Best Practice: *Leprosy Mapping as an Auxiliary Tool for Early Diagnosis of New Cases*

Subthemes

- Early detection and prompt treatment
    - Program management

Target Audience(s)

- Program managers
- Health staff
- Scientists

Contributors

JG Baretto, Federal University of Pará (UFPA), Brazil / Castanhal (State of Pará)

Key Messages

The geographic distribution of leprosy is characterized by concentration of high detection rates in specific areas (clusters or hotspots). These areas can be identified by case mapping followed by spatial epidemiological analysis.

Leprosy mapping has been used to increase the efficiency and improve the cost-effectiveness of new case-detection approaches through targeted, active case-finding protocols.

Beside early diagnosis, spatial analysis tools can also help to monitor the extent of multidrug therapy (MDT) coverage and could play a major role in vaccine-efficacy or chemoprophylaxis trials.

Key Informant / Date Submitted

JG Baretto
August 2019

Description of the Best Practice

Introduction

The spatial distribution of leprosy is heterogeneous—the more socioeconomically developed countries have eliminated leprosy as a public health problem while high-disease burden pockets remain in developing nations, particularly in India, Brazil, and Indonesia. This heterogeneous pattern seen in the global leprosy distribution scenario can also be seen at regional, local, and even ward levels.

Because of the continuous transmission of leprosy in Brazil—with evidences of high hidden prevalence, especially in the North, Central-West, and Northeast regions—visits to hyperendemic cities in the

Brazilian Amazon region were commenced in order to increase health teams' knowledge about the real epidemiological scenario through field investigation studies in these hard-to-reach areas.

With the objective of guiding the activities of the health care team to survey the most at-risk population, a preliminary phase of the project consisted of mapping previously reported cases to identify the main clusters of leprosy and, ultimately, to increase our probability of detecting and promptly treating new cases at early stages of the disease.

Objectives and Methodology

The main goal of leprosy mapping was to identify the spatial distribution pattern of the disease in hyperendemic municipalities and the areas with high levels of case detection, also known as clusters or hotspots. This information assisted programme managers in targeting active case-finding interventions to the most at-risk populations.

This approach is based on literature evidence that *M. leprae* transmission occurs in clusters. The need to improve the cost-effectiveness of interventions was an additional reason to implement this intervention.

Implementation of Practice

The residences of people affected by leprosy reported during the last 5-10 years were georeferenced to produce detailed maps of the leprosy distribution. Additionally, spatial statistical methods were applied to identify patterns and possible risk factors associated with *M. leprae* infection.

The residential addresses and demographic and epidemiological variables were collected from the Brazilian National Notifiable Diseases Information System (SINAN). The exact location of each residence was then georeferenced using a handheld GPS receptor. In addition to field-work mapping, we have been using some methods of remote mapping such as participatory mapping (local health agents who know the people affected by leprosy show us in a digital map the patient's house) and web-based geocoding applications (Google Maps, OpenStreet Maps, Batchgeo, etc).

To analyze these spatial data, QGIS (https://www.qgis.org/en/site/), a free and open-source Geographic Information System (GIS) was applied.

We have now 10 years of experience doing this case mapping in highly endemic municipalities of Pará State, Brazilian Amazon region, where we have visited 34 cities since 2009.

This leprosy mapping strategy has been used in important ongoing international research projects, such as the NLR-PEP++ in India, Brazil, and Indonesia. Local research assistants were trained to perform the case mapping by themselves at their own study sites. The Bangkok Declaration Special Fund (BDSF) project in Brazil has also applied case mapping to support the local health care workers to increase case detection at selected municipalities.

Key partners in this process were the Federal University of Pará, Secretaries of Health, program managers, SINAN technicians, local health care workers, community health agents, undergrad and post-graduation students, and research assistants.

Results—Outputs and Outcomes

These maps have facilitated active leprosy surveillance among school children. The selection of the schools to be surveyed was guided by data from the case mapping.

Selecting schools in predefined hotspots of *M. leprae* transmission has doubled our efficiency for new case detection. On average, 8% of the students evaluated at these clusters have clinical manifestations of leprosy. We observed that all new cases among school children were living within 200m of at least one reported case and 54.5% of them within 100m.

Other research groups have reported increased efficiency and cost reduction by using leprosy mapping to target intervention for leprosy control activities.

Lessons Learned

The following lessons have been learned from the leprosy case mapping efforts:

1. As a visual communication tool, the mapping results enhance the comprehension of the problem. It is extremely easy to understand the maps.
2. Leprosy has a strong clustering distribution pattern. It is uncommon to have a single spatially isolated case.
3. Case mapping increases the efficiency for new case detection through targeted, active case-finding strategies.
4. Each map scale, such as global, regional, local, or patient level, brings different insights on the level of leprosy transmission.
5. Associated with other data, results from case mapping can spotlight multiple issues such as operational problems, early childhood transmission, subclinical infection, hidden prevalence, strain subtypes distribution, etc.
6. Identifying the location of cases is a powerful tool for planning research projects such as vaccine-efficacy or chemoprophylaxis trials.
7. The fieldwork involved in mapping is time consuming and can be occasionally dangerous in some areas because of urban violence. Alternatively, we have used techniques of remote mapping, such as web-based geocoding and/or participatory mapping.
8. Missing data on reported cases can be a problem for mapping accuracy.
9. Leprosy mapping alone cannot address the problem; its results need to be associated with and followed by others active measures.

Replicability and Scalability

This practice has been implemented in selected areas in the most endemic countries (India, Brazil, and Indonesia) and in Africa as well, mostly for research purpose. Hence, leprosy mapping still needs to be translated into operational routine in a regular and sustained manner.

The costs to implement case mapping can be reduced by the use of regular smartphones with GPS functions. Even in low- or middle-income countries, primary healthcare workers have access to this technology. They can be easily trained on how to use their own devices for real-time case mapping, without necessity to acquire additional hardware or software. Our experience in hard-to-reach areas indicates that it can be replicated elsewhere.

Conclusions

Leprosy mapping along with spatial analysis provides a better understanding of transmission of the disease. These findings can be applied to guide leprosy control programs to target intervention to high risk areas.

Regular and sustained leprosy mapping, associated with amplified active contact tracing, would increase new case detection and contribute significantly to the strategic goal of zero transmission.

The use of spatial analysis tools to support active case-finding strategies for early diagnosis has been shown to be efficient, resulting in important cost reductions in leprosy control activities.

These tools can also help to monitor the extent of MDT coverage and could play a major role in vaccine-efficacy or chemoprophylaxis trials.

An operating national, regional, or local digital health information system with accurate leprosy data gathering and storage makes case mapping more efficient and sustainable.

Further Readings

1. Bakker MI, Scheelbeek PF, Van Beers SM. The use of GIS in leprosy control. Lepr Rev 2009; 80:327–331.

2. Barreto JG, Bisanzio D, Frade MAC, et al. Spatial epidemiology and serologic cohorts increase the early detection of leprosy. BMC Infect Dis 2015; 15(1):527.

3. Barreto JG, Bisanzio D, Guimarães L de S, et al. Spatial analysis spotlighting early childhood leprosy transmission in a hyperendemic municipality of the Brazilian Amazon region. PLoS Negl Trop Dis 2014; 8(2):e2665.

4. De Souza Dias MC, Dias GH, Nobre ML. The use of Geographical Information System (GIS) to improve active leprosy case finding campaigns in the municipality of Mossoró, Rio Grande do Norte State, Brazil. Lepr Rev 2007; 78:261–269.