almost everywhere from 2002 to 2003.

For diarrhoea, Figure 3.9 shows (a) that the locations of high morbidity in 2002 were in the southern part of the province with just three subdistricts having high morbidity in the north, and (b) that there was not a lot change from 2002 to 2003.

Figures 3.10 and 3.11 show the corresponding range maps for pneumonia and pyrexia of unknown origin, respectively. For pneumonia, Figure 3.10 shows (a) that locations of very high morbidity in 2002 were scattered around the northern half of the province with high morbidity also in the south, and (b) that with some notable exceptions in the north the disease incidence did not change substantially from 2002 to 2003.

For pyrexia of unknown origin, Figure 3.11 shows (a) that the locations of high morbidity in 2002 were in northern and central regions of the province, and (b) that the changes from 2002 to 2003 were not substantial.

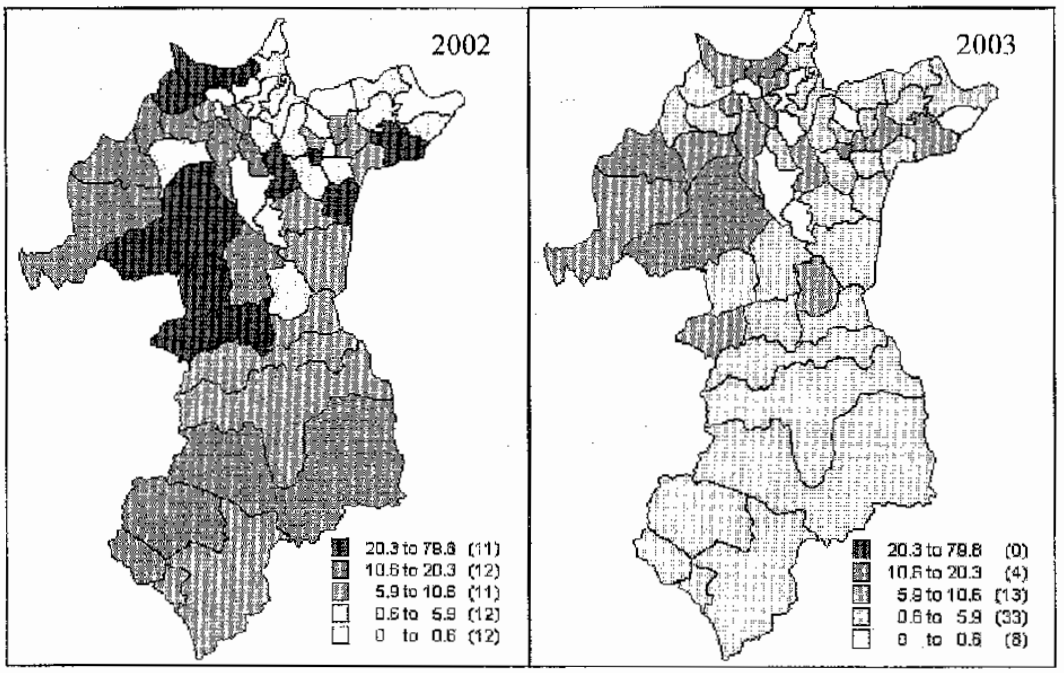

Figure 3.8: Range Map of haemorrhagic conjunctivitis from 2002 to 2003 in Yala

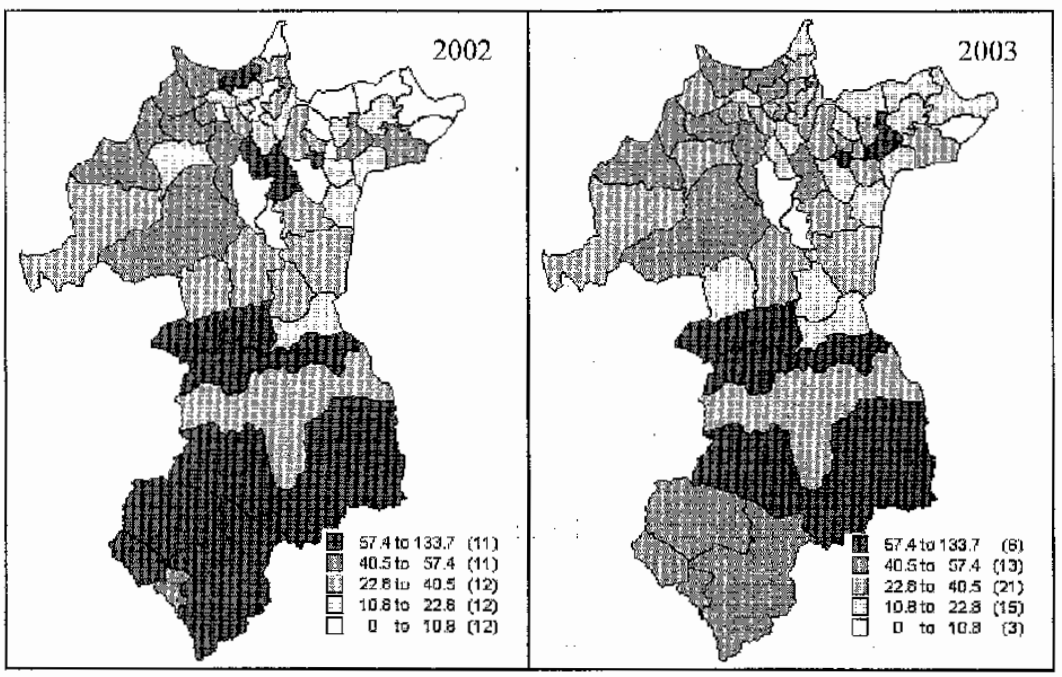

Figure 3.9: Range Map of Diarrhoea from 2002 to 2003 in Yala Province

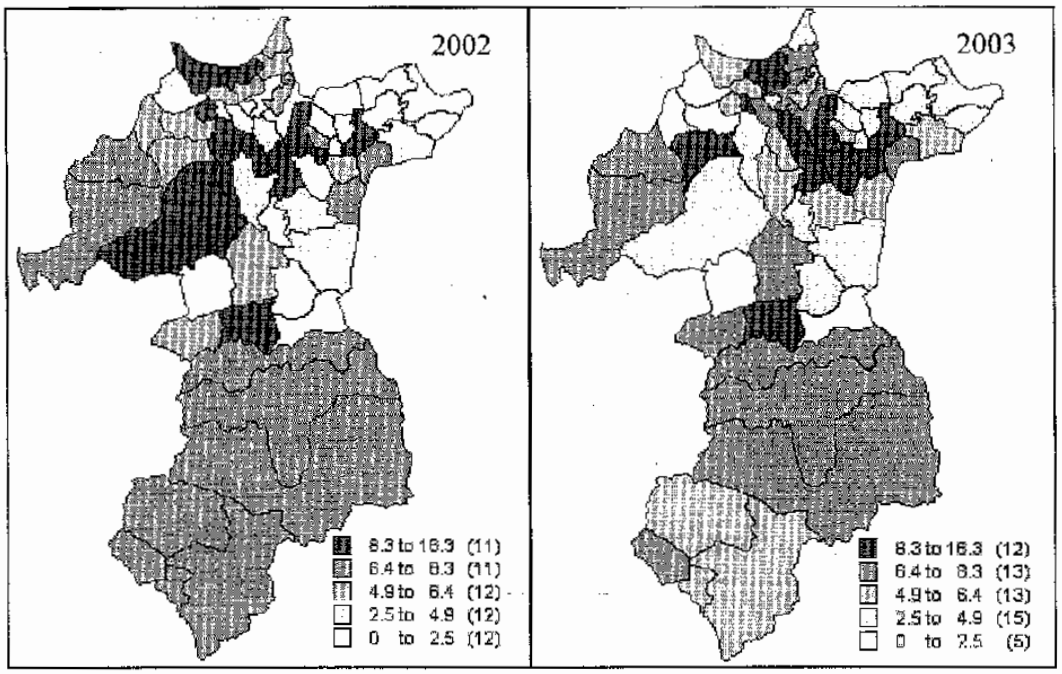

Figure 3.10: Range Map of the Pneumonia from 2002 to 2003 in Yala Province

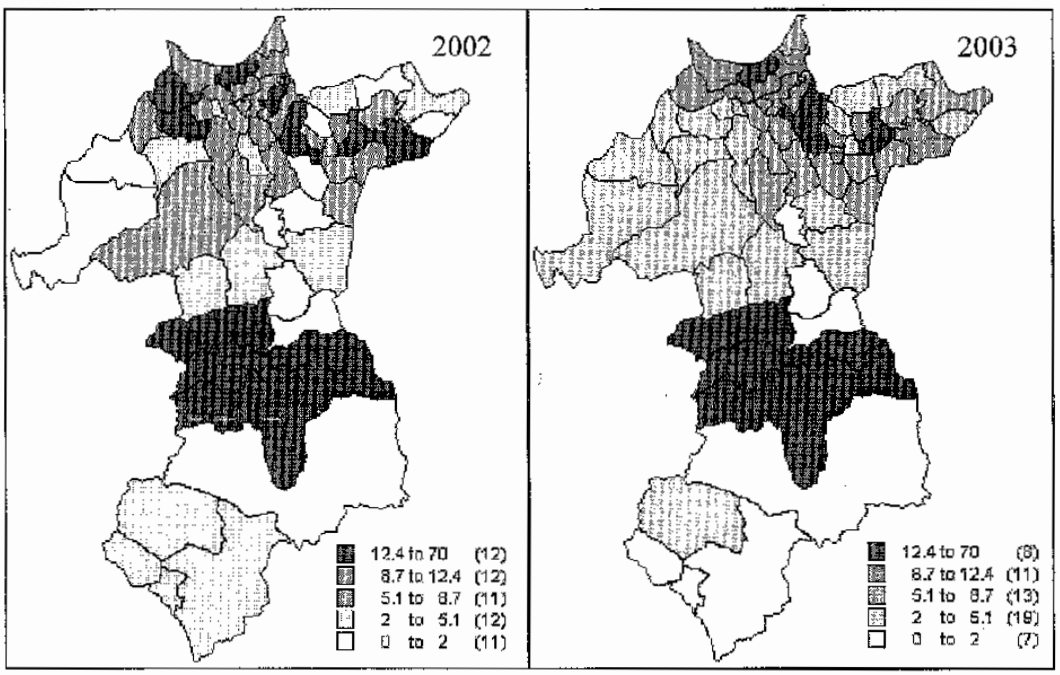

Figure 3.11: Range Map of Pyrexia from 2002 to 2003 in Yala Province

For malaria, Figure 3.12 shows (a) that the locations of high morbidity in 2002 were in the western and central parts of the province, and (b) that there was some increase in morbidity from 2002 to 2003.

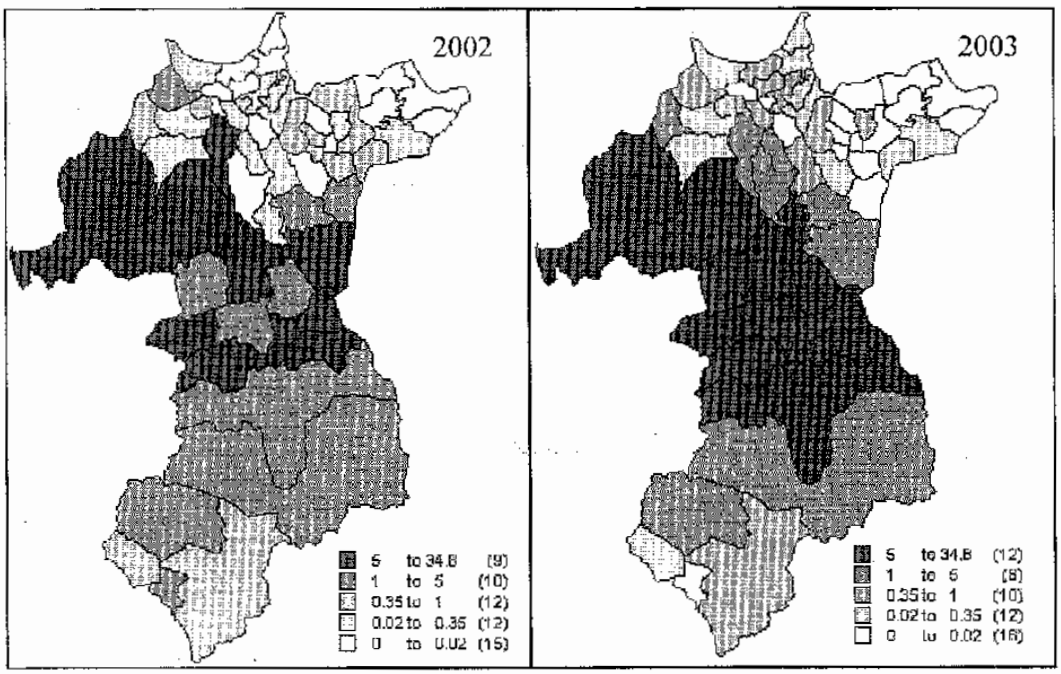

Figure 3.12: Range Map of the Malaria from 2002 to 2003 in Yala Province