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Burden of Leprosy in Indonesia: A Comprehensive Analysis from the Global Burden of Disease Study 2021

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Abstract

Indonesia is the fourth most populous country in the world and has the third highest burden of Leprosy after India and Brazil. Prevention and treatment have been carried out in Indonesia by trying to improve services and quality of Leprosy care, but the incidence of this disease is still relatively high. This study aims to analyze the incidence, prevalence, and total DALYs (Disability Adjusted Life Years) of Leprosy in Indonesia based on the results of the GBD 2021(Global Burden of Disease) study. Researchers analyzed absolute figures, rates/levels, and age-standardized figures from 1990 to 2021. In this study, researchers used GBD 2021 data to estimate the temporal trend of the Leprosy burden in Indonesia. The analysis used three standard epidemiological measures, namely incidence, prevalence, and disability-adjusted life years (DALYs) by sex and age in Indonesia. The results of the analysis showed that 1992 was the lowest year with a prevalence of 24,725 cases and 2015 was the highest year with 37,287 cases. The lowest incidence of Leprosy occurred in 1990 with 3,018 cases and the highest incidence occurred in 2020 with 4,568 cases. The year with the lowest DALY was 1992 with 1,304 cases and the year with the highest DALY was 2013 with 1,984 cases. The results of this study are expected to be used as a strategy for controlling Leprosy in Indonesia. Researchers hope that the government or health workers will carry out early detection of prevention in high-risk communities to stop the transmission of Leprosy and to reduce the prevalence of disability or negative side effects that will cause stigma in society.

Keywords: *Burden of Disease, DALY (Disability Adjusted Life Years), Incidence, Indonesia, Leprosy, Prevalence.*

Introduction

Indonesia is the fourth most populous country in the world. With such a large population, Indonesia has the third highest burden of Leprosy in the world after India and Brazil, which have also experienced several changes in the last few decades [1]. Leprosy can spread to various regions, especially in tropical countries and especially in developing and underdeveloped countries [2]. Leprosy or leprae or Morbus Hansen (MH) is a disease caused by *Mycobacterium Leprae* infection [3]. The main targets of this bacteria are the skin and peripheral nerves. In addition, other organs and tissues such as the eyes, lymph nodes, joints, and testicles can also be infected [4]. The bacteria undergo a fairly long division process between 2-3 weeks with a survival rate of up to 9 days outside the human body [5].

However, *M. Leprae* bacterial infection does not immediately cause signs and symptoms of Leprosy in sufferers. The presence of other risk factors such as socio-economic factors, gender, ethnic or tribal factors, and age factors also play an important role in the course of this disease [6]. Men are more likely to be affected by Leprosy than

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women [7]. In terms of age, Leprosy can occur in all groups, from infants to the elderly. However, the most sufferers are those who are still of productive age or around 35-50 years old [8]. The environmental and economic conditions of the sufferers also have a significant role. A dirty, unkempt environment that does not meet the requirements for a healthy home will be a good place for bacteria to infect sufferers. In addition, considering that Indonesia still has a low economic status and low education levels, it will also have a significant impact on Leprosy sufferers [9]. Some people are still reluctant to go to the nearest health facility for check-ups. However, when sufferers who have been diagnosed with Leprosy routinely have check-ups, they will also receive more information and education about the disease from health workers at health facilities.

Prevention and treatment have been carried out in Indonesia, and so far health workers have tried to improve the service and quality of Leprosy care. However, there are still several obstacles that make it difficult for these individuals to seek treatment and receive therapy. This factor is also what causes cases of Leprosy to still be high in Indonesia.

Based on data from the Indonesian Ministry of Health (2020), there were 17,439 new cases of Leprosy reported. Around 85% of these cases were multi-bacillary (MB) Leprosy in 2019 [4]. The prevalence of skin diseases has generally increased over the past few decades [10]. Focusing on Leprosy, WHO said that most Leprosy cases were detected in Southeast Asia and 10,000 cases were reported [11]. The above data shows that prevention and treatment related to Leprosy are still minimal. This study aims to analyze the incidence, prevalence, and total DALY (Disability Adjusted Life Years) of Leprosy in Indonesia based on the results of the GBD 2021 (Global Burden of Disease) study. Researchers analyzed absolute figures, rates/levels, and age-standardized figures from 1990 to 2021.

Materials and Methods

Data Sources

Data on the burden of Leprosy in Indonesia were obtained from the GBD Result Tool (https://vizhub.healthdata.org/gbd-results/) [12]. The GBD study group uses multiple data sources and complex statistical models. In this study, researchers used GBD 2021 data to estimate the temporal trend of the burden of Leprosy in Indonesia. In the analysis of the burden of Leprosy, we used three standard epidemiological measures, namely incidence, prevalence, and disability-adjusted life years (DALYs) at rates per 100,000 population with UI by sex and age groups in Indonesia.

Statistical Indicators and Graphs

Incidence, prevalence, and age-standardized DALYs were calculated with the global age structure in 2021. The 95% uncertainty interval (UI) was calculated by taking 1,000 samples from the posterior distribution of each step in the modelling process and is reported.

Results

Researcher conducted an analysis of the incidence of Leprosy in Indonesia from 1990-2021 using GBD 2021 data. The data about prevalence, incidence, and disability-adjusted life years (DALYs) are described yearly from 1990 to 2021 in Table 1. The table consists explanation of the prevalence, incidence, and DALYs in certain years, with the lower and upper values.

The first data is about the prevalence of Leprosy in Indonesia. In 1992, there were 24,725 (21,424 to 28,603) cases of prevalence, which was the year with the least number of cases of Leprosy, and in 2015, there were 37,287 (32,328 to 43,426) cases, the highest number of cases throughout 1990-2021. The development of the increase in the prevalence of Leprosy each year is close to linear, although there was a decline after 2015. The highest prevalence occurred in 2015 with a total of 37,287 cases and there were 34,044

(29,591 to 39,585) general cases of Leprosy in Indonesia in 2021. Researchers have an additional way to make a clear understanding of the prevalence data, a figure about the prevalence of Leprosy in Indonesia is available in Figure 1.

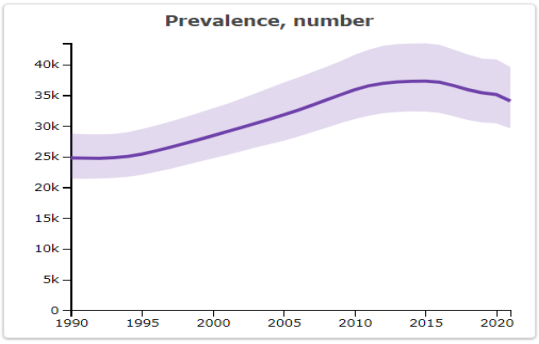

Figure 1. Prevalence of Leprosy in Indonesia 1990-2021

The next data are about the incidence of Leprosy from 1990 to 2021. The incidence of Leprosy in Indonesia, 1990 there were 3,018 (2,551 to 3,565) cases with the lowest incidence of Leprosy, and in 2020 there were 4,568 (3,799 to 5,501) cases with the highest incidence of Leprosy during the period mentioned, for the detail incidence see Figure 2.

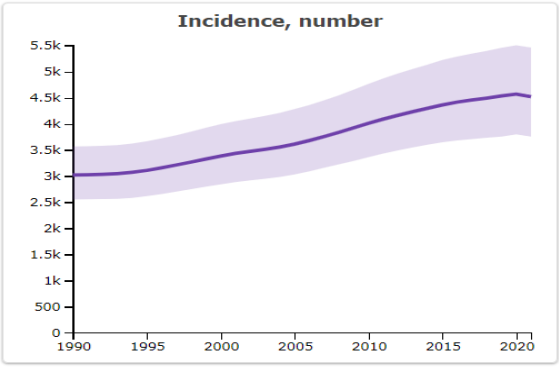

Figure 2. Leprosy incidence in Indonesia 1990-2021

Finally, there is the data about Leprosy DALYs in Indonesia, from 1990 to 2021, the age-standardized DALY rate for Leprosy decreased in both men and women (all genders). The year with the lowest DALY was 1992 with 1,304 (837 to 1,902) cases and the year with the highest DALY was 2013 with 1,984 (1,288 to 2,936) cases. The details of the research results can be seen in Figure 3.

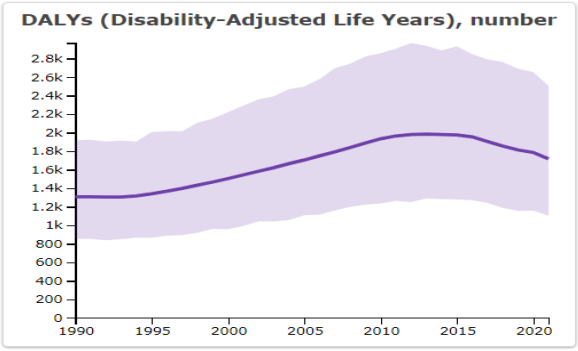

Figure 3. DALYs total incidence of Leprosy in Indonesia 1990-2021

Table 1. Prevalence, Incidence, and DALYs of Leprosy in Indonesia 1990-2021

Year	Prevalence			Incidence			DALYs		
	Value	Upper	Lower	Value	Upper	Lower	Value	Upper	Lower
1990	24,767.89	28,711.96	21,414.36	3,018.79	3,565.88	2,551.31	1,305.62	1,914.25	852.90
1991	24,731.19	28,638.03	21,401.29	3,023.96	3,569.94	2,556.06	1,306.45	1,923.04	851.60
1992	24,725.21	28,603.15	21,424.39	3,031.39	3,577.25	2,556.96	1,304.23	1,902.48	837.20
1993	24,799.62	28,691.00	21,516.00	3,045.14	3,591.95	2,565.18	1,304.80	1,911.75	848.43
1994	25,003.55	28,955.69	21,707.09	3,068.90	3,618.56	2,581.37	1,316.63	1,903.64	865.17
1995	25,391.43	29,461.27	22,029.16	3,106.63	3,661.46	2,614.22	1,339.29	2,004.76	865.37
1996	25,923.71	30,027.56	22,516.96	3,155.94	3,718.31	2,655.51	1,366.57	2,014.20	885.66
1997	26,498.04	30,676.60	23,000.55	3,209.77	3,779.21	2,702.04	1,397.33	2,016.02	892.89
1998	27,108.16	31,372.69	23,575.05	3,266.74	3,847.96	2,750.46	1,431.84	2,105.71	919.20
1999	27,742.10	32,093.51	24,140.19	3,324.81	3,924.19	2,795.73	1,466.39	2,148.85	960.34
2000	28,388.21	32,820.52	24,681.43	3,381.82	3,989.39	2,839.69	1,503.18	2,220.80	955.26
2001	29,044.25	33,563.70	25,247.39	3,431.35	4,046.40	2,884.13	1,542.03	2,288.53	991.65
2002	29,702.54	34,400.65	25,844.60	3,472.10	4,098.78	2,917.68	1,582.52	2,358.94	1,041.41
2003	30,375.25	35,262.88	26,451.38	3,510.96	4,151.52	2,946.42	1,620.49	2,391.36	1,040.34
2004	31,056.50	36,137.51	27,016.16	3,553.72	4,208.55	2,981.35	1,664.93	2,468.44	1,055.43
2005	31,766.17	37,028.91	27,569.92	3,609.20	4,279.35	3,028.86	1,704.09	2,496.76	1,107.15
2006	32,539.09	37,849.34	28,241.34	3,679.09	4,359.91	3,090.62	1,748.72	2,579.13	1,114.82
2007	33,350.93	38,694.10	28,942.99	3,755.75	4,447.59	3,158.40	1,792.07	2,693.42	1,159.31
2008	34,188.80	39,561.45	29,667.24	3,837.59	4,543.66	3,223.20	1,837.13	2,743.51	1,198.92
2009	35,030.72	40,481.05	30,403.58	3,922.45	4,651.88	3,289.50	1,886.44	2,819.37	1,222.17
2010	35,852.97	41,563.63	31,086.23	4,007.98	4,761.82	3,361.53	1,932.88	2,856.50	1,236.08
2011	36,514.98	42,373.16	31,657.25	4,088.85	4,866.88	3,429.12	1,963.59	2,906.94	1,263.89
2012	36,918.13	43,016.02	32,035.31	4,162.44	4,962.08	3,489.98	1,978.51	2,966.68	1,250.48
2013	37,132.37	43,300.98	32,254.38	4,230.76	5,047.38	3,546.16	1,984.63	2,936.84	1,288.16
2014	37,229.08	43,383.71	32,366.22	4,295.85	5,131.14	3,596.68	1,978.88	2,888.64	1,282.69
2015	37,287.99	43,426.91	32,328.63	4,359.88	5,221.82	3,644.88	1,974.98	2,928.45	1,276.79
2016	37,103.73	43,183.60	32,129.73	4,414.38	5,286.41	3,681.15	1,953.33	2,846.37	1,269.44
2017	36,554.23	42,400.45	31,577.81	4,455.09	5,340.23	3,707.17	1,902.92	2,789.05	1,239.06
2018	35,886.37	41,623.99	30,958.65	4,490.85	5,395.63	3,731.34	1,855.08	2,761.01	1,187.27
2019	35,374.34	40,951.88	30,535.84	4,531.41	5,454.88	3,755.16	1,812.05	2,690.75	1,154.59
2020	35,093.86	40,787.57	30,411.16	4,568.02	5,501.70	3,799.17	1,785.50	2,651.84	1,156.19
2021	34,044.94	39,585.55	29,591.59	4,517.23	5,457.92	3,752.86	1,714.98	2,503.33	1,103.98

Discussion

This study reports the burden of Leprosy in Indonesia based on age and sex using GBD 2021 data. From 1990 to 2021, the incidence, prevalence, and DALY numbers for Leprosy in Indonesia still tended to increase in the same period. In the analysis, the incidence of Leprosy based on sex and age increased significantly from 1990 to 2021. The analysis from GBD 2021 shows that the burden of Leprosy in Indonesia is still relatively high.

The seventh Indonesian census conducted in 2020 showed that around 70.72% of the population was of productive age (15-64 years) and around 9.78% of the population was over 65 years old. Leprosy sufferers aged around 30-45 years and over 60 years have a higher risk of experiencing side effects such as

physical disability. However, the number of physical disabilities caused by Leprosy will be relatively lower if good monitoring of the treatment program is given [6].

Leprosy has been one of the long-standing health problems in Indonesia. Social perceptions also stigmatize affected individuals, making it difficult to eradicate the disease. The high level of stigma is driven by low levels of knowledge, misunderstandings about Leprosy, local beliefs, and fear of transmission [13]. From some of these stigmas, sufferers sometimes lack self-confidence and feel unaccepted by society. In addition, the side effects of this disease seem to have an impact on the psychological side of sufferers. They often experience mixed feelings such as upset, confused, anxiety, hopelessness, and anger because of Leprosy reactions and prolonged treatment [14]. Patients feel bored because they have to follow a treatment program that is too long so many patients do not routinely take medication or check their condition. Patients with Leprosy who have disabilities tend to experience stigma more often because they are easy to notice and identify because of the physical abnormalities and other disorders they experience [15].

There is a relationship between poverty indicators and the incidence of Leprosy [16]. Most Leprosy sufferers are economically disadvantaged people, which causes them to be left behind in terms of education and awareness to undergo check-ups at health facilities [16]. The economic factor of families who are unable to meet the medical needs of Leprosy sufferers also results in sufferers tending to isolate themselves from their families and the surrounding community [17]. However, until now, there has been no preventive action that can reduce the incidence of Leprosy in Indonesia. Handling will be carried out when symptoms appear. In addition to the lack of knowledge and public awareness of Leprosy, Indonesia's geographical conditions are also a challenge. Geographical conditions that are still found such as the distance between residence and health facilities are far, especially in disadvantaged, outermost, and remote areas [18]. Access to health facilities is not evenly distributed in every region, so many people are ignorant and choose to seek treatment from shamans or health facilities that are not guaranteed in quality. Limited services also hinder early diagnosis of the disease. The complexity of identifying early symptoms causes delays in health interventions. Even if treatment is given, its availability and effectiveness are inconsistent, which will affect the patient's outcome later.

Leprosy has significant physical, psychological, and social impacts on the lives of sufferers. Affected individuals experience physical discomfort, stress, stigma, and economic hardship [14]. Sometimes it takes years for the effects of Leprosy to appear. These reactions or side effects can also be influenced by nutritional status factors. Unbalanced nutritional intake will suppress individual immunity, thereby increasing the risk of contracting *M. Leprae* bacteria [19]. There are two main types of Leprosy, paucibacillary (PB) and multibacillary (MB) Leprosy, which can be classified based on the number of bacteria present [20]. Leprosy is a chronic infection that is treated with a combination of drugs including rifampicin, clofazimine, and dapsone. However, one of these drugs, dapsone, can cause patients to experience adverse side effects, namely skin hypersensitivity and has the potential to cause death in up to 9.9% of cases [21]. The main signs of Leprosy that have been known for more than 100 years are: loss of sensation in skin lesions, enlargement of peripheral nerves, and positive skin smears [22]. In addition, most individuals are not aware of the symptoms of Leprosy in themselves [23]. Disability in Leprosy sufferers is divided into three levels, namely degrees 0, 1, and 2. As for

degree 0, it will show normal sensation without any visible disturbance. Degree 1 shows a disturbance of sensation but is not accompanied by visible disturbance. Finally, degree 2 shows visible disturbance or deformity [24]. These symptoms can begin with the presence of white spots like tinea versicolor and skin bumps that become thicker, stiffer and drier. If there are symptoms of inflammation on the skin, it will cause redness, swelling, pain and heat. This discomfort can be treated with Aloe vera gel to increase the transparency and thermal stability of the film so that the inflamed skin improves [25]. If a case of Leprosy is found, an assessment needs to be carried out to establish the correct diagnosis and treatment [26].

The results of this study are expected to be used as a strategy for controlling Leprosy in Indonesia. With the data on prevalence, incidence, and DALYs of Leprosy cases for several years, researchers hope that the government or health workers will conduct early detection and prevention in communities that are at high risk to stop the transmission of Leprosy and to reduce the prevalence of disability or negative side effects that will cause stigma in society. Interventions can be carried out on individuals who have symptoms of Leprosy, especially in poor and disadvantaged populations so that disease control and health goals by WHO can be achieved.

Conclusion

GBD 2021 analysis of the burden of Leprosy shows that the disease is still relatively high in Indonesia. Early detection of cases is needed to avoid delays in diagnosing the disease. It is recommended to conduct health education and active case detection to prevent delays and disabilities in Leprosy sufferers.

Conflict of Interest

The authors declare that this research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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