

## Global Burdens, Impacts and Global Efforts towards Hansen's Disease

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### Abstract

**Introduction:** Elimination slogan of leprosy can create a misunderstanding that the disease is no more a problem. A lot remains unknown about the disease transmission and pathogenesis. Hence, the need for further research and study to understand transmission and pathogenesis is crucial to fill the gap.

**Method:** The present paper reviews, peer-review and English-language literature about leprosy using PubMed/Medline and Google scholar with global health context of leprosy were used in order to clarify the gaps which will help in the future.

**Results:** There is a marginal increment in new case detection in south east Asia and Africa. After the introduction of surveillance and training which has resulted in the newly identified relapse cases which puts concern on drug resistant leprosy. This threat in newly arising cases of leprosy in poor and marginal countries might no longer be an issue with the evidence showing population movement might pose concern on the transmission of leprosy in worldwide. There are studies showing that direct contact with infected armadillos can contribute to its transmission. Leprosy is a complex disease which has a social, economic and psychological impact.

**Conclusion:** Despite the attainment of leprosy elimination goal of many countries, there is still a threat on the globe because of the newly arising cases in endemic countries. With the impact of globalization and trends of rapid population movement which can contribute to the spread of then disease. In addition, the concerns of animal reservoir of mycobacterium leprae which can be another source of spread of the disease. In general, the global coalitions have played a great role in achieving elimination goal. However, there is a need for a shift in concern on how to prevent and upgrade clinical diagnostic technologies which can be crucial means in decreasing transmission worldwide.

**Keywords:** *Leprosy; Global Burden; Global Health Context; Leprosy Elimination; Epidemiology*

### Abbreviation

DANIDA: Danish International Development Agency; NGO: Non-governmental Organization; MDT: Multidrug Therapy; ILEP: International Leprosy Federation; SMHF: Sasakawa Memorial Health Foundation

### Introduction

Leprosy or Hansen's disease is a chronic infectious disease caused by the *Mycobacterium leprae*. It involves the skin, eye, peripheral nerves and other organs [1]. The disease is dreaded because of the damage that occurs in weak and anesthetic hands and feet, as well as in blindness and facial disfigurement [1]. There is a definitive treatment and management for leprosy. Multidrug therapy (MDT) is highly effective in curing the mycobacterial infection, but treating the nerve damage is much more difficult [1]. It is still a major health problem in several countries of Asia, Latin America, and Africa. In 2015, the annual reports of new cases indicate more than 210,758 even after the introduction of multidrug therapy (MDT) by the World Health Organization (WHO) [2].

There is a global partnership, which is integrated to eliminate leprosy. Elimination is defined as a prevalence of less than 1 case per 10000 populations. The "elimination of leprosy" slogan galvanized activities worldwide but has also dominated the priorities in leprosy work [1]. Despite the presence of multiple drug treatment for leprosy, there are still global concerns on the newly arising cases. There are several challenges and misunderstanding behind it. Multiple drug treatment has been very effective in treating leprosy cases. However, there is no evidence of a decline of disease transmission since the inception of MDT [3]. We all are talking about how can we eliminate leprosy when it is a chronic disease which has no screening and diagnostic modality. Leprosy has a long incubation period, ranging from 2 to 20 years [4]. Patients newly diagnosed with leprosy may have transmitted the disease to others in their family or community long before their disease is detected. Even if we reach elimination goal there is chance of these disease manifesting on those infected but asymptomatic patients years back. It is a fact that there has been great progress in the decrement of cases of leprosy after the start of multiple drug treatment. It was soon realized that the widespread introduction of MDT would lead to a dramatic reduction in the registered prevalence of leprosy, and this did in fact occur over the subsequent two decades [1]. On contrary, the newly arising cases raises a question mark on the MDT. There is evidence showing that leprosy cannot be eliminated solely with multiple drug treatment [5].

A lot remains unknown about the disease transmission and pathogenesis. It is well established that leprosy is transmitted by person-to-person contact [6]. However, controversy remains whether there is another source, by airborne droplets from nasal and/or mouth, direct contact with infected armadillos [7,8] can be an alternative mode of transmission. However, the lack of diagnostic modality to differentiate the patient who has active infection from those having subtle infection makes leprosy diagnosis solely on clinical diagnosis. These can create a limitation in interrupting transmission and impair leprosy control.

The issue of drug resistance has been shown in past and still is an issue in endemic countries. There have been advances in the elucidation of molecular events responsible for drug resistance in mycobacteria [9,10]. However, *M. leprae* has not been cultivated on artificial media; therefore, to identify drug susceptibility patterns, bacteria must be tested using Shepard's mouse footpad assay [11]. This method can take for 6 months and require a large number of bacteria. This can create a threat in controlling leprosy.

There is, in general, a great need for further research and study to understand the transmission and pathogenesis in order to fill this gap. The term elimination can be misleading to thinking that leprosy is no more a problem to be considered. Which can divert the important research sources of funds and difficult to attract scholars to leprosy research. No one would be willing to build a career on a disease that is perceived as being eliminated. That maybe threat for a lot of concerns arising in the globe.

In this review article, the global burden of leprosy will be discussed. Moreover, this review states the main focus of most researchers in leprosy as; global concerns; antibiotic resistance, migration, and impact of leprosy; Socioeconomic and psychological. Finally, the review tries to give highlight of global players and efforts. From the existing literature would try to conclude by indicating areas where further research would be particularly important to improve the response to leprosy.

### **Global burden**

The new case detection rate is calculated using the number of cases detected during the year per 100000 populations. During 2015, 210758 new leprosy cases were detected globally. The new case detection rate was 3.2 per 100000 populations, marginally less (3141 cases) than the previous year [2]. The number of new cases detected over the past 10 years shows that overall dramatic decline from 265 661 in 2006 to 210 758 in 2015 [2]. There is a marginal increment in new case detection in south east Asia and Africa. Southeast Asia accounted for 74% of the global new case load; this was followed by America with 14% and Africa with 9% [2]. Western pacific region and eastern Mediterranean region contributed 2% and 1% of the global new case load, respectively [1]. In general, there is a general slow decline in new cases was seen in many countries except Africa and south East Asia as noted below (Table 1). This slight increase may be due to leprosy case selection and awareness creation campaign.

Country	Number of new cases detected										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2014	2015
Africa	34480	34468	29814	28935	25345	20213	20599	20911	18597	18597	20004
America	47612	42135	41691	40474	37740	36832	36178	33084	33789	33789	28806
Eastern Mediterranean	3261	4091	3938	4029	4080	4357	4235	1680	2342	2342	2167
South east Asia	174118	171576	167505	166115	156254	160132	166445	155385	154834	156118	156118
Western pacific	6190	5863	5859	5243	5055	5092	5400	4596	4337	43337	3645
Europe											18
Total	265661	258133	249007	244796	228474	232857	232857	215656	213889	213899	213899

**Table 1:** Trends in detection new cases of leprosy [WHO 2015].

In 2015, 14 countries reported > 1000 new cases. These 14 countries represented 95% of the global leprosy burden with the remaining 5% of new cases reported by 92 other countries worldwide. Some of these countries reported very high case detection rates [2]. India reported 127,326 new cases, accounting for 60% of the global new leprosy cases; Brazil reported 26,395 new cases, representing 13% of the global new cases; and Indonesia reported 17,202 new cases, 8% of the global case load [2]. Eleven countries reported between 1000 and 10 000 cases: from Africa, the Democratic Republic of Congo, Ethiopia, Madagascar, Mozambique, Nigeria and the United Republic of Tanzania; from Southeast Asia, Bangladesh, Myanmar, Nepal and Sri Lanka; and from the Western pacific region, the Philippines [2]. Collectively, these countries reported 19,069 new cases, 14% of all new cases globally. The remaining 10,286 new cases (5%) were reported by 92 countries. Thirty countries reported zero new cases [2].

The new case detection is slightly lower in women who have leprosy because of limitation and access to leprosy services for women and the possible effects of discrimination against women with leprosy. Globally 38.8% of new cases in 2015 were female [2]. The detection of leprosy in children which signifies the continued transmission of infection in the community. After established surveillance system in many countries and there has been a report of relapse leprosy case. The proportion of new child cases globally was 8.9%. In 2015, of 103 countries reporting cases of relapse in leprosy, 57 reported zero relapses and 46 countries reported 3039 relapses [2].

### Global concerns in leprosy

Great progress has been done in the reduction of leprosy cases. There are newly arising cases concerns towards leprosy globally. After the introduction of surveillance and training which has resulted in the newly identified relapse cases which puts concern on drug resistant leprosy. The other concern we have is the controversy in knowing the transmission and knowing the limitation in diagnostic technique which can create a way in spreading the disease. There is several Global concerns; antibiotic resistance, migration association with leprosy and role animal reservoir in the spread of leprosy.

### Global impact

Leprosy, if untreated, leads to progressive physical, psychological and social disabilities. In 2015 report, about 1 million people live with grade 2 disabilities [2]. Leprosy is a complex disease which has a social, economic and psychological impact.

### Global efforts

In 1982, WHO recommends multiple drug treatment as treatment a modality. After MDT was introduced, a steady decline was seen in the number of patients on treatment. MDT would lead to a dramatic reduction in the registered prevalence of leprosy, and this did in fact, occur over the subsequent two decades [1]. Starting in 1995, WHO further strengthened its programs by providing MDT medications for free to endemic countries. The treatment was simple but effective. By 2002, the number of countries reporting endemic Hansen's disease had dropped from 122 to 12 [12].

In 1999, the global alliance was inaugurated with the aim of elimination of leprosy. WHO drafted the 'Final Push' strategy (2000 - 2005) to eliminate leprosy. There are Many partners supported the elimination struggle including the WHO, the World Bank, the International Leprosy Federation (ILEP), the Nippon Foundation and the Sasakawa Memorial Health Foundation (SMHF), Novartis, the Danish International Development Agency (DANIDA) and much more [13]. The support from the program came from a various non-governmental organization. The Nippon Foundation pledged to meet substantial needs in leprosy drugs until 2000 [14].

Furthermore, there were major contrasts emerged between some of the global alliance partners, namely between WHO and international leprosy federation, who always remained critical of the elimination-focused strategy. The clash was so strong that international leprosy federation was expelled from the alliance at the end of 2001 [15]. Following that WHO invited an independent team of experts to evaluate the global alliance [15]. The evaluation report recommended to extend the activities beyond 2005 and to consider tackling the chronic complications of leprosy. To re-shift the elimination goal in favor of an explicitly broad-based approach to the control of the disease, the avoidance of nerve damage, and the rehabilitation of those in need [13].

WHO worked in collaboration with its partners, international leprosy federation, The Nippon Foundation and Novartis, and developed a new strategy for the period 2006 - 2010 for sustaining quality leprosy control activities [16]. The Nippon Foundation and SMHF have been active worldwide since 1975 in combating leprosy, having spent more than US\$ 200 million in this period. They don't involve directly to elimination project rather they give the fund to WHO and other alliance members. From 1995 to 1999, the Foundation provided MDT drugs free of charge to anybody who needed it anywhere on the planet [17]. This Foundation has been working towards ending social discrimination against leprosy patients [17]. Another NGO involved in this program is Novartis. The Novartis Foundation provided free supply of MDT to endemic countries the WHO since 2000 and committed to doing so till now [2].

After a lot of work has been done in elimination campaign led by WHO. In May 2001, WHO announced that leprosy had been eliminated as a public health problem at a global level. However, during 2015, 210758 new leprosy cases were detected globally and about 2 - 3 million people with leprosy live with disability [2]. Because of this issues, WHO has started global leprosy strategy from 2016 to 2020. The targets of this program is to strengthen governmental ownership, to stop the complications of leprosy and stopping discrimination.

The coalition of these partnerships has great success in reducing leprosy cases worldwide. However, the term elimination has created a vague understanding and assumption as no longer a problem worldwide. This has influenced the accessibility of funds for research. As it is known Bill and Melinda Gates foundation have decided not to fund because it is no longer perceived as it is important problem. Furthermore, other competing priorities (e.g. human immunodeficiency virus/acquired immunodeficiency syndrome, malaria, and tuberculosis) may appear to be of relatively greater importance.

All in all, it is important to open these limitations and consider investigating about the transmission, diagnostic and screening modalities and animal reservoir of leprosy. These all help us get prevention method and controlling transmission rate rather than only treat the existing disease with a drug.

### Conclusion

The concept of global burden, global concern, global impacts and global players with respect of leprosy has been discussed. Global distribution of leprosy is quite different in every country. Despite the attainment of leprosy elimination goal of many countries, there is still a threat on the globe because of the newly arising cases in endemic countries. With the impact of globalization and trends of rapid population movement which can contribute to the spread of the disease. In addition, the concern of animal reservoir of *Mycobacterium leprae* that can be another source of spread of the disease.

Newly arising relapse cases in most endemic countries have created concern on the efficacy of multiple drug treatment and issue of antibiotic resistance. This can aggravate the disease burden because of the limitation of diagnostic modalities. In addition, because no available culture for the bacteria which can result in difficulty for a finding of a new treatment.

In general, the global coalitions have played a great role in achieving elimination goal. However, there is a need for a shift in concern on how to prevent and upgrade clinical diagnostic technologies which can be crucial means in decreasing transmission of leprosy worldwide.

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