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Original Article

A Study on Trends and Patterns of Leprosy in Guyana during a Ten year Period, 2007-2016

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Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*, an acid-fast, rod-shaped bacillus. This study reports the trends of leprosy in Guyana during the year 2007-2016. This is a retrospective study conducted by analyzing records of all cases registered with Guyana Hansen's Disease Control Programme (GHDCP) during the ten year period. A total of 265 patients data were analyzed in this study. Mean age ± standard deviation (SD) of leprosy patients was 34.5 ± 17 (95% CI 32.5-36.6). There was a noticeable overall increase in the number of leprosy cases throughout the years 2007 to 2016. The trend of PB cases on the other hand, revealed noticeable increase from 9.9% in 2007 to 12.7% in 2016 similarly percentage of multibacillary (MB) cases also showed an increase from 9.4% in 2007 to 14.1% in 2016 (p=0.61). Significantly more cases were recorded for MB (71.9%; 95% CI 66.1-77.2) ($p \leq 0.001$) than Paucibacillary (PB) (26.6%; 95% CI 21.4-32.3) ($p \leq 0.001$). Within MB, significantly more cases were with LL (28.5%; 95% CI 23.1-34.3) followed by BL (13.9%; 95% CI 9.9-18.6) ($p \leq 0.001$). However, the highest proportion of childhood leprosy and a considerable number of new cases could witness the active transmission of the disease and the existence of new infections within the country. This study therefore provides an insight into the trends of leprosy in Guyana and the result should be considered important to create awareness and reinforcement of policies towards leprosy care.

Key words: Guyana, leprosy, trends, 2007 to 2016

Introduction

Leprosy is a chronic, infectious disease, also known as Hansen Disease, is caused by *Mycobacterium leprae*. The last few decades have seen a notable decline in leprosy incidence worldwide, due in part to general socioeconomic development as well as the advent of fixed-dose combination therapy. Every year more than 210,000 new cases are detected worldwide (WHO 2015). After India, Brazil has the second largest number of leprosy patients detected. In 2014, there were 31,064 new cases reported, mostly from the Amazon region (WHO 2015). The introduction of multidrug therapy (MDT) to leprosy programmes in the mid-1980s resulted in a significant reduction in the prevalence of the

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disease, from 5.4 million cases at that time to a few hundred thousand currently and aim is to reduce numbers as well as make it disease without stigma (WHO 2016a, b, c). MDT has been administered to approximately 16 million leprosy patients within the past two decades allowing WHO's 2000 leprosy elimination goal (to achieve global elimination of leprosy as a public health problem i.e. reduction in leprosy prevalence to less than 1 case per 10,000 populations) to be achieved by many countries (Anjum et al 2015, Cooreman 2015, WHO 2016b).

Guyana borders Brazil which has the second highest number of cases of leprosy in the world. Leprosy in Guyana is monitored via the Guyana Hansen's Disease Control Programme (GHDCP), funded by Netherlands Leprosy Relief Association (NSL). The risk of leprosy is high in Guyana due to the fact that most cases are due to 'imported' cases from its neighboring territory Brazil (Ramnarine 2016). Recently, Guyana reported 54 cases of leprosy (Cummings 2017). According to PAHO, with the exception of Brazil, out of its 35 countries in the Americas 24 have successfully eliminated leprosy as a public health problem at the national level. Moreover, within 2003 - 2013 there has been a significant decrease in leprosy cases in the Americas, Latin America and the Caribbean. Leprosy cases were declined by 37% in the Americas over a decade (PAHO 2015).

Leprosy is not a new occurrence in the Caribbean. An article written by Stefan Lovgren for National Geographic News pointed to the Caribbean's history as an explanation for its presence. Although researchers had posited that leprosy originated on the Indian subcontinent before being introduced to Europe by Greek soldiers returning from the India campaign of Alexander the Great, new research revealed that the disease originated in East Africa. Scientists say Europeans and North Africans spread the disease to West Africa. From there, the slave trade brought it to the Caribbean, South America, and North America (Lovgren 2016). With the implementation of MDT the prevalence of leprosy declined significantly across the world (Li et al 2011, Larrea 2012). Guyana has a very active GHDCP for leprosy care and treatment but very little is published about the trend of leprosy in Guyana during the last two decades. To author's knowledge, this study therefore will be the first attempt to highlight the recent trend and pattern of leprosy in Guyana.

Methodology

The present study was a retrospective analysis of data collected over a period of ten years from the GHDCP during 2007-2016. All patients who were in the register of the GHDCP with complete information were retrieved and included in the study. The data obtained from the skin clinic was first entered in Microsoft Excel 2010 and later in SPSS for analysis. The number of relapse cases was used to measure the effectiveness of MDT during the ten year period.

Ethical consideration

All patient information were dealt with confidentiality. Ethical approval was sought and granted by the Institutional Review Board (IRB), Ministry of Public Health, Guyana.

Results

Socio demographic status

A total of 265 patients data were retrieved for the study. Table 1 shows the demographic statistics of the study population. Mean age ± standard deviation (SD) of leprosy patients was 34.5 ± 17 (95% CI 32.5-36.6). The minimum and maximum age of the patients were 2 - 80. Median age and standard error (SE) and interquartile range (IQR) of the study population were 35 ± 1.05 and 26 respectively. The study had significantly more males 61.7% (95% CI 55.5-67.5) than females

Table 1 : Socio-demographic status of patients enrolled during the period 2007-2016

Sex (266)	**n(%)**	**95% CI**	
Female	102(38.4)	32.5- 44.5	
Male	164(61.7)	55.5-67.5	p≤0.0001
Ethnicity (264)			
I	126(47.7)	41.6-53.9	
A	106(40.2)	34.2-46.3	
Mix	29(10.9)	7.5-15.4	
C	3(1.1)	0.2-3.3	p≤0.001
Region (268)			
1	1(0.4)	.009-2.1	
2	18(6.7)	4.0-10.4	
3	44(16.4)	12.2-21.4	
4	142(52.9)	46.8-59.1	
5	1(0.4)	.009-2.1	
6	49(18.3)	13.8-23.4	
8	1(0.4)	.009-2.1	
10	12(4.5)	2.3-7.7	p≤0.001
Clinics (261)			
C/B	1(0.4)	.01-2.1	
Grove	2(0.8)	0.1-2.7	
Linden	7(2.7)	1.1-5.4	
McKenzie	3(1.2)	0.2-3.3	
N/a	29(11.1)	7.5-15.5	
P/H	1(0.4)	.01-2.1	
P/M	6(2.3)	0.8-4.9	
Parika	23(8.8)	5.7-12.9	
PHC	147(56.3)	50.1-62.4	
PP	2(0.8)	0.1-2.7	
S/Dyke	15(5.8)	3.3-9.3	
Skeldon	3(1.2)	0.2-3.3	
V/Hoop	22(8.4)	5.4-12.5	p≤0.001
Referred by (256)			
Contact	40(15.6)	11.4-20.6	
Doctor	61(23.8)	18.7-29.5	
Family	8(3.1)	1.4-6.1	
Medical Staff	15(5.9)	3.3-9.5	
Others	3(1.2)	0.2-3.4	
Public	24(9.4)	6.1-13.6	
Self	96(37.5)	31.6-43.7	
Survey	9(3.4)	1.6-6.3	p≤0.001

38.4% (95% CI 32.5-44.0) ($p \leq 0.05$). Analysis on ethnic distribution found East Indians (47.7% 95% CI 41.6-53.9) significantly most dominant followed by the Africans (40.2% 95% CI 342-46.3), mixed race (10.9% 95% CI 7.5-15.4) and Chinese (1.1% 95% CI 0.2-3.3) ($p \leq 0.001$). Region 4 (capital of Guyana) recorded significantly the most number of cases with 52.9% (95%CI 46.8-59.1; $p \leq 0.001$). Primary Health Center documented the most cases of leprosy with 56.3% (95% CI 50.1-62.4; $p \leq 0.001$) followed by self-identification by patients 37.5% (95%CI 31.6-43.7) and by Doctor referral 23.8% (95% CI 18.7-29.5).

There was a noticeable increase in the overall leprosy cases throughout the years 2007 to 2016 (p=0.6). The trend of PB cases on the other hand revealed noticeable increase from 9.9% in 2007 to 12.7% in 2016 similarly percentage of Multibacillary (MB) cases also showed an increase from 9.4% in 2007 to 14.1% in 2016 (p=0.6). The year 2012 showed a tremendous decrease in all cases of leprosy when compared to other years (Fig 1). However, there was no documentation on the cause of such decline in leprosy cases during the year 2012. Table 2 shows the classification of leprosy. Significantly more cases were recorded for MB (71.9%; 95% CI 66.1-77.2) ($p \leq 0.001$) than Paucibacillary (PB) (26.6%; 95% CI 21.4-32.3) ($p \leq 0.001$). Within MB, significantly more cases were with LL (28.5%; 95% CI 23.1-34.3) followed by BL (13.9%; 95% CI 9.9-18.6) ($p \leq 0.001$). Among PB, BT was recorded to be high but not statistically significant (9.0%; 95% CI 5.8-13.1) ($p \leq 0.4$). Significantly more students (19.8%; 95% CI 14.5-26.1) were identified with leprosy followed by housewives (18.3%; 95% CI 13.1-24.4) and blue collar jobs (14.7%; 95% CI 10.1-20.5) ($p \leq 0.001$).

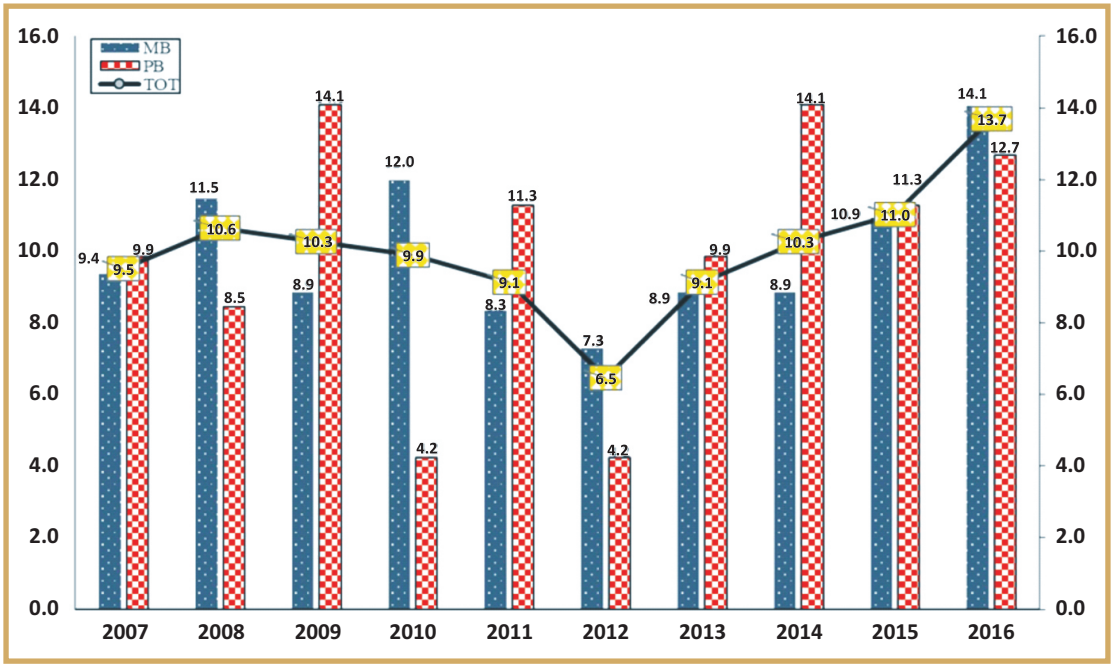

Fig 1 : Year wise Distribution of Multibacillary and Paucibacillary leprosy

Table 2 : Types of leprosy and social status of patients

Class/Type (267)	n(%)	95% CI	
Paucibacillary	71(26.6)	21.4-32.3	
TT	18(6.7)	4.0-10.4	
BT	24(9.0)	5.8-13.1	p=0.4
Multibacillary	192(71.9)	66.1-77.2	
BB	9(3.4)	1.6-6.3	
BL	37(13.9)	9.9-18.6	
LL	76(28.5)	23.1-34.3	p≤0.001
Indeterminate	4(1.5)	0.4-3.8	
Social condition (91)			
Good	20(21.9)	13.9-31.8	
Fair	55(60.4)	49.6-70.5	
Poor	16(17.6)	10.4-26.7	p≤0.001
Occupation (197)			
Blue collar jobs	29(14.7)	10.1-20.5	
White collar jobs	21(10.7)	6.7-15.8	
Farmer	20(10.2)	6.3-15.2	
Housewife	36(18.3)	13.1-24.4	
Self-employed	31(15.7)	10.9-21.6	
Skilled workers	14(7.1)	3.9-11.6	
Student	39(19.8)	14.5-26.1	
Unemployed	7(3.6)	1.4-7.2	p≤0.001

Table 3 : Multibacillary (MB) and Paucibacillary (PB) leprosy and disability grade

Age Group	MB	PB	ADM (DF)			
			0	1	2	
> 10	2 (1.1)	13 (18.3)	15 (7.4)	0	0	
10 - 19	24 (12.7)	18 (25.4)	42 (20.6)	1 (5.0)	1 (2.4)	
20 -29	35 (18.5)	6 (8.5)	30 (14.7)	7 (35.0)	6 (14.6)	
30-39	52 (27.5)	11 (15.5)	49 (24.0)	3 (15.0)	12 (29.3)	
40 -50	41 (21.7)	7 (9.9)	33 (16.2)	6 (30.0)	9 (22.0)	
> 50	35 (18.5)	16 (22.5)	35 (17.2)	3 (15.0)	13 (31.7)	p=0.005

Table 3 describes disability status and age group of leprosy among the recorded cases. MB leprosy (27.5%) as well as grade 2 disability (29.3%) were recorded high among 30-39 age group. PB (25.4%) was recorded high among 10-19 age group. Significantly 15.7% of patients were admitted

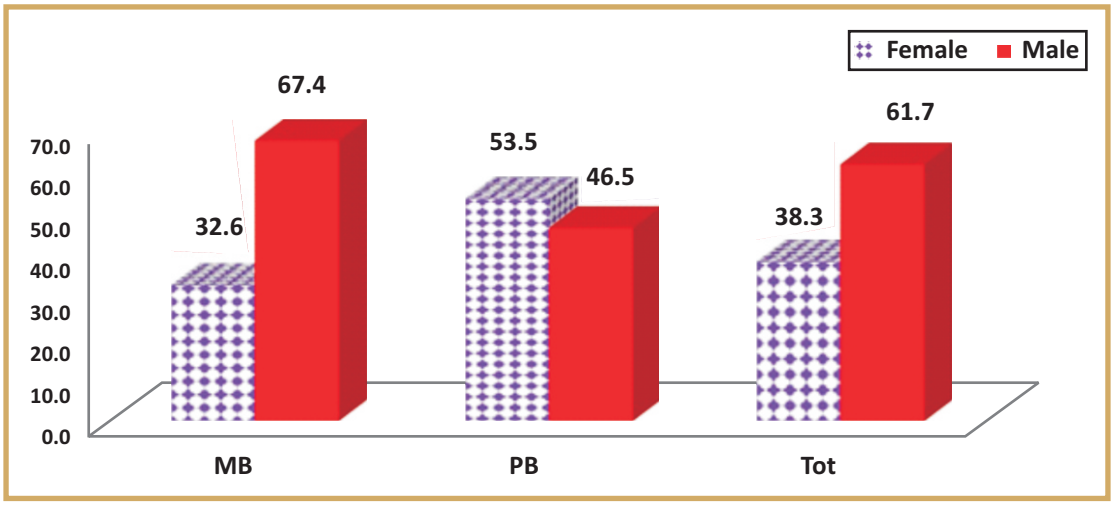

Fig 2 : Distribution of leprosy according to gender.

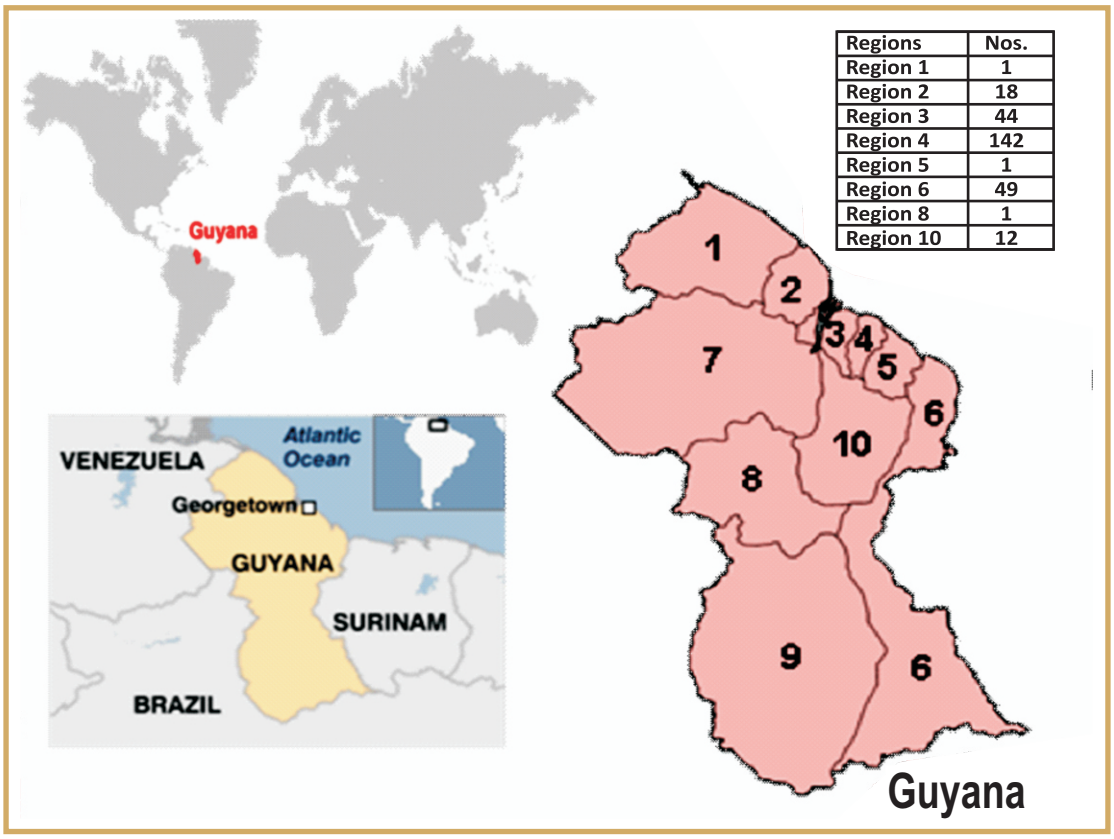

Fig 3 : Shows the map of Guyana with its ten administrative regions and number of leprosy cases during the study period

with grade 2 disability mostly with MB leprosy type (30.2%) ($p \leq 0.05$).

Fig 2 shows the gender distribution among recorded leprosy cases. Male-over-female preponderance was recorded among total cases of leprosy (61.7%>38.3%). Males (67.4%; 95% CI 60.2-74.0) were also recorded higher among MB leprosy than females (32.6%; 95% CI 26.0-39.8) with odds ratio of 2.4 (OR=2.4). On the other hand, PB recorded higher among females (53.5%; 95% CI 41.3-65.5) than males (46.5%; 95% CI 34.6-58.7) with odds ratio of 2.0 (OR=2.0). Fig 3 shows map of Guyana and overall distribution of leprosy in the ten administrative regions of Guyana. Region 4 is also the capital of Guyana, has also recorded the highest cases of leprosy.

Within the study frame there were only 4 reported cases of relapse. MDT was indeed found to be effectively treating leprosy cases in Guyana. One was a female who had PB leprosy in 2012 and the other three were males who had MB leprosy with 1 case occurring in 2015 and the remaining 2 cases occurred in 2016. Two male patients of 30-39 years old with grade 2 disability died.

Discussion

There is no doubt that the prevalence of leprosy is declining, in part due to the advent of fixed-dose combination therapy (Turner et al 2015). There has been worldwide decline in registered patients. Between the years 2010 and 2014, new reported cases of leprosy in Latin America and the Caribbean declined from 37,571 to 33,789 (WHO 2011, WHO 2014), a 10.1% reduction. The fact that Brazil reported 31,064 new cases in 2014, accounted for 91.9% of the new cases reported in the region. Reports confirm that by 2014, all countries of Americas had reached the national goal of elimination of leprosy as a public health problem (<1 case per 10,000 inhabitants), with the exception of Brazil (1.27). Guyana was among the seven countries at the first subnational administrative level that had yet to reach the goal along with Argentina, Bolivia, Dominican Republic, Paraguay, Suriname, and Venezuela. On the other hand in 2014, the rate of new cases with grade 2 disability in Latin America and the Caribbean was 3.59 per million population. WHO global target was of less than 1 per million population to be reached by 2020 (WHO 2016b).

Because of the fact that Guyana has uncontrolled entry of Brazilians (Brazil has second largest leprosy cases) both legally and illegally, could be a reason for increased leprosy incidence in Guyana. Studies in European countries have highlighted similar fact that foreign-born citizens from countries where leprosy is endemic, such as Brazil imports leprosy (WHO 2008, WHO 2009, Larrea et al 2012, Ramos et al 2016). Leprosy has long incubation period and takes long time to show clinical manifestations may be a key factor explaining its importation. Asymptomatic people emigrate before developing any clinical signs of the disease and develops leprosy once they reach in foreign country (WHO 2016c).

Likewise, schools and various areas require leprosy surveys once they were indicated. Li et al also explained the importance of self-reporting of leprosy patients as a great contributor to the identification of new leprosy cases as well as voluntary reporting centers which were both passive surveillance. However, Li et al (2011) also utilized active case finding strategies such as house-to-house surveys, physical examinations for cured patients, household contacts of confirmed leprosy patients, and the clue survey, by which professional health workers collected and confirmed leprosy patients in the area according to the information provided by rural paramedical workers. Social condition provides an idea as to the economic status of leprosy patients. This is necessary because leprosy is

linked to poverty. Thus, we are able to see how many persons of poor economic status had leprosy. From the results it can be seen that most persons who were diagnosed with leprosy had a fair economic status. This meant that leprosy was not as prevalent amongst those of a poorer economic status. Patients that were diagnosed with MB leprosy were placed on the 3-drug regime (Dapsone, Clofazimine and Rifampicin) while patients who were diagnosed with the PB leprosy were placed on the 2-drug regime (Dapsone and Rifampicin). Alexander and Persaud (1997) confirmed that every patient that was registered, was placed on WHO-MDT standard regimes which included the use of Dapsone and Rifampicin for PB cases and Dapsone, Rifampicin and Clofazimine for MB cases. This medication was convenient to patients and health workers.

However, in September 1991 in order to facilitate the International Federation of Anti-Leprosy Associations (ILEP) recommendations, MB patients were given 24 monthly doses of MDT. As such, PB patients were treated for 6 months and MB for 24 months. Annually, the average number of patients who used chemotherapy was 38. In 1994, 100% of PB compliance and 95-98% MB compliance was recorded in Guyana. Thus, all patients completed their treatment within the set time frame. Patients who no longer had to use treatment were placed on passive surveillance (3 years for PB cases and 5 years for MB patients). Usually, the Guyana Hansen's Disease Control Programme prolonged treatment of patients for at least one year when they had negative smears or after their prednisolone therapy ended. Unfortunately, facilities were unavailable to determine what caused the relapse or re-infection. Between 2006 and 2016, 46% of new leprosy cases detected in Guyana occurred in people residing in the coastal regions with 19% occurring in Georgetown, confirming findings similar to De Souza Dias who examined the links between health, the local environment and development in Brazil.

This study recorded a trend in the leprosy cases in Guyana but the cases were not evenly distributed throughout region. The Hansen's Disease Control Programme was expanded in the year 2012, and hence could be a reason for decline in the year 2012, and the gradual enhancement of leprosy health care and service delivery over the preceding years indicating improved diagnosis and detection. To link with this, it will be wise to determine whether increased case detection of isolated cases are linked to prior base cases, migration of cases, presence of pathogen in the environment, or a disease wave. Region 4 recorded higher leprosy cases than other region. This could be due to the fact that region 4 is the capital of the country and patients could find it easy to approach the facility for diagnosis or treatment. New case detection activities, unavailability of data for some regions and integration of vertical systems into primary health systems as well as decentralization, could have resulted in fluctuations (increase and decrease) of leprosy cases throughout the ten years. The age group with 30-39 demonstrated high incidence of leprosy, this could be assumed due to their lengthy stay / exposure with parents who have / had the disease. This study did not analyze the relationship between disability before and after the diagnosis and treatment, so as to determine if any risk factors contributed to any further progression of the disabilities. A thorough study on finding the trends of leprosy among children, ethnic groups, various regions and so, would really contribute in understanding the cause of

leprosy. Moreover, the follow up of patients, even after their treatment / cure will be important to understand the challenges faced by the patient in the society.

Conclusion

Hansen's disease control programme in Guyana has been successful in controlling the disease. However, this effort should be further strengthened and elaborated, allocating resources and making all other efforts, within all regions until the disease is eliminated from the pockets of each administrative regions of the country.

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