A big challenge in case finding at low endemic situation: Analysis on 1462 new leprosy patients detected in China in 2007

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Summary
Objective: To understand the characteristics of newly detected leprosy patients at low endemic situation in China in order to provide information for better leprosy control.
Methods: A study was carried out using a designed questionnaire in a retrospective method in China in 2007.
Results: Among 1462 new patients studied, the average age at diagnosis was 41.5 ± 15.8 years. Nearly half of new patients were detected by a passive method at the skin clinic. This might relate to a long delay between disease onset and diagnosis (3.23 ± 4.5 years) as well as a high rate of disability Grade 2 among new patients (22.6%). There were 363 (24.8%) patients who came from non-leprosy endemic areas, 844 (57.7%) patients who came from non-leprosy families and 409 (28.0%) patients who came from villages where leprosy outbreaks had never occurred before.
Conclusion: Case finding within low endemic areas of China is a big challenge in leprosy control. Maintaining sustainable leprosy control and strengthening leprosy training among dermatologists may be the important strategy in the future.

Introduction

Leprosy in China has been at a low endemic level since the 1980s. However, it is puzzling that with more than a decade of hardworking control on leprosy in China, the number of newly detected cases each year has not significantly decreased. There are still more than 1500 new leprosy patients who have been detected annually for nearly 15 years. What are the
characteristics of new patients detected and what changes happened in case detection methods? Where did these new patients come from? Are there some differences in case finding and characteristics of new patients detected between Southwest and East China? In order to understand the characteristics of newly detected leprosy patients at low endemic situation in China, and to provide information for better leprosy control, we carried out a special survey on new leprosy patients detected in China in 2007.

Patients and Methods

Leprosy patients newly detected in 2007 in the country were included for analysis. A special questionnaire was designed which included general information about the patient’s name, sex, age, residence, time of onset and diagnosis of leprosy, clinical type, method of detection, bacterial index, endemic situation of residence area, leprosy history in the family and village, etc. The questionnaire was sent to each county unit responsible for leprosy control through the Provincial Centre. The questionnaires were filled in by health workers at county level and then sent to the National Centre for Leprosy Control through the Provincial Centres.

The data were checked, then put into the computer for analysis using SPSS software version 10.0.

DEFINITION OF TERMS USED IN THE STUDY

Endemic areas: All China is at a low leprosy endemic situation as compared with other leprosy endemic countries in the world. However, in this study we use a relative leprosy endemic concept that the provinces with case detection rate of more than 0·2/100,000 at provincial level are regarded as leprosy endemic areas, such as Yunnan, Guizhou, Sichuan, Tibet and other provinces in China.

Non endemic areas: The provinces with case detection of less than 0·2/100,000 are regarded as leprosy non-endemic areas, such as many northern provinces in China. The eastern provinces in China previously had a high leprosy prevalence and now the case detection rates are significantly reduced to less than 0·2/100,000, so are also regarded as non leprosy endemic areas.

Leprosy family: In China, there is a special Station for Leprosy Control or a Department for Leprosy Control at the Centre for Disease Control and Prevention at county level in most areas of the country. They are actively working on leprosy control. All leprosy drugs are sent by these units from the National Centre for Leprosy Control, and the medical documents of leprosy patients are kept at these units. So the family history of a leprosy patient is clearly known by local health workers. The families with previous registered patients are regarded as leprosy families.

Non leprosy family: The families without any previous registered leprosy patients.

Clue survey: This is usually organised by the county Station of Leprosy Control or the Department of Leprosy Control at county level by issuing a formal document requiring paramedical workers working at all village clinics to visit villages and report suspected cases of leprosy after a simple training on leprosy knowledge.

Contact survey: This is usually done by professional workers at county level. All household contacts of leprosy patients who are not clinically cured should be checked each year as stipulated by the National Guidelines of the Leprosy Control Programme.
Group survey: This is also done by professional workers through examining of a whole group of people at a school, or a place of recruitment for new workers, or new army soldiers.

Skin clinic: There are many skin clinics at county towns in China. Most county stations for leprosy control set a skin clinic as a ‘window’ to find leprosy patients among people with skin diseases. The county stations for leprosy control originated from local leprosy hospitals or leprosy villages in the 1980s when most medical staff moved into county towns to set units of leprosy control. As a consequence, the skin clinics at district or provincial level usually have some experienced leprosy experts. The skin clinics at district or provincial level are usually working as referral centres for diagnosis of difficult cases of leprosy coming from nearby areas. Many leprosy experts working at skin clinics are members of the China Leprosy Association. They also train young health workers working at a lower level on leprosy.

Referral: Leprosy is a rare disease for many dermatologists working at general hospitals. When they suspect a patient of having leprosy, but cannot confirm it, they will advise the patient to go to the special skin clinics for diagnosis of the disease.

Migrants: People who live and work in a place that is not his/her place of birth for more than one year are regarded as migrants. In this study, due to a small proportion of new migratory patients as compared to all newly registered patients in China, leprosy patients detected among migrants were analysed with other new cases in the resident areas where they were detected.

Results

In 2007, a total of 1526 new leprosy patients were detected in the country according to the National Surveillance System on Leprosy. But during the study, some questionnaires could not be used due to many errors. Only 1462 questionnaires (patients) were qualified for the study which accounted for 95·8% of all newly detected cases. The map shows the distribution of 1462 new patients at district level.

Most new patients were detected in southwestern provinces of China (Yunnan, Sichuan and Guizhou). In eastern provinces, where the economy is comparatively developed (Shandong, Jiangsu, Zhejiang), fewer new patients were detected. There was also a phenomenon that many migratory leprosy patients mostly coming from southwestern provinces were detected in eastern provinces (Figure 1).

Among the 1462 new patients, 1012 were male and 449 were female. The average age at diagnosis was 41·5 ± 15·8 years and mean delay from disease onset to diagnosis was 3·23 ± 4·5 years. The rate of Grade 2 disability among new patients was high at 22·6%, and 2·3% were child cases. By WHO classification 253 patients (17·3%) were paucibacillary (PB), 1173 (80·2%) were multibacillary (MB) and 36 (2·5%) were not clearly classified. Nine hundred and twenty two patients (63·1%) were skin smear positive and 392 (26·8%) were negative. The remaining 148 (10·1%) patients did not receive a skin smear at diagnosis. Regarding leprosy reaction at diagnosis, 79 (5·4%) patients had a Type I reaction and 121 (8·3%) patients had a Type II reaction. Five (0·3%) patients had a mixed Type I and II reaction, and 1030 (70·5%) patients had no reaction. In 227 (15·5%) patients the reactional status was not clear.
The environmental background of patients with respect to leprosy endemicity is shown in Table 1.

Of the 1462 patients, 199 (13.6%) were detected within 1 year of the onset of symptoms of leprosy, 418 (28.6%), 307 (21.0%), 167 (11.4%), 93 (6.4%) and 50 (3.4%) were detected 2, 3, 4, 5, and 6 years after onset of symptoms, respectively. There were 228 (15.6%) patients who had been detected 7 years or more after onset of symptoms.

Table 2 shows differences in case detection between eastern and southwestern provinces of China. The mean age at diagnosis of patients in southwest provinces was lower than that in eastern provinces. The mean delay from onset of symptoms to diagnosis of leprosy was shorter in patients detected in eastern provinces. The proportion of BI positivity among new patients detected was similar between southwestern and eastern provinces (Table 2).

Indicators in the method of case detection for new patients also showed some differences between southwestern and eastern provinces of China. In eastern provinces, skin clinics ranked at the top showing that 63.1% of all new patients were detected by this method. This was followed by referral (20.6%), clue survey (9.2%), other (3.1%), not clear (2.8%) and contact survey (2.1%) which ranked the last. Although the skin clinic also ranked at the top in southwestern provinces of China, it only constituted 45.6% of all new patients.

Table 1. The leprosy endemic status of leprosy patients diagnosed in China in 2007

<table>
<thead>
<tr>
<th>No. of patients studied</th>
<th>No. of new patients coming from different areas (%)</th>
<th>No. of new patients coming from families (%)</th>
<th>No. of new patients coming from villages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non leprosy endemic</td>
<td>Leprosy endemic</td>
<td>Not clear</td>
</tr>
<tr>
<td>1462</td>
<td>363 (24.8)</td>
<td>1354 (67.8)</td>
<td>108 (7.4)</td>
</tr>
</tbody>
</table>

Concerning the detection of new patients, we found that, overall, skin clinics (49.7%) ranked first, followed by clue survey (22.4%), referral (11.3%), contact survey (8.0%), group survey (7.0%).
followed by clue survey (25.3%), contact survey (12.0%), group survey (9.1%), referral (6.6%) and not clear (1.5%), respectively, which were different from those in eastern provinces of China (Table 3).

The indicators of leprosy for migratory patients also showed differences from non-migratory ones. Among 78 migratory patients, the delay time was 4.3 ± 4.9 years which was longer than (3.2 ± 4.5 years) of non-migratory patients. Migratory patients had an 83% (63/76) of skin smear positivity, while non-migratory patients only 70% (859/1238).

### Discussion

When leprosy prevalence decreases, there is an increasing trend in the mean age of patients at detection. Usually, the mean age at detection is a little higher at a low endemic situation than at a high endemic one. It was reported that the age of new patients at detection in Tamil Nadu, India, a leprosy high endemic area, was 31.2 years old.\(^1\) In China, the mean age of new patients at detection was 37.9 years in 1997.\(^2\) Our study found that the mean age had increased by nearly 4 years from 37.9 years in 1997 to 41.5 years in 2007. In the USA, from 1932 to 1981, the delay between onset and detection of the disease shortened, and the mean age of patients at detection increased by 2.7 years over each 10 year period, reaching 51.7 years by 1981.\(^3\)

During the MDT and post MDT era from 1985 to 2002, there was an increase in MB/PB ratio and the proportion of patients with bacteriological index among new patients in China.\(^4\) This trend was also investigated in India.\(^1,5\) In our study, the MB patients accounted for 80.2% and the proportion of patients with BI positive accounted for 63.1% of all new patients, respectively. The high proportion of MB cases who were BI positive may increase the risk of leprosy transmission among the non-immune public.

### Table 2. Comparison of some indicators of leprosy between eastern and southwestern provinces in China in 2007

<table>
<thead>
<tr>
<th>Areas*</th>
<th>Population (millions)</th>
<th>New cases detected</th>
<th>Case detection rate/100,000</th>
<th>Mean age at diagnosis</th>
<th>No. of Child cases (%)</th>
<th>Delay to diagnosis (years)</th>
<th>BI positivity among new patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern provinces</td>
<td>220.5</td>
<td>88</td>
<td>0.040</td>
<td>46.4 ± 17.2</td>
<td>1 (1:1)</td>
<td>4.56 ± 5.4</td>
<td>73.6 (64/87)</td>
</tr>
<tr>
<td>Southwestern provinces</td>
<td>166.1</td>
<td>792</td>
<td>0.477</td>
<td>39.4 ± 14.9</td>
<td>18 (2:3)</td>
<td>2.56 ± 3.5</td>
<td>72.0 (518/719)</td>
</tr>
</tbody>
</table>

*Eastern provinces comprise Jiangsu, Shandong and Zhejiang provinces, Southwestern provinces comprise Yunnan, Guizhou and Sichuan provinces.

### Table 3. Comparison of detection type among new patients between southwestern and eastern provinces of China in 2007

<table>
<thead>
<tr>
<th>Areas</th>
<th>Skin clinic (%)</th>
<th>Referral (%)</th>
<th>Contact survey (%)</th>
<th>Clue survey (%)</th>
<th>Group survey (%)</th>
<th>Not clear (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southwestern provinces</td>
<td>45.6</td>
<td>6.6</td>
<td>12.0</td>
<td>25.3</td>
<td>9.1</td>
<td>1.5</td>
</tr>
<tr>
<td>Eastern provinces</td>
<td>63.1</td>
<td>20.6</td>
<td>2.1</td>
<td>9.2</td>
<td>3.1</td>
<td>2.8</td>
</tr>
</tbody>
</table>
Leprosy is an infectious disease. The household contacts of leprosy are the population with the high risk of developing the disease,6–8 especially in a leprosy family with more than 7 members.9 It was reported that during the leprosy elimination campaign (LEC) carried out in China from 1998–2000, the number of new patients detected was significantly higher than previously observed.10 The rapid village survey can also be applied as an effective method in case finding under low-endemic conditions as reported in Thailand and Indonesia.11,12 However, some new findings observed in our study showed that 24·8% of new patients came from leprosy non-endemic areas, 57·7% of new patients coming from non-leprosy families and 28% of new patients came from a village that had never had leprosy before. This new situation brings about a difficulty in case finding, especially at a low endemic situation. Previously effective methods of active case finding show no dramatic results in detecting new patients in recent years in China. It was reported that no leprosy case was detected in a rapid village survey in 91 villages with a total population of 104,885 in Shandong province.13 According to personal communication, very few new patients were detected in the LEC supported by local governments in some areas in recent years. There also was a study in East China of Shandong Province showing that a household contact survey had little value in case finding, as only 13·3% and 11·1% of household contact patients could be detected within 5 or 10 years, respectively.14 So China faces the situation that leprosy does not disappear; some new leprosy patients decreased in some areas, but some new cases occurred in other areas. This may be a reason why active case finding activities cannot be effective in detecting many new cases in some areas at a low leprosy endemic situation.

It is an astonishing fact that only 13·6% of patients were detected within 1 year of the onset of symptoms of leprosy. This also meant that 86·4% patients were detected within 2–6 years or even later after they suffered from leprosy. Considering that the high skin smear positive rates among new cases, and the number of new patients detected each year has not decreased significantly in the past 10 years in some provinces in China, we can conclude that the transmission of leprosy continues at a low endemic situation.

Methods for detecting new leprosy patients in China have changed. We found that skin clinics were the most effective, detecting 49·7% of new patients. The clue survey which relied on a rural health paramedical worker working at village clinics to report those suspects of having leprosy, ranked second (22·4%), and referral ranked third (11·3%). The contact survey only accounted for 8·0%, ranking it fourth. In comparing southwestern provinces with eastern provinces in case detection, a big difference was observed. In eastern provinces, most new patients were detected by a passive case finding method. The skin clinic and referral accounted for 63·1% and 20·6% of all new patients, respectively. The contact survey (2·1%) and clue survey (9·2%) only detected very small numbers of new patients. However, active methods such as the clue survey (25·3%) and contact survey (12·0%) were important methods in case finding in southwestern provinces. The skin clinic (45·6%) also detected a high proportion of cases. A large proportion of new patients that were diagnosed with leprosy through a passive method at the skin clinics, showed a long delay between disease onset and detection (3·23 years on average), and also showed a high rate of Grade 2 disability (22·6%).

Because the skin clinic played an important role in case detection, a study was conducted in China that assessed the knowledge and skill of dermatologists working at general hospitals.15 It found that continuous training was needed for dermatologists, especially for palpation of the peripheral nerve trunks and sensation examinations of the skin lesions. At a low endemic situation, delay in diagnosis of leprosy is a common phenomenon. Dr. Diana Lockwood reported that delay in diagnosis occurred in 82% of cases in the UK. She also
reported that misdiagnosis as dermatological and neurological conditions were important causes of delay.\textsuperscript{16} Leprosy that was misdiagnosed as other skin diseases, also occurred frequently in China.\textsuperscript{17–19} The weakness in diagnosis of leprosy by dermatologists indicates that improving leprosy knowledge is very important to early case finding, especially in East China which is at a very low endemic situation. Extensive leprosy health education is also very important among the population with a risk of developing the disease.

When leprosy becomes a low endemic disease, leprosy funds, control units and health workers will decrease. There must be some ‘blank areas’ where a leprosy service is lacking or stopped for many years. This really happened in some areas of China. Considering that many active methods are not effective in detecting new patients in some areas, this presents a big challenge to leprosy control in China. Maintaining sustainable leprosy control and strengthening leprosy training among dermatologists may be an important strategy in the future. The Geographic Information System may also be useful for us to find these ‘blank areas’ and enable us to take action in time.\textsuperscript{20}

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References

A big challenge in leprosy case finding


