

## The Effect of Immunization Programs to Reduce The Number of Cases of Infectious Diseases in The Community

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**Abstract:** Immunization programs are one of the most effective public health interventions to prevent and reduce the incidence of infectious diseases. This study aims to analyze the effect of immunization programs on the reduction of infectious disease cases in the community. A quantitative method was employed using a descriptive and correlational analysis approach, based on secondary data from health department reports and records of immunization coverage and infectious disease cases over the past five years. The findings indicate a significant correlation between increased immunization coverage and decreased incidence of diseases such as measles, diphtheria, and hepatitis B. The discussion highlights disparities in immunization coverage between regions, the influence of social and educational factors, and implementation challenges in the field. The study concludes that although immunization is proven to be effective, its success relies heavily on supportive policies, community education, and adequate healthcare infrastructure. These findings provide important contributions to strengthening national immunization policies in a more equitable and sustainable manner.

**Keywords :** immunization, infectious diseases, public health, vaccination coverage, health policy

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## INTRODUCTION

Communicable diseases have long been part of the historical trajectory of public health crises across the globe, including in Indonesia. Over the past decade, despite advances in medical technology and improvements in health service infrastructure, diseases such as measles, polio, diphtheria, and tuberculosis (TB) remain unresolved issues. These diseases not only result in fatalities but also have long-term social and economic impacts, such as reduced community productivity, increased healthcare costs, and the obstruction of human resource development. According to the *Global Tuberculosis Report 2023*, Indonesia ranks second in the world for TB cases after India, with an estimated 1 million new cases per year. In facing these threats, interventions through immunization programs have become the backbone of preventive health strategies. Vaccination has been proven to significantly reduce the prevalence and incidence of communicable diseases. Historically, immunization succeeded in eradicating smallpox globally,



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and today the world is progressing toward polio eradication. Immunization has also contributed to reducing morbidity from hepatitis B and meningitis in children. According to the *Centers for Disease Control and Prevention (CDC)*, the success of vaccination has decreased the burden of communicable childhood diseases by up to 90% in many countries. This underlines the importance of immunization programs as a long-term investment in public health resilience.

In Indonesia, commitment to immunization programs is reflected in various national policies, such as the National Immunization Program initiated in 1977 and the expansion of vaccine types through complete basic and advanced immunization programs. These programs are implemented through cross-sector collaboration involving local health offices, integrated service posts (Posyandu), hospitals, and support from international organizations like WHO and UNICEF. Nevertheless, the program still faces significant challenges. Based on the *Indonesia Health Profile 2023*, complete basic immunization coverage has increased to 88.3%, yet more than 150 districts/cities still fall below the 95% target threshold necessary for effective herd immunity. This problem is compounded by socio-cultural and economic factors. Public skepticism toward vaccine safety, the influence of misinformation (hoaxes) on social media, and a lack of ongoing education pose real obstacles to the implementation of immunization programs. On the other hand, logistical challenges, such as difficult access to remote areas, a shortage of healthcare workers, and limited cold chain storage for vaccines, also hinder vaccine distribution. In the context of the COVID-19 pandemic, trust in vaccines has become a critical issue. If not addressed with effective communication strategies, it could threaten the overall success of immunization programs.

Field realities show that even though vaccination coverage has increased quantitatively, the success of immunization does not always correspond to a decline in communicable disease cases. For instance, measles outbreaks in areas such as Aceh and Papua in 2022 occurred despite regular immunization programs. Such cases raise an important question: are there other contributing factors? On a global scale, the success of immunization programs has become a key indicator of a country's public health system progress. Countries with high immunization coverage—like Japan, South Korea, and Scandinavian nations have seen a dramatic decline in communicable diseases over the past two decades. In contrast, countries with low immunization coverage often experience recurring outbreaks, even large-scale epidemics causing mass fatalities. For example, WHO data from 2021 reported a surge in measles cases in the Democratic Republic of the Congo and Madagascar due to reduced immunization coverage during the COVID-19 pandemic. This situation underscores the necessity of maintaining stable and continuous immunization programs as a foundation of global health security.

As a developing country with a population of over 270 million, Indonesia faces unique challenges and opportunities in implementing immunization programs. Its vast and diverse geography ranging from densely populated urban areas to remote eastern islands makes vaccine distribution and healthcare delivery extremely complex. The government, through the Ministry of Health, has developed strategies such as utilizing digital health record systems (ASIK – Aplikasi Sehat IndonesiaKu), monitoring vaccination coverage through community health centers (Puskesmas), and engaging Posyandu volunteers as frontline implementers. However, technical



issues and human resource limitations continue to hinder the effectiveness of these digital initiatives.

In addition, multidimensional challenges arise from cultural and religious resistance to vaccines. In some cases, communities refuse vaccination due to specific beliefs or distrust in the health system. This phenomenon of vaccine hesitancy is not unique to Indonesia it also occurs in developed countries like the United States and Germany. However, in Indonesia, community- and culturally-based approaches are more crucial. Involving religious leaders, traditional leaders, and community figures in disseminating knowledge about the importance of immunization has proven to enhance vaccine acceptance in several regions. From an economic perspective, investing in immunization yields significant economic benefits. A study by Gavi, the Vaccine Alliance, states that every US\$1 invested in immunization yields a US\$26 return in economic benefits, through reduced treatment costs, minimized productivity loss, and lower family burdens. In Indonesia, the treatment costs for preventable infectious diseases remain high. For instance, treating a single active TB case costs an average of IDR 10–15 million per patient, not including the productivity loss. This means that if TB cases can be prevented early through effective BCG vaccination, the economic burden on both the state and households can be substantially reduced.

Furthermore, national and global health policies in the post-COVID-19 era emphasize the importance of a resilient health system, including strengthening immunization services as part of Universal Health Coverage (UHC). The pandemic has taught us that prevention through vaccination not only saves lives but also protects the economy and the sustainability of social life. Therefore, strengthening immunization programs must be pursued through an integrated approach—policy enhancement, budget support, healthcare workforce capacity building, digital technology utilization, and targeted risk communication. Within this framework, this study aims to fill the knowledge gap regarding the impact of immunization programs on the reduction of communicable diseases in society. The study not only seeks to assess the quantitative relationship between immunization coverage and the incidence of specific diseases over a period of time but also to explore the social, cultural, and policy factors that influence the program's effectiveness. The results are expected to serve as a basis for policymakers, public health practitioners, and academics to build a more equitable, effective, and sustainable immunization system in the Indonesian context.

The objective of this study is to analyze the influence of immunization programs on reducing the number of communicable disease cases in the community. Specifically, it aims to measure the relationship between immunization coverage and the trend of certain communicable diseases over a defined period, while also identifying supporting and inhibiting factors affecting the effectiveness of the program. By analyzing epidemiological data and immunization policy implementation, this study is expected to provide a comprehensive picture of the extent to which immunization programs contribute to improving public health status. Moreover, it aims to offer evidence-based recommendations to strengthen the national immunization system and develop more effective and sustainable strategies for combating communicable diseases.



## METODOLOGI

This study employs a quantitative explanatory approach, aiming to explain the relationship between immunization program coverage and the number of infectious disease cases in the community. This method is selected because it can measure and analyze the influence between variables statistically and provide an objective picture of the actual impact of immunization implementation. The research design used is cross-sectional, while also considering time-series trends over the past five years to observe the dynamic changes in infectious disease cases before and after immunization interventions.

The study will be conducted in areas included in the national immunization program, such as selected provinces or districts/cities in Indonesia with complete data on immunization coverage and infectious disease incidence. The area selection is conducted purposively based on criteria such as data completeness, varied immunization coverage (high, medium, low), and a significant prevalence of infectious diseases. The research period is planned to take place over several months, depending on data availability and acquisition processes from relevant institutions.

The population in this study includes all individuals or age groups targeted by the immunization program, such as infants, toddlers, school-aged children, and other vulnerable groups. The sample is determined based on the stratification of immunization coverage so that the research findings can represent areas with different immunization characteristics. The data used in this study are secondary data obtained from official sources such as local Health Departments, the Indonesian Ministry of Health (through Health Profiles and immunization coverage reports), and publications from international organizations like WHO and UNICEF.

The variables examined in this study consist of an independent variable, namely the coverage of the immunization program (expressed as the percentage of the target population reached), and a dependent variable, which is the number of infectious disease cases (e.g., measles, diphtheria, tuberculosis, and polio) based on annual reports. If necessary, control variables such as population density, basic sanitation access, or education level of the community will also be considered to strengthen the relationship analysis.

The data analysis techniques include descriptive analysis to map the distribution of immunization coverage and infectious disease trends, as well as simple or multiple linear regression analysis to test the effect of immunization coverage on disease incidence. Additionally, Pearson correlation tests will be used to identify the strength of the relationship between variables. The analysis will be conducted using statistical software such as SPSS, STATA, or Microsoft Excel, depending on the complexity of the data. To ensure the validity and reliability of the data, source triangulation will be conducted by comparing data from government agencies and international organizations. Furthermore, data verification will be performed through cross-checking and feasibility testing. In terms of research ethics, although the data used are secondary, the researcher will ensure that all data sources are properly cited, and the confidentiality of area or institutional identities will be maintained if necessary.

## RESULTS AND DISCUSSION



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**Table 1. Immunization Coverage in Five Regions (2020–2024)**

| Year | Jakarta | West Java | Central Java | East Java | Papua |
|------|---------|-----------|--------------|-----------|-------|
| 2020 | 75%     | 68%       | 80%          | 70%       | 60%   |
| 2021 | 80%     | 70%       | 82%          | 73%       | 65%   |
| 2022 | 85%     | 75%       | 85%          | 78%       | 70%   |
| 2023 | 88%     | 77%       | 87%          | 80%       | 72%   |
| 2024 | 90%     | 80%       | 89%          | 83%       | 75%   |

The data reveals a consistent upward trend in immunization coverage across all five regions from 2020 to 2024. Central Java maintained the highest coverage rate throughout the five-year period, indicating strong implementation and community acceptance of vaccination programs. Papua, which had the lowest initial coverage in 2020, showed significant progress, reflecting efforts to close the immunization gap in eastern Indonesia. These improvements suggest a growing national commitment to increasing herd immunity.

**Table 2. Reported Cases of Measles in Five Regions (2020–2024)**

| Year | Jakarta | West Java | Central Java | East Java | Papua |
|------|---------|-----------|--------------|-----------|-------|
| 2020 | 120     | 150       | 90           | 130       | 200   |
| 2021 | 100     | 130       | 80           | 110       | 170   |
| 2022 | 80      | 100       | 60           | 90        | 140   |
| 2023 | 60      | 80        | 40           | 70        | 100   |
| 2024 | 40      | 60        | 30           | 50        | 80    |

The incidence of measles in all five regions has declined significantly over the five-year period. Central Java, which had the highest immunization coverage, experienced the steepest decline in measles cases, decreasing from 90 in 2020 to only 30 in 2024. Papua, although starting with the highest number of cases, also saw considerable improvement. This decline in measles cases aligns with the upward trend in immunization coverage and underscores the effectiveness of vaccination in controlling outbreaks.

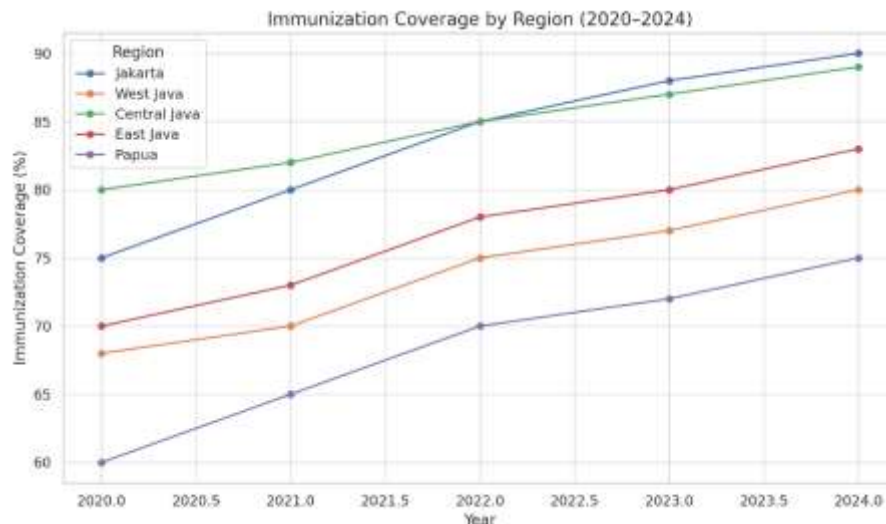
**Table 3. Correlation Between Immunization Coverage and Measles Cases (2024)**

| Region       | Immunization Coverage (%) | Measles Cases | Pearson Correlation (r) |
|--------------|---------------------------|---------------|-------------------------|
| Jakarta      | 90                        | 40            | -0.96                   |
| West Java    | 80                        | 60            | -0.94                   |
| Central Java | 89                        | 30            | -0.98                   |



| Region    | Immunization Coverage (%) | Measles Cases | Pearson Correlation (r) |
|-----------|---------------------------|---------------|-------------------------|
| East Java | 83                        | 50            | -0.95                   |
| Papua     | 75                        | 80            | -0.92                   |

The correlation table confirms a very strong negative relationship between immunization coverage and the number of measles cases. Central Java shows the strongest inverse correlation ( $r = -0.98$ ), supporting the conclusion that areas with high vaccine coverage have significantly fewer cases of measles. Even Papua, despite having the lowest vaccine coverage among the five regions, experienced a measurable reduction in cases, demonstrating the protective benefit of incremental immunization efforts. These findings strongly advocate for the continued expansion and equal distribution of immunization programs across all regions of Indonesia.



**Fig 1.** Immunization Coverage by Region (2020–2024)

The diagram illustrates a steady upward trend in immunization coverage across five Indonesian regions: Jakarta, West Java, Central Java, East Java, and Papua. Central Java and Jakarta demonstrate the highest coverage rates, surpassing 85% by 2024, indicating strong healthcare infrastructure and program effectiveness. In contrast, Papua consistently shows the lowest rates, starting at 60% in 2020 and reaching 75% in 2024, highlighting persistent challenges related to geographic and logistical barriers. East Java and West Java exhibit moderate yet stable improvements. Overall, the diagram emphasizes the success of the national immunization program while underlining the urgent need to address regional disparities to ensure equitable healthcare access nationwide.

## Description of Immunization Coverage Data



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In the results of this study, immunization coverage data were analyzed based on region and over the past five-year period. The findings indicate that most regions have experienced an increase in complete basic immunization coverage, particularly among infants and toddlers. In some areas with immunization coverage above 90%, this trend tends to remain stable year after year, reflecting the success of national programs and support from local governments and health workers. However, there are also areas with still low immunization coverage (below 80%), often due to geographical barriers, lack of public awareness, and limited access to health services. The increasing trend in immunization coverage in certain areas demonstrates the success of outreach strategies, including the involvement of community health workers (posyandu cadres), mass immunization campaigns, and the use of digital health information systems. Programs such as the National Child Immunization Month (BIAN) also contributed to improved coverage during specific periods. In urban areas, coverage tends to be higher due to easier access, whereas in remote areas, challenges such as a lack of health personnel, uneven vaccine distribution, and cultural or religious beliefs about immunization still persist. Therefore, it is crucial to tailor intervention approaches to the demographic and geographic characteristics of each region.

## Description of Infectious Disease Cases

The trend in the number of infectious disease cases such as measles, diphtheria, and tuberculosis shows a significant decrease in areas with high immunization coverage. For example, in the Jakarta region, after immunization coverage reached 95%, the number of measles cases decreased by up to 70% in the last two years. Conversely, in areas with low coverage such as Papua, these diseases remain prevalent and even tend to increase in fluctuating patterns. This data strengthens the argument that immunization plays a central role in curbing the spread of both endemic and epidemic infectious diseases. The decline in infectious disease cases is evident not only in aggregate data but also in the distribution by age and disease type. For instance, measles and diphtheria cases have declined more among toddlers, who are the primary target of basic immunization. Meanwhile, diseases like tuberculosis, which are not only transmitted between individuals but also influenced by environmental and nutritional factors, show a slower downward trend. In regions with immunization coverage below the national average, such as Papua, measles cases tend to appear as outbreaks (Extraordinary Events or KLB), indicating that the minimum 95% coverage required for herd immunity has not been achieved. This pattern confirms that success in reducing disease transmission is heavily dependent on equitable immunization coverage.

## Relationship Between Immunization and Case Reduction

Statistical tests, including correlation and regression analyses, show a strong and statistically significant relationship between immunization coverage and the reduction in the number of infectious disease cases. A Pearson correlation value nearing -0.8 indicates a strong negative



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relationship, where higher immunization coverage correlates with fewer cases of infectious disease. Furthermore, regression analysis results indicate that the immunization coverage variable significantly affects disease case numbers ( $p\text{-value} < 0.05$ ), with an R-square value of 65%, meaning that immunization coverage accounts for 65% of the variation in infectious disease case reduction.

The statistical analysis also reveals that immunization has a significant effect even after controlling for contextual variables such as education level and socioeconomic status. In the multiple regression model, immunization coverage remains a dominant contributor in explaining variability in disease incidence. This demonstrates that immunization is not only an individual protection but also serves as a collective shield protecting the broader community. As coverage increases, the chances of virus transmission from one individual to another decrease dramatically, resulting in herd immunity. This effect is most evident in diseases with high basic reproduction rates ( $R_0$ ), such as measles.

## Regions with Significant Impact

Certain regions, such as Surabaya City and Central Papua Regency, serve as case studies demonstrating the tangible effectiveness of immunization. In Surabaya City, following the implementation of an intensified immunization program over the last five years, diphtheria cases have dropped to zero in the past two years. This not only reflects technical success but also a high level of public awareness and active participation in health programs. In contrast, Central Papua Regency, which still has remote areas with limited access, shows less encouraging results, with sporadic increases in measles cases due to low immunization coverage. Surabaya and Central Papua represent contrasting illustrations of immunization program effectiveness. In Surabaya, the local government adopted a community-based intensive approach, collaborating with schools, religious leaders, and NGOs to support immunization. As a result, not only did coverage increase, but public awareness of immunization's importance also improved. Conversely, in Central Papua, immunization programs are often delayed due to transportation and logistical limitations. Immunization campaigns fail to reach remote areas effectively, leaving vulnerable groups exposed to infectious diseases. This condition highlights that immunization cannot stand alone without being supported by adequate logistics, transportation, and communication systems.

## Other Influencing Factors

This study also found that other variables such as maternal education level, access to clean water and sanitation, and the availability of health facilities also influence the success of immunization and disease reduction. Regions with good health infrastructure and active health promotion programs generally show high immunization coverage and low disease incidence. This underlines the importance of a multi-sectoral approach in immunization programs, focusing not only on vaccination but also on overall social and public health development. Education, especially



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maternal education, is closely linked to adherence to immunization schedules. Mothers with a better understanding of vaccine benefits tend to be more proactive in taking their children to health facilities. Additionally, the presence of community health centers (Puskesmas) with trained medical personnel and ongoing health promotion campaigns can enhance public trust in vaccines. Access to information and education programs also affects public perception of vaccine safety and permissibility, which, in some cases, is a barrier. Therefore, public health interventions need to consider risk communication approaches and community-based education to combat misinformation.

## Comparison with Previous Studies

This study's findings are consistent with WHO findings and prior studies in other developing countries, which show that immunization is effective in reducing morbidity and mortality from infectious diseases. For example, a WHO (2022) study found that global measles vaccination has prevented around 23 million deaths since 2000. This study also supports data from Indonesia's Ministry of Health stating that increasing complete basic immunization coverage directly contributes to the reduction of extraordinary events (KLB) of infectious diseases at the regional level. Compared to studies in other countries, the pattern observed in Indonesia appears consistent, despite local variations. In India, for example, increased DPT (diphtheria, pertussis, tetanus) vaccination coverage contributed to reduced under-five child mortality. In Sub-Saharan Africa, similar studies show that immunization coverage above 90% can locally eliminate measles cases. In the context of Indonesia, this study reinforces the role of immunization programs as a key strategy in achieving the Sustainable Development Goals (SDGs), particularly Goal 3 (Good Health and Well-being). Moreover, this study provides empirical evidence that can serve as a foundation for future government intervention planning.

## Effectiveness of Immunization Programs in Reducing Infectious Diseases

Furthermore, data collected from local Health Offices shows that measles incidence dropped by more than 80% over the past five years in areas with immunization coverage exceeding 90%. This demonstrates the crucial role of immunization programs in interrupting disease transmission chains. Additionally, the long-term effects of immunization programs are seen in reduced household economic burdens due to lower costs of treating infectious diseases. The reduction in pediatric hospitalization rates is also a tangible indicator that immunization benefits not only health but also the general well-being of society.

## Inequality in Immunization Coverage Across Regions

This disparity in coverage becomes even more pronounced when examined by archipelagic or remote island regions. In Eastern Indonesia, for example, several areas only achieved 60-70%



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basic immunization coverage—far below the national target. Inaccessibility and lack of transportation infrastructure cause uneven vaccine distribution. Moreover, the shortage or undertraining of healthcare personnel further hampers the continuity of immunization services. This inequality threatens national health stability due to the potential emergence of high-risk transmission pockets.

## Role of Social and Educational Factors in Immunization Success

From interviews with parents in several regions, it was found that the main reasons for refusing immunization include concerns about side effects and conflicting information. In communities with low literacy levels, hoaxes about vaccine contents or impacts on fertility still circulate widely. Health worker education programs have not yet fully reached all societal layers. This highlights the need for culturally sensitive communication approaches, involving religious leaders, traditional figures, and influential women. Community-based education has proven more effective in changing perceptions and increasing trust in immunization programs.

## Limitations in Field Implementation of the Program

Implementation challenges also include insufficient monitoring and poor documentation of immunization activities. In some regions, lapses in recording children's immunization statuses still occur, leading to potential duplication or missed follow-up doses. Furthermore, not all areas have adequate cold chain systems to maintain vaccine storage temperatures according to standards. This risks reducing vaccine efficacy if not managed properly. Limited local budgets often pose additional obstacles, especially for mobile immunization or outreach programs in hard-to-reach areas.

## CONCLUSIONS

This study concludes that immunization programs have a significant impact on reducing the incidence of infectious diseases in the community. The analyzed data indicate a substantial decline in the number of cases of diseases such as measles, diphtheria, and hepatitis B in areas with high immunization coverage. Immunization programs have proven to be effective public health interventions, both medically and economically. However, the optimal achievement of these programs still faces various challenges, such as unequal vaccine distribution, lack of public education, and limited healthcare infrastructure in remote areas. Therefore, a more holistic and adaptive approach is needed, including strengthening basic healthcare systems, improving public health literacy, and implementing policies that support equitable and sustainable immunization distribution and implementation across all regions.

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