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THE HIDDEN ECONOMIC BURDEN OF LEPTOSPIROSIS: HEALTHCARE COSTS AND PATIENT IMPACT

Beban Ekonomi Tersembunyi Leptospirosis: Analisis Biaya Kesehatan dan Dampak Finansial pada Pasien

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Abstract

Background: Leptospirosis is a public health issue caused by the *Leptospira bacterium*, leading to significant economic impacts. The cost of illness due to Leptospirosis encompasses hidden costs that significantly affect individuals and society
Aims: This study aimed to assess the hidden economic burden (direct and indirect costs) experienced by patients and their families due to healthcare treatment of leptospirosis.
Methods: This descriptive cross-sectional study was conducted in Banyumas Regency from February to June 2024. Data were collected from patients who completed leptospirosis treatment in 2023. The variables of cost were categorized into direct treatment cost, treatment cost, and indirect cost, which were analyzed descriptively.
Results: Most leptospirosis patients were male, aged 26 – 45 years old, and the majority worked as farmers. Our study reveals that uninsured patients incurred higher out-of-pocket expenses during leptospirosis' treatment. The productivity loss was estimated at USD 44.75, with significant hidden costs being transportation (USD 31.90), caregiver support (USD 86.38), and hospital treatment (USD 231.40).
Conclusion: The significant burden of Leptospirosis in Indonesia highlights the economic impact on individuals and the challenges within the healthcare system. This study calls for enhanced public health strategies focused on prevention, early diagnosis, and improved healthcare access to address the leptospirosis burden effectively.

Keywords: *Cost of illness,* economic burden, financial impact, leptospirosis, productivity loss.

Abstrak

Latar Belakang: *Leptospirosis merupakan masalah kesehatan masyarakat yang disebabkan oleh bakteri Leptospira, dan berdampak secara ekonomi. Kerugian ekonomi akibat leptospirosis mencakup biaya tersembunyi yang memengaruhi individu dan masyarakat.*
Tujuan: *Penelitian ini bertujuan menghitung beban ekonomi tersembunyi yang dialami pasien dan keluarganya akibat pengeluaran medis serta dampak finansial dari pengobatan leptospirosis..*
Metode: *Penelitian deskriptif dengan pendekatan potong lintang ini dilakukan di Kabupaten Banyumas pada Februari–Juni 2024. Data dikumpulkan dari pasien yang telah menyelesaikan pengobatan pada 2023. Biaya dikategorikan menjadi biaya langsung, pengobatan, dan tidak langsung, lalu dianalisis secara deskriptif.*
Hasil: *Mayoritas pasien adalah laki-laki, dan sebagian besar biaya pengobatan ditanggung Jaminan Kesehatan Nasional. Namun, pasien tanpa asuransi mengeluarkan biaya pribadi lebih tinggi. Rata-rata kehilangan produktivitas sebesar USD 44,75. Biaya tersembunyi utama meliputi transportasi (USD 31,90), pendampingan (USD 86,38), dan perawatan rumah sakit (USD 231,40).*
Kesimpulan: *Dampak akibat leptospirosis di Indonesia, signifikan berdampak pada individu dan merupakan tantangan untuk sistem pelayanan kesehatan. Penelitian ini menyarankan untuk meningkatkan strategi kesehatan masyarakat yang berfokus pada pencegahan, peningkatan diagnosis sedini mungkin, dan meningkatkan akses pelayanan kesehatan untuk menurunkan beban leptospirosis secara efektif.*

Kata kunci*: Beban ekonomi, dampak finansial, kehilangan produktifitas , kerugian ekonomi, leptospirosis.*

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Introduction

One of the severe public health issues in Indonesia is Leptospirosis. The causative agent of this infection is a bacterium known as Leptospira, which can be transmitted to humans and other animals. Its transmission is facilitated by a tropical climate, frequent flooding, and a highly dense population where water contaminated by urine from infected animals is usually present. Indonesia is estimated to have an annual morbidity of 39.2 leptospirosis cases per 100,000 people.

However, this ailment is usually missed due to its vague signs and symptoms and lack of diagnostic facilities. Research involving more than 1,500 febrile patients showed that about three-point-five percent had acute infections with leptospirosis, thus suggesting underdiagnosis for numerous individuals suffering from such illnesses (Gasem *et al.*, 2020). Central Java province alone accounts for 36.1% of Indonesia's leptospirosis cases (Sukendra *et al.*, 2023). Indonesia's tropical climate and environment create ideal conditions for spreading this zoonotic disease (Husni, Martini, and Suhartono, 2023). It is mainly transmitted through contact with contaminated water, soil, or food and the urine of infected animals.

The economic impact of leptospirosis extends far beyond medical bills, encompassing a range of hidden costs that significantly affect individuals and society. The spread of leptospirosis also has indirect effects on public health by overwhelming healthcare services, increasing absenteeism from work and school, and contributing to long-term disability among survivors. The significant impact on patients as individuals may also suffer long-term complications like chronic kidney disease, contributing to ongoing disability and lost productivity.

While the exact financial burden is not quantified, the high incidence, severe complications, and diagnostic challenges of leptospirosis likely impose a substantial economic burden on Indonesia as social impacts (Ehelepola, Ariyaratne and Dissanayake, 2019). A study indicated that the global productivity cost of leptospirosis was estimated at approximately USD 29.3 billion, with potential high estimates reaching USD 52.3 billion in 2019. This highlights the significant economic burden of lost productivity, particularly in lower-middle-income countries like Indonesia, where the disease is prevalent (Agampodi, Gunarathna, J. S. Lee, *et al.*, 2023).

Despite its considerable presence, Indonesia's overall illness burden needs to be better studied. Quantifying the burden is critical for effective prevention and control efforts (Saizan *et al.*, 2019). Precise data on the distribution of cases, productivity loss estimation, and the cost of treatment remain critically needed inputs to shape effective public health interventions. Understanding the actual burden of the disease will be necessary for effective public health planning and resource allocation (Munoz-Zanzi *et al.*, 2020).

However, the study that focused on the economic impact of leptospirosis in Indonesia was uncommon. The findings of this study are expected to raise awareness among policymakers about the need for targeted interventions and more substantial public health investment. As a result, this research is critical to the overall improvement of Indonesia's health-care systems. This study aims to assess the hidden economic burden experienced by patients and their families during leptospirosis treatment.

Method

This descriptive cross-sectional study was conducted in Banyumas Regency, Central Java Province, Indonesia, from February to June 2024. Central Java recorded the highest number of leptospirosis cases in Indonesia in 2023. According to the Health Profile of Central Java Province, Banyumas Regency was one of the top five regencies in Central Java that reported the highest number of cases of leptospirosis from 2019 to 2023.

The population of this study was all patients in Banyumas Regency who had been diagnosed with leptospirosis. 109 patients were eligible based on the

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inclusion criteria. The sample size was determined using the Slovin formula with a 12.5% margin of error, considering time and human resource constraints.

The inclusion criteria were patients with ICD.10 code for leptospirosis who had been treated in 2023 and lived in Banyumas Regency during the study. A total of 40 patients who met the inclusion criteria were interviewed between March and May 2024. A structured interview was performed in this study. The data were grouped into three main variables: (1) direct patient costs, including transportation, self-medication, and other additional treatment-related expenses; (2) indirect costs, including caregiver expenses and communication costs; (3) treatment costs, referring to total hospital care expenses.

The cost components were analyzed descriptively using an economic formulation (Drummond *et al.*, 2015). It was assessed individually and averaged to estimate the financial burden. Additionally, this study calculated productivity losses, defined as the total number of workdays lost due to illness multiplied by the patient's daily wage (Drummond *et al.*, 2015). The patient's daily wage was obtained from the Banyumas district demographic data.

This study also examined the Average Length of Stay (ALOS) among leptospirosis patients, comparing those covered by health insurance and those paying out-of-pocket. The ALOS number was pivotal in examining social cost due to leptospirosis. The formulation of social cost is multiplied by ALOS, prevalence rate, minimum wage, and population (Drummond *et al.*, 2015). The prevalence rate and number of communities in 2023 were performed to estimated it.

Result and Discussion

Table 1 presents the demographic and socio-economic characteristics of respondents from Banyumas District. The population is predominantly male (80%) and aged between 26 and 45. The majority of participants are covered by National Health Insurance or JKN (*Jaminan Kesehatan Nasional*) (75.5%), and most of the respondents (57%) had completed elementary school. Furthermore, most households' incomes (52.5%) are below the Banyumas minimum wage (IDR 2,287,572 or USD 150,09).

Demographic factors like age, gender, and occupation also influence leptospirosis risk. Adults aged 20-50 are the most affected group, comprising 58.2% of cases in Rio Grande do Sul, Brazil (Teles *et al.*, 2023). Due to occupational exposure and less cautious behavior, men are more frequently infected, particularly those in high-risk jobs like agriculture (Petrakovsky *et al.*, 2014). Understanding these factors helps target public health interventions and resources effectively.

Geographic and demographic factors further complicate measuring the burden of Leptospirosis in Indonesia. The country's diverse environments affect transmission dynamics, including urban and rural areas with varying conditions (Dhewantara, Riandi, and Wahono, 2022). Regions prone to flooding and poor sanitation see higher disease incidence, while occupational exposure differences, such as among farmers and waste management workers, increase infection risks (Widawati et al., 2023).

Urban and rural areas show significant disparities in leptospirosis incidence and risk factors. Urban outbreaks are often linked to poor living conditions, such as proximity to contaminated water and rodent infestations (Ilma, Martini, and Raharjo, 2022). In rural areas, infection rates can be up to eight times higher, especially among agricultural workers and those in livestock-related occupations, who face greater exposure to infected soil, water, and animals (Hernandez-Rodriguez, Gómez, and Villamil, 2017; Galan et al., 2021). Rural areas have a consistent year-round risk due to ongoing agricultural activities, while urban outbreaks are more seasonal, often after floods (Kembhavi, Velhal, and Shah, 2021).

Measuring the burden of Leptospirosis in Indonesia faces significant challenges, primarily due to underreporting and misdiagnosis, as well as a lack of standardized data collection methods. Underreporting occurs because many healthcare providers are unaware of the

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Table 1. Characteristics of Respondents in the Banyumas District in 2023

Variable	N	%
Sex		
Male	32	80.0
Female	8	20.0
Age Groups		
16 – 25	5	12.5
26 – 35	10	25.0
36 – 45	10	25.0
46 – 55	5	12.5
56 – 65	8	20.0
>= 65	2	5.0
Health Insurance Status		
JKN (Indonesian National Health Coverage)	30	75.5
Out of pocket	10	25.0
Educational Background		
No formal education	2	5.0
Elementary school	23	57.5
Junior high school	9	22.5
Senior high school	6	15.0
Job		
Farm Worker	6	15.0
Housewives	1	2.5
Students	4	10.0
Gardener	1	2.5
Farmer	12	30.0
Coconuts Sap Tapper	2	5.0
Entrepreneur	2	5.0
Others informal job	12	30.0
Household income per month		
< Banyumas minimum wage	21	52.5
> Banyumas minimum wage	19	47.5

Source: Primary data

disease's prevalence and symptoms, often mistaking leptospirosis for other febrile illnesses infection (Sriyani et al., 2023). This leads to delays in treatment and worsened clinical outcomes. Furthermore, misdiagnosis is common because leptospirosis shares symptoms with other infections, making it challenging to identify. The need for better diagnostic tools and specialized training for healthcare professionals is crucial to addressing this issue (Md-Lasim et al., 2021).

Another major obstacle is the inconsistency in data collection methods across different regions. The Indonesian healthcare system requires to implement a standardized method for an integrated data that ensures proper vigilance and subsequent response strategies (Eka Purnama and Hartono, 2023). The healthcare system lacks standardized diagnostic and reporting mechanisms, which affects the efficiency of surveillance and response efforts (Yuniasih *et al.*, 2022).

Table 2 compares the health expenditures for leptospirosis patients covered by national health coverage or JKN insurance and patients without

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insurance (out-of-pocket patients). The direct costs for insurance patients were performed as additional medical treatments not covered by national health coverage, transportation costs, and self-medication. Table 2 shows that the results for all those costs were relatively low. The details were medical treatments at an average of USD 0.63, transportation at USD 8.81, and self-medication at USD 3.79. Then, the indirect costs for the insurance patient were expenses on average for caregivers (USD 82.45) and average communication costs (USD 1.37).

Conversely, the direct costs for out-of-pocket patients included the average transportation costs (USD 31.90) and the average self-medication (USD 2.62). Meanwhile, the average number of caregiver costs for out-of-pocket patients was USD 86.38, and the average number of communication costs was USD 2.62. This study reveals significant cost differences between those covered by the National Health Insurance and out-of-pocket patients. Both groups incurred high expenses, with indirect costs, mainly caregiver expenses (accommodation, food, transportation), being the largest.

Transportation and food dominated caregiver costs. Sabermahani et al. found that nonmedical costs doubled the hospital bills (Sabermahani *et al.*, 2021). Transportation posed a financial burden, especially for rural patients needing to travel to urban facilities (Yuan, Zhang, and Li, 2022; Thomson *et al.*, 2023). The family of leptospirosis patients faced high transportation costs due to the distance to reach the hospital, often incurring more costs than the patients themselves. On the side, the caregivers also faced significant consumables such as food or drink expenses while waiting for patients, especially when multiple family members accompanied them. Research reveals that longer hospital stays lead to increased caregiver food expenses (Destanul Aulia, Sri Fajar Ayu, 2017).

The results also reveal the high costs patients and their families expended during the treatment. The average transportation cost of out-of-pocket patients was three times that of insurance patients. Transportation barriers are essential to access health services, especially for those with low incomes or without insurance/ insurance (Samina T. Syed, Ben S. Gerber, 2013). Leptospirosis inpatients in the Banyumas District use varied modes of transportation; most patients use public transit, motorbikes, cars, or ambulances owned by health centers. The study explains that the difference in transportation utilization related to accessible modes of transportation varies according to the level of public transportation infrastructure (Jang, Seon, and Oh, 2020).

The majority of insurance patients were treated in hospitals that were at home due to the insurance regulations. Conversely, out-of-pocket patients have varied options when selecting a hospital for the leptospirosis treatment. Our study reveals that the type of hospital (public or private) tended to perform at a high cost.

Thereafter, the insurance patients were likely to spend more money compared to out-of-pocket patients. Along with the majority of the insurance, patients experienced the over-the-counter drug, and/or traditional remedies called jamu and/or massage before they sought medical care. It was related to the statement of the Indonesia Central Bureau of Statistics that most of the community (79%) engaged in self-medication (Badan Pusat Statistika, 2024).

Most citizens relied on traditional medicine due to accessibility and affordability (Widowati and Nurhayati, 2017). Research conducted in Kudus Regency revealed that the education and knowledge of the patients influenced their self-medication behavior (Ferika Indrasari, Eleonora Maryeta Toyo, Siti Munawaroh, 2024). In more detail, decision-makers in family and health information affected the decision to self-medicate (Rauf *et al.*, 2021)

Table 2 compares healthcare costs for JKN (Indonesia's national health insurance) and general patients, covering various medical services and treatments. It highlights the minimum, maximum, and average costs for both groups. The cost components are laboratory tests, medications, doctor consultations, medical

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and nonmedical examinations, inpatient emergency room accommodations, medical procedures, and hemodialysis.

To summarize, the insurance patients performed the average total cost at USD 226.46, which is cheaper compared to the total cost of out-of-pocket patients (USD 231.40). The result showed that the drug and accommodation indicated the highest cost during the treatment of Leptospirosis in Banyumas. The insurance patients reported the highest cost at USD 346.95; the average cost was USD 65.72 for drugs and other medical consumables.

Table 2. The Cost Components of Leptospirosis Patients during Treatment in Banyumas Regency, 2023

Cost Component	Minimum Cost (USD)	Maximum Cost (USD)	Average Cost (USD)
National Health Insurance Patients			
Direct Costs			
Additional medical treatment costs (not covered by NHI)	0.00	16.40	0.63
Transportation	0.00	45.93	8.81
Self-medication	0.00	26.25	3.79
Indirect Costs			
Caregiver cost	0.00	629.88	82.45
Communication	0.00	13.12	1.37
Treatment cost			
Length of Stay (in days)	3 days	20 days	7 days
Laboratory	18.24	93.92	43.10
Drug and other stuff medical consumables	20.13	346.93	65.72
Professional cost	2.46	43.49	16.67
Procedural cost (surgical and non-surgical)	18.48	105.09	28.50
Medical Support Cost	0.00	117.83	14.34
Nonmedical Support Cost	1.42	20.01	9.97
Inpatient Accommodation	34.99	92.77	43.01
Emergency Room Accommodation	0.00	9.42	4.03
Haemodialysis	0.00	86.61	10.02
Intensive Care Service	0.00	57.77	3.98
Total	**128.94**	**845.77**	**226.49**
Out-of-Pocket Patients			
Direct Costs			
Transportation	0.79	118.10	31.90
Self-medication	0.00	15.09	2.62
Indirect Costs			
Caregiver cost	20.01	383.18	86.38
Communication	0.00	16.40	2.62
Treatment Cost			
Length of Stay (in days)	3 days	20 days	7 days
Laboratory	18.24	93.92	43.10
Drug and other medical consumables	20.13	346.93	65.72
Professional cost	2.46	43.49	16.67
Procedural cost (surgical and non-surgical)	18.48	105.09	28.50
Medical Support Cost	0.00	117.83	14.34

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Cost Component	Minimum Cost (USD)	Maximum Cost (USD)	Average Cost (USD)
Nonmedical Support Cost	1.42	20.01	9.97
Inpatient Accommodation	34.99	92.77	43.01
Emergency Room Accommodation	0.00	9.42	4.03
Haemodialysis	0.00	86.61	10.02
Intensive Care Service	0.00	57.77	3.98
Total	**128.94**	**845.77**	**226.49**

Source: Primary Data
1 USD = IDR 15,241

Table 3. The Opportunity Cost and Cost of Illness of Leptospirosis Patients in Banyumas Regency, 2023

Opportunity Cost Component	Number of References	Opportunity Cost Average of (ALOS X minimum wage)
Uninsurance's Patient		
Average Length of Stay	7th days	USD 40.65
Average Daily Minimum Wage (20 effective working days)	USD 6.69	
National Health Insurance Patients		
Average Length of Stay	9th days	USD 44.75
Average Daily Minimum Wage (20 effective working days)	USD 6.69	
Disparity		**USD 3.90**
Cost of Illness		**USD 464,01**

Source: Primary Data
1 USD = IDR 15,241

On the other hand, patients who were uncovered by insurance recorded drugs and other stuff medical consumables with an average of USD 70.63 and USD 243.31 as the highest records during leptospirosis treatment. The average cost of leptospirosis treatment in hospitals slightly differs between national health insurance and out-of-pocket patients. Out-of-pocket patients were likely more expensive compared to insurance patients.

Delays in diagnosing leptospirosis infections and hospitalization lead to patient's worse health outcomes. Leptospirosis symptoms are likely to be similar to those of influenza, dengue fever, and other viral hemorrhagic infections. It influenced the doctors in diagnosing the patient with leptospirosis. Meanwhile, patients who have been diagnosed with leptospirosis lately might require intensive healthcare. Furthermore, intensive healthcare is associated with high expenditure due to a high total cost of treatment.

Leptospirosis often leads to significant workdays lost due to illness and long-term disability. Leptospirosis patients experience a wide range of debilitating symptoms, starting with fever and headache. In addition, some of the patients experienced severe complications like kidney or liver damage, which required intensive medical care. They risked being unable to work or perform daily tasks during treatment, bed rest, and some medical procedures (Agampodi, Gunarathna, J.-S. Lee, *et al.*, 2023). Hence, this illness also brings substantial financial losses for individuals and families.

Table 3 presents the opportunity cost for both insurance (Indonesian National Health Insurance) and out-of-pocket patients, which is examined based on the average length of stay in the hospital and the daily minimum wage. The average length of stay of insurance patients was 7 days, which led to the estimation of opportunity cost at USD 40.65. In comparison, out-of-pocket patients recorded an average length of stay of 9th

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days, and the result showed the opportunity cost at USD 44.75.

Table 3 also depicts the average Cost of Illness (COI) due to leptospirosis. It was USD 464.01 in economic losses due to leptospirosis during 2023. The cost includes the hospital treatment and the amount of non-treatment expenses the patient must incur. The other study conducted in Banyumas found that the cost of illness due to leptospirosis, obtained from health facilities's vision, was reported at USD 289.64 in 2021 (Nugraheni *et al.*, 2024).

Another study in New Zealand found that the average loss due to Leptospirosis was USD 4.42 million. These figures included the losses due to absenteeism, medical expenses, and treatment until recovery (Sanhueza *et al.*, 2020). The amount of therapy and other patient costs are consequences of the cost of illness. Although the cost of treatment in a healthcare facility was covered by insurance, different direct and indirect costs were not covered by the insurance payment.

Furthermore, this study also estimated the social cost due to leptospirosis in 2023. This study performed the average length of stay (ALOS) of all leptospirosis patients at 8 days. Then, the prevalence rate of leptospirosis in 2023 was 5.96%, and the population of Banyumas Regency was 1,828,573. The formulation of social cost is multiplied by ALOS, prevalence rate, minimum wage, and population (Drummond *et al.*, 2015). As a result, the social cost lost due to Leptospirosis in Banyumas amounts to USD 6,068.79 per month.

Productivity losses rose from the patient's inability to work and family members who may need to take time off to provide care (Agampodi, Gunarathna, J. S. Lee, *et al.*, 2023). Long-term complications can lead to further loss of productivity and financial strain, impacting households and the broader workforce. Additionally, the burden on healthcare resources and society's overall quality of life is significant when the disease is not adequately managed (Wang *et al.*, 2024).

Public health strategies must emphasize prevention through surveillance programs and public awareness campaigns to reduce the cost of leptospirosis illness. Engaging communities in environmental management can enhance these efforts, minimizing transmission and reducing the financial burden on healthcare systems (Widawati *et al.*, 2023).

Strengthening the surveillance systems of leptospirosis is essential to ensure adequate diagnosis and response to outbreaks. Following that, collaborative efforts to improve sanitation and emergency preparedness are keys to preventing leptospirosis in endemic areas (Sykes *et al.*, 2022).

Rapid diagnostic tests are critical for early detection. However, obstacles to availability lead to delayed treatment, which increases the risk of high costs. Therefore, ensuring access to these tests and advanced treatments can reduce long-term healthcare costs and improve patient outcomes (Rajapakse, 2022). Mobile health applications and telemedicine platforms can enhance case tracking and elevate treatment management and resource allocation. The application can assist in calculating treatment costs and economic losses, providing a clearer understanding of the financial impact of leptospirosis and guiding more effective resource distribution (Petakh *et al.*, 2024).

Conclusion

In conclusion, this study highlights the significant burden of Leptospirosis in Indonesia, emphasizing both its economic toll on individuals and the systemic challenges within Indonesia's healthcare system. The demographic data shows that leptospirosis predominantly affects males, especially in agricultural and rural communities, where environmental conditions and occupational exposure increase the risk of infection.

The analysis of healthcare costs reveals substantial financial strain due to hospitalization and indirect caregiving costs, particularly for those uninsured or dependent on public healthcare programs like JKN. With significant costs and productivity losses, leptospirosis affects

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individuals, households, and the wider community. Thus, the results of this study could be an evidence for the authority to ensure the health allocation for better healthcare especially for leptospirosis in endemic areas in Indonesia. Whereupon, this result plays a role as first stage of the health economic evaluation for healthcare systems and the implementation of universal health coverage in Indonesia.

This study addressed the limitations of retrospective recollections of patients' and caregivers' responses due to the total costs, and the small sample size. All eligible patients were interviewed about their treatment-related expenses. However, discrepancies arose when patients and caregivers argued over the total cost of their treatment. To help recall these out-of-pocket costs, we used the price of gasoline and the distance from their homes to healthcare facilities (primary care centers or hospitals) to remind them.

Consequently, the study unnecessarily incorporated bias by being dependent on extrinsic cues. Notwithstanding these constraints, the results offer practical and realistic data on the economic costs to households of leptospirosis. The magnitude of this economic impact is poorly documented in Indonesia, and the present study thus contributes to filling this gap, potentially enabling public policy.

This study suggests that future studies should consider DALYs as a target outcome to study (Lost years of life deaths specifically and years spent living with the disease (Kim *et al.*, 2022). Hitherto, research that examines DALYs related to leptospirosis is uncommon in Indonesia. Consequently, an expanded inquiry across a broader geographic area must be conducted to enhance the existing data.

Notwithstanding the limitation, our findings emphasize the impact of leptospirosis on human productivity and the burden it inflicts on households. The preventive measures and the promotion and prevention of the leptospirosis control program require an improvement to mitigate the outcome effectively.

Finally, this study recommends that the local government of Banyumas Regency and Central Java Province develop a strategy to decrease the occurrence of severe cases of leptospirosis. Nationally, this study advocates for enhanced public health strategies focusing on prevention, early diagnosis, and improved healthcare access to address the leptospirosis burden effectively. Key measures such as implementing comprehensive vaccination programs, improving sanitation, and conducting public awareness campaigns are essential to reducing disease transmission. Strengthening disease surveillance and ensuring access to rapid diagnostic tools will enable timely interventions, ultimately lowering the overall healthcare costs associated with leptospirosis.

Abbreviations

DALYs: Disability-adjusted life years; JKN: Jaminan Kesehatan Nasional; WHO: World Health Organization; GDP: Gross Domestic Product; MoH: Ministry of Health; IDR: Indonesian Rupiah; ICD.10: International Statistical Classification of Diseases 10th revision; USD: United States Dollar.

Declarations

Ethics Approval and Consent Participant

The study was conducted by the Ethical Approval for Study and approved by the National Research and Innovation Agency Health Ethics Commission, Republic of Indonesia, approval letter 042/KE.03/SK/05/2023, approval date May 2nd, 2023.

Conflict of Interest

The authors declare that they do not have a conflict of interest.

Availability of Data and Materials

The author cannot publicly disclose the data since neither a third party nor the Banyumas Regency and researchers, the data's owner, are authorized to do so.

Authors' Contribution

Conceptualization: WPN and SDL. Methodology: SDL and IP. Software:

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