Impairments and Hansen’s disease control in Rondônia State, Amazon region of Brazil

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Summary This retrospective study of impairments in a decentralized and integrated, routine Hansen’s disease (HD) programme was done on a cohort of all new patients detected in Rondônia state from 1996 to 1999. It shows that the dynamics of impairments during treatment in Rondônia are similar to what has been published in other recent studies from Africa and Asia. Data about impairments at detection and at release from treatment (cure), the prescription of steroids, and epidemiological information are provided. Of the original 5350 new patients, 4230 patients (80%) completed multidrug therapy (MDT) and had complete data about their impairment status. At the start of treatment, 9% of the paucibacillary (PB) and 26% of the multibacillary (MB) patients had WHO grade 1 impairment. Three percent of the PB and 11% of the MB patients had visible deformities (WHO grade 2 impairment). Of the patients without impairments (grade 0) at the start of treatment, 5% of the PB and 20% of the MB patients developed impairments during treatment. Of the PB patients with a WHO impairment grade 1 at start of treatment, 34% improved and 6% got worse. Of the MB patients 34% improved and 12% became worse. In a separate study of patients from the 1997 intake, 17% of the PB and 58% of the MB patients were treated at least once with a course of steroids or thalidomide during MDT treatment. It is noted in the literature that the percentage of persons with recent nerve function impairment (NFI), nerve pain or tenderness and/or reaction reactions differs between projects. This may reflect real differences or may be caused by differences in routine monitoring and/or criteria and methods of treatment. The use of the WHO maximum score, particularly for the patients with grade 2, is not as sensitive to change as utilizing the summary of Eye, Hand and Foot (EHF) scores. If overall impairment
figures are given, the proportions of MB patients may define the differences between projects, therefore it is important to analysis and present the results of PB and MB patients separately. The most simple (outcome) indicator to estimate the effectiveness of patient management would be the proportions of patients with impairment grade 0 at start of treatment who develop either grade 1 or 2 impairments during treatment. An additional (outcome) indicator could be the proportion of patients with impairment grade 1 at start of treatment who develop grade 2 impairments during treatment. Currently, no operational targets or acceptable level of performance for patient management have been set. This would be important to enable programme managers to determine if adequate patient education, treatment and follow up have been provided after the disease detection to prevent and/or minimize problems associated with the disease. The available evidence strongly suggests that reactions and impairments related to HD will continue to occur in large numbers, requiring the development of adequate infrastructures and sustainable services to detect and to manage problems associated with HD during and after MDT treatment.

Introduction

Many Hansen’s disease (HD) patients have already developed nerve function impairment (NFI) at the time of diagnosis. As stated by the ILA Technical Forum in 2002, the best way to prevent impairments is with early disease detection, and this should be a high priority. However, early detection and treatment with MDT alone will not prevent all NFI. Significant numbers of patients develop NFI during and even after treatment. MB patients are at highest risk of developing reactions and NFI. The presence of impairment at diagnosis proved to be a major risk factor for developing new impairment in both PB and MB patients. Over the past few years, many well documented studies have been published. In most HD control programmes, regular monitoring of nerve function and the treatment with steroids have been introduced. Prevention of nerve damage and the proper management of impairments are important components of any HD programme. The objective of impairment prevention is that patients should not develop new impairments apart from those that were irreversible at diagnosis. A simple programme outcome indicator to estimate the effectiveness of patient management is needed.

Until the end of the 1940s, HD patients in Brazil were segregated and forcefully required to live in leprosaria. Many patients escaped and went to hide in the Amazon forest of Northern Brazil. This is one explanation given to explain why many foci of Hansen’s disease were found among the riverside dwellers and rubber gatherers. Remarkably, HD is not found among the indigenous people, although this group has a high incidence of tuberculosis.

Rondônia, one of the Amazon region states of Brazil, saw a rapid increase of population with the opening of a national highway in 1982. The population grew from 490,000 in 1980 to one million in 1989. Rondônia changed from being a state mainly inhabited by persons living alongside rivers, rubber gatherers and indigenous people, to a state characterized by migrants from all over Brazil. Most of these migrants settled along the new highway and started to move into the interior. They became involved in the wood industry, agriculture, cattle raising and mining.

HD turned out to be highly endemic among the new migrant population. One example is observed in the municipality of Buritis. Buritis originally was a part of another municipality which had a recorded population of only 4000 persons in 1993. In 1995, Buritis became a
municipality of its own with a population in 1996 of 9157 persons. This population had grown to 30,000 in 2002. The number of new HD patients of Buritis was eight in 1996 (a detection rate of 9 per 10,000). Notification increased rapidly, reaching 54 in 2000 (21 per 10,000), 117 in 2001 (42 per 10,000) and 81 in 2002 (27 per 10,000).

In 1994, a new National Information System for Notifiable Diseases (SINAN) was introduced by the Ministry of Health. For the first few years, only notification data were processed through SINAN, but since 2000, follow-up data (e.g. release from treatment) are required for chronic diseases like HD and tuberculosis. There have been many problems with the introduction of this system, particularly related to the collection and completeness of follow-up data.

This article will be using the term ‘Hansen’s disease’ (HD) out of respect to persons with the disease, in addition to honouring Brazil’s political and legal requirements to use this term when referring to the disease of leprosy.

The current study was undertaken to investigate whether the occurrence and dynamics of impairment in Rondônia would differ from those already published from Asia and Africa.

Materials and methods

This is a retrospective study of all patients newly diagnosed and notified in Rondônia from 1996 to 1999. A treatment cohort analysis along with impairment data at diagnosis and release from treatment are presented. Patients registered before 1996 were not included because national impairment criteria were not well defined. Patients registered after 1999 have not been included because not all had finished their treatment at the time of this analysis. The MDT MB 12 dose regimen has only been gradually introduced since 2000 and as of 2002 not all MB patients are on a 12-dose regimen.

In addition, some data are used from a study in 2001 which evaluated records of new patients of 1997. All MB patients and half of the PB patients were included. Part of this study was presented as a poster during the Salvador ILA Congress in August 2002. However, none of the data presented in this paper were presented at the Congress.

Rondônia

Rondônia is situated in the north-western part of the country, bordering Bolivia. The state was established in 1943 by dividing up parts of the states of Mato Grosso and Amazonas. The land surface area is 239,000 km² and the population was 1.4 million in 2002. Porto Velho is the capital, with 319,000 inhabitants. Sixty-six percent of the population live within urban areas and the majority of the population has only a minimum standard of living. The state is characterized by a poorly developed infrastructure and services. Many diseases common in this region are: malaria, leishmaniasis, rabies, leptospirosis, tuberculosis, HD and countless other diseases. The climate in the Amazon region is hot and humid.

Hansen’s Disease Control Programme

Up till 1992, the HD control programme was poorly organized and patient care was provided by a specialized, vertical service situated only in the main population centres. At the end of 1992, a new state coordinator/manager was appointed and a more systematic organized
control programme started. At that time there were 23 polyclinics in 22 of the 40 municipalities where patients were diagnosed and treated. In 1994, the gradual process of decentralization and integration of HD control into the general health services was started. Today, 48 out of the now existing 52 municipalities (92%) provide HD services with only a few health centres in each municipality actually involved in the programme. Health education campaigns and surveys were organized in 1994, 1995 and 1996. The training of health staff to do a neurological examination of patients, prevent impairments and disabilities started in 1994. Self reporting and to a lesser extent contact examination are the main modes for case detection. Patients are seen monthly for supervised MDT treatment. Nerve function is monitored every 3 months when there is no specific problem observed. There is no active surveillance after release from treatment. There is one non-governmental hospital providing surgical and non-surgical rehabilitation.

WHO RECOMMENDED MDT REGIMEN

Multidrug therapy (MDT) was first introduced in Porto Velho in 1989. One hundred percent MDT coverage of all newly diagnosed patients was reached in 1996. A fixed 24-dose MDT regimen for MB cases existed in 1994, which since 2000 is gradually being changed to a 12-dose regimen.

DIAGNOSIS AND CLASSIFICATION

Up until recently, the diagnosis and classification of the disease were based on clinical examination and routine split skin smears. The classification followed the system as advised by the Madrid International ILA Congress of 1953. With the introduction of the WHO regimen (in Rondônia in 1989), the terms ‘indeterminate’ and ‘tuberculoid’ were assigned to the MDT-PB group and ‘dimorphous’ and ‘vichowian’ to MDT-MB group (as has been the case in this study). In 2000, the Ministry of Health decided that the diagnosis could be made on clinical grounds (loss of sensation in a typical skin lesion and/or thickening of peripheral nerve) with split skin smears done only in exceptional cases. However, in Rondônia, smears continue to be taken from all suspected cases.

NERVE FUNCTION IMPAIRMENT AND REACTIONS

The diagnosis of nerve function impairment (sensory and/or motor function loss), nerve pain or tenderness and reactions are similar to international criteria. In Brazil, sensory testing is performed with a nationally made Semmes-Weinstein monofilament kit consisting of 6 filaments (approximately 0.05, 0.2, 2, 4, 10 and 300 g). In Figure 1, sensory testing sites for the eyes, hands and feet are shown. Corneal sensation is tested with a standard 5 cm length of dental floss touching perpendicular in the lateral lower quadrant of the cornea. Six sites on the palmar surface of the hands are tested, three ulnar and three median nerve innervated sites. The sole or plantar surface of the foot is tested at nine sites. Rondônia state used the three scales (strong, weak, paralysed) in the field to evaluate the movements of eyelid closure, finger and thumb abduction, fifth finger intrinsic position, wrist extension, extension of the hallux and dorsiflexion of the foot (see Table 1).
Impairments are registered according to the WHO disability grade (8) with a grade 1 recorded if the 2 g monofilament or the light touch of the pen is not felt to the palm of the hands or the soles of the feet. A grade 1 also includes corneal sensory loss. A grade 2 impairment is given for any visible impairment related to HD such as lagophthalmos, central corneal opacity, clawing of fingers and toes, wounds or injuries to areas with sensory loss, etc. and a visual acuity loss of 6/60 or inability to count fingers at 6 meters. In Rondônia, prednisolone treatment starts with approximately 60 mg (1–2 mg/kg bodyweight), which is reduced gradually to zero over a 4-month period. If the clinical signs lack improvement, this period can be extended for several additional months, and the patient referred to the surgeon for nerve decompression. The national programme recommended criteria for nerve decompression are: Patients who have a contraindication for the use of corticosteroids, nerve abscess, patients whose pain and/or nerve function does not change or improve after clinical treatment with corticosteroids (1–2 mg/kg) within 4 weeks, repeated signs and symptoms (three episodes) of nerve function impairment and/or pain after adequate treatment of a previous neuritis and patients with uncontrolled and/or chronic pain. In case of ENL, thalidomide is the drug of choice in males, and prednisolone and clofazimine is used in females of child-bearing age.

<table>
<thead>
<tr>
<th>Eyes</th>
<th>Light lid closure, lid gap measured in mm (facial nerve) Force measured strong, weak or paralysed for tight lid closure, lid gap measured in mm (facial nerve)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands</td>
<td>Fifth, second finger abduction and fifth finger intrinsic position (ulnar nerve) Thumb abduction (median nerve) Wrist extension (radial nerve)</td>
</tr>
<tr>
<td>Feet</td>
<td>Force measured strong, weak or paralysed for: Extension of hallux (peroneal nerve) Dorsiflexion of the foot (peroneal nerve)</td>
</tr>
</tbody>
</table>
Data Analysis

Patient data were retrieved through the bank of the National Information System for Notifiable Diseases (SINAN). Epi-Info software was used for the analysis. The official state epidemiological reports describe the epidemiological changes that occurred from 1991 to 2001.

Results

The prevalence rate of HD in Rondônia was 39/10,000 in 1991 and declined to 11/10,000 in 2001. The detection rate increased from 6/10,000 in 1991 to 13 in 1996, and declined to 9 in 2001. Thirteen percent of new patients had a WHO impairment grade 2 in 1992, declining to 4% in 2001. Patient data before 1991 are not very reliable, and therefore are not presented here.

New Patients 1996–1999

In total, 5360 new patients were registered from 1996 to 1999. The MB proportion of new patients was 32%, the male/female ratio 1:5 and the percentage of children was 9%. Ninety-eight percent of patients underwent an impairment examination at the start of treatment, demonstrating that 9% of the PB patients and 26% of the MB patients had WHO grade 1 impairment. Three percent of the PB patients and 11% of the MB patients had WHO grade 2 impairment. The combined percentages of PB and MB patients demonstrate that 80% had no impairments and that grade 1 impairments were 3 times that of the grade 2 impairments (Table 2).

Treatment Cohort Analysis

Of the original group, 62 turned out to have been misdiagnosed; therefore the treatment cohort of 5298 is shown in Table 3. Data about patients cured, those who died, those who were transferred out (within municipalities, to other municipalities, to other states) and defaulters in both PB and MB groups are presented. The impairment data of the ‘defaulter’ group were slightly better than of the total cohort. However, of the ‘transferred out’ group, the impairments in both PB and MB patients were worse. In addition, the MB proportion of the transferred group was 50%.

Patients Who Completed Their MDT Treatment

Table 3 showed that 4328 patients (82%) finished their MDT treatment of which 98% underwent an impairment examination at the time of release from treatment (RFT). In all,
Table 3. Cohort analysis of treatment results of Hansen patients, Rondônia, 1996–1999

<table>
<thead>
<tr>
<th>Treatment outcome</th>
<th>PB</th>
<th>MB</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cured</td>
<td>3126</td>
<td>1202</td>
<td>4328</td>
</tr>
<tr>
<td>Died</td>
<td>14</td>
<td>41</td>
<td>55</td>
</tr>
<tr>
<td>Transferred out</td>
<td>220</td>
<td>288</td>
<td>508</td>
</tr>
<tr>
<td>Defaulters</td>
<td>223</td>
<td>184</td>
<td>407</td>
</tr>
<tr>
<td>Total</td>
<td>3583</td>
<td>1715</td>
<td>5298</td>
</tr>
</tbody>
</table>

4230 cured patients had an impairment examination at the start of treatment and at RFT. A comparison of impairments at diagnosis and at RFT is demonstrated in Tables 4 and 5. Of the 2747 cured PB patients with no impairment at the start of treatment, 146 patients (5%) developed impairments during treatment of which most were WHO grade 1. Of the 249 patients who had a grade 1 at the start of treatment, 149 (60%) stayed the same, 85 (34%) improved becoming grade 0, and 15 (6%) got worse. Of the 61 patients with grade 2 at the start of treatment, 51 (84%) stayed the same and 10 (16%) improved of which 3 became grade 0. At RFT 88% of the PB patients had no impairments, 9% had grade 1 and 3% grade 2 (Table 4). Of the 842 cured MB patients with no impairment at the start of treatment, 165 (20%) patients developed impairments during treatment of which most were WHO grade 1. Of the 232 patients who had a grade 1 impairment at the start of treatment, 126 (54%) stayed the same, 79 (34%) improved becoming grade 0 and 27 (12%) got worse. Of the 99 patients with grade 2 at the start of treatment, 53 (54%) stayed the same and 46(46%) improved of which 14 became grade 0. At RFT 66% of the MB patients had no impairments, 25% had grade 1 and 9% grade 2 (Table 5).

RECENT NF1, NERVE PAIN OR TENDERNESS AND/OR REACTIONS AMONG PATIENTS REGISTERED IN 1997

In 2001, the records of 50% of the PB patients and 100% of the MB registered in 1997 were reviewed. During MDT treatment, 66/389 PB patients (17%) and 154/267 MB patients (58%)

Table 4. Comparison of the impairment grades of the 1996–1999 cohort of new PB patients at diagnosis and at release from treatment

<table>
<thead>
<tr>
<th>At diagnosis</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>At release from treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0*</td>
<td>2601</td>
<td>130</td>
<td>16</td>
<td>2747</td>
</tr>
<tr>
<td>1</td>
<td>85</td>
<td>149</td>
<td>15</td>
<td>249</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>7</td>
<td>51</td>
<td>61</td>
</tr>
<tr>
<td>Total</td>
<td>2689</td>
<td>286</td>
<td>82</td>
<td>3057</td>
</tr>
</tbody>
</table>

*To read cross tabulation: at start of treatment 2747 PB patients had no impairments; at release from treatment 2601 (95%) were still grade 0, 130 (4.7%) became grade 1 and 16 (0.3%) grade 2.
had been treated for a new NFI, nerve pain or tenderness and/or reactions (including ENL in MB patients) with steroids or thalidomide in case of ENL in males. The majority of patients were treated for new NFI, nerve pain or tenderness. Of the PB patients with grade 0 at start of treatment 13% were treated with steroids, and of the patients with the grades 1 and 2 this was 36%. Of the MB patients with grade 0 at start of treatment 54% were treated with steroids or thalidomide, and of the patients with the grades 1 and 2 this was 63%.

Discussion

The standard of patient care and the reliability of data from decentralized, integrated control programmes cannot be compared to the quality of a specialized vertical programme. Routinely collected data are often unreliable; however, that should not stop the data collection, as long as its limitations are understood. It reinforces the need to constantly supervise the quality of data collected. HD control programmes depend on them for its planning and management. The absolute values of process and outcome indicators, operational and epidemiological indicators may not be as important as the trends they demonstrate. Clearly defined and consistent indicators allow comparison within and between countries. Differences in the numbers of patients with (recent) NFI, nerve pain or tenderness and/or reactions noted in the literature and between projects may reflect real differences, but may be caused by differences in routine monitoring and/or criteria and methods of treatment.

IMPAIEMENTS AT DETECTION

In this study, 12% of PB patients and 37% of MB patients had grade 1 or 2 impairments at the start of treatment. There is a gradual decline in the percentages of new patients with grade 2 impairments over the past 10 years suggesting a decrease in the delay of diagnosis in Rondônia. Percentages of impairments (WHO grades 1 and 2 together) at first examination vary greatly world-wide. In the literature, impairment figures in PB patients from Bangladesh are 10% as compared to 55% in Ethiopia. Impairment figures for MB patients in Nepal are 31% compared to 56% in Ethiopia. This variation may partly reflect unclear and/or non-specific definitions for the WHO impairment grades, especially grade 1 and the different methods used to determine grade 1 (2, 10 g, or ballpoint pen). If impairment figures combined...
PB and MB patients are given, the proportions of MB patients may define the differences between projects.

TREATMENT COMPLETION

The Ministry of Health of Brazil considers a cure rate of 90% and higher a good result, a cure rate of less than 75% as poor. In Rondônia, 87% of PB patients and only 70% of the MB patients completed their treatment (this improved to 80% in the 2000 MB cohort). This indicates a need to determine why patients are not completing treatment, particularly MB patients. This treatment result is distorted by the large group of patients, especially MB group, transferred out (Table 3). Patients transferred within the state, and if they report to the new treatment centre can be traced back through SINAN. However, patients transferred to other states cannot be traced. It appears that this group of ‘transferred out’ patients in this study is different from the overall cohort. Sometimes it is advised not to include patients ‘transferred out’ in the denominator of the cohort analysis. However, based on the above observation this would not be advisable. In TB programmes in Africa, patients ‘transferred out’ are said to be actually hidden defaulters. One has to be aware of this, and efforts should be made by the team to follow up these patients.

NEW IMPAIRMENTS DURING MDT TREATMENT

The Bangladesh Acute Nerve Damage Study group proposed a clinical prediction rule to estimate NFI occurring within 2 years of diagnosis.\textsuperscript{13} PB patients with no NFI detectable at diagnosis are considered low risk; PB patients with NFI or MB patients without NFI are considered medium risk; and MB patients with NFI are considered high risk.

In the group of patients having no impairments at the start of treatment, 5% of PB and 20% of MB developed impairments during treatment (Tables 4 and 5). The literature shows figures (the risk of getting impaired) ranging in PB cases from 0.8% in Thailand\textsuperscript{14} to 4% in Ethiopia,\textsuperscript{15} and ranging in MB cases from 10% in Nepal\textsuperscript{2} to 21% in Ethiopia.\textsuperscript{15} Out of the initially impaired PB patients, 65% stayed the same, 31% improved and 4% progressed to a higher impairment grade at RFT. Of the initially impaired MB patients, 54% stayed the same, 38% improved and 8% progressed to a higher grade.

In the more recent literature, the preference is to use the combined EHF (eyes-hands-feet) scores and not just the maximum WHO grade per person as the EHF score is more sensitive to change.\textsuperscript{16} One has to be aware that the maximum WHO grade is different from the EHF score, requiring care when comparing results in the literature. Van Brakel \textit{et al.}\textsuperscript{17} showed how EHF detected changes in the impairment status that were ‘hidden’ when using the maximum grade score. Grade 2 impairments are ‘unable’ to deteriorate due to the limitation of the maximum WHO grading system. In 31% of patients, the changes detected with the EHF score were bigger than revealed by the method of maximum grades. Improvement or deterioration of impairment status (EHF score versus stable maximum grades) were missed in 16% of the patients.\textsuperscript{17} This is a strong argument in favour of using the EHF score, instead of the maximum grade. In the present study, 104 patients who had grade 2 impairments at the start of treatment still were classified as grade 2 at release from treatment. Even if only a small proportion of these 104 patients with grade 2 impairments had deteriorated (as measured by the EHF score), this could have made a big difference in the overall percentage of patients who became worse during treatment. The worsening of EHF scores among WHO grade 2
patients frequently reflects difficulties of teaching and/or practising self-care in addition to providing and/or using of protective footwear which can prevent or minimize complications in those persons who have permanent NFI.

EHF scores were used in recent studies from Ethiopia. In Ethiopia, out of the initially impaired PB patients, 41% improved and 13% progressed to a higher total EHF score. Out of the impaired MB patients, 43% improved and 13% progressed to a higher total EHF score.\textsuperscript{15} Saunderson \textit{et al.} write that ‘patients with no new neuropathy after diagnosis show a gradual improvement in their EHF score, while those with any episodes of neuropathy after diagnosis show a gradual deterioration after completion of MDT’.\textsuperscript{4} In some studies spontaneous recovery of nerve damage was found in up to a third of nerves.\textsuperscript{18} In another study, many of the cases recovered more than one year after treatment with steroids.\textsuperscript{4} In the same study, the recovery of new NFI treated with steroids was good, but recovery of recurrent or chronic cases was considerably less.

\textbf{STERIOD PRESCRIPTION DURING TREATMENT}

In the study from Rondônia about new patients from 1997, 17% of PB and 58% of MB patients received steroids or thalidomide (once or more times) during treatment. Corresponding figures from the AMFES project in Ethiopia were 19% for PB and 37% for MB patients.\textsuperscript{19} Although there are national guidelines from the Ministry of Health, Brazil for the use of steroids, prescription practice of steroids in Rondônia differs widely, as it does in many other states of the country. This calls for constant attention of the state and municipal health managers during supervisory visits, patient discussion and seminars.

\textbf{PERFORMANCE PATIENT MANAGEMENT}

Chemotherapeutic effectiveness is measured by the relapse rate among patients who completed the course of treatment. The MDT treatment outcome of a control programme is determined by the proportion of patients who completed treatment within the prescribed period of time. The effectiveness of patient management can be roughly measured by the occurrence of impairments among cohorts of patients whose WHO grade is measured at the beginning of treatment and compared to their WHO grade at RFT.

The most commonly used measurement of impairments is the maximum WHO Disability Grade found for eyes, hands and feet. It is used as an indicator for early case-detection and could be used to evaluate if a cohort of patients has been managed adequately during treatment. However, it has very limited value in monitoring the progress of individual patients. Routine assessments of nerve function, based on voluntary motor testing and sensory testing, are more appropriate for monitoring NFI of individual patients.\textsuperscript{1} As mentioned earlier, the advantage of using the total EHF score is that it reflects the seriousness of the total impairments per patient and can be more sensitive in showing changes that are not perceived when using the maximum WHO impairment grade.\textsuperscript{2,16,18} Usually national health managers want to keep data input to a minimum; therefore details on impairments are generally restricted to the maximum WHO grade. It is possible to calculate EHF scores when reviewing records at the individual local health centre.

No operational targets or acceptable level of performance for patient management has yet been set. Even in the best circumstances some patients will deteriorate during (and after) treatment. A multicentre study will be needed to determine what would be the best
performance under most optimal conditions. The simplest indicator to estimate the effectiveness of patient management would be the proportion of patients with no impairment at start of treatment who develop either grade 1 or 2 at RFT. In the literature the risk of getting impaired at the lower range is stated as 0·8% in PB patients in Thailand and 10% in MB patients in Nepal. An additional indicator would be the proportion of patients with impairment grade 1 at start of treatment who developed grade 2 impairments at RFT. Both indicators are calculated by comparing the impairments at start and release from treatment in a treatment cohort group. The use of cohorts could help managers determine acceptable levels of performance in health services to follow patients adequately with needed education and treatment during and after MDT to prevent and minimize complications and disability.

HANSEN’S DISEASE AMONG MIGRANT POPULATION

It is not well understood why such a high incidence of HD is seen among this migrant population. Assuming that infection rates are high among most communities in Rondônia, is the incidence among the migrants different from the incidence among the family members and neighbours who stayed behind? Does the process of migration play a role, or are the physical surroundings and poor living conditions to blame?

CONCLUSION

The available evidence strongly suggests that a significant HD problem will continue to exist for many years to come. Services to detect new cases and to manage the problems associated with HD must therefore be sustained by integrated and decentralized health services.

Acknowledgements

We dedicate this article in memory of Mrs Wally Hirschmann, nursing officer, who died in July 2001 after a long illness. For many years, she was the driving force behind the HD programme of Rondônia. The dedication and motivation of the many health staff in Rondônia made it possible to achieve the excellent results in this endemic and difficult to access area. Kind assistance was given to the state team by the technical advisory team of the National HD Control Programme Coordination Office of the Federal Ministry of Health, Brazil. The Netherlands HD Relief (NLR) provided ample support throughout the years.

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