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Coverage of Complete Basic Immunization and Complete Immunization of Toddlers Against Undernutrition Status and Malnutrition Status in Toddlers

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Abstract. *Immunization is one of the most effective public health interventions in preventing infectious diseases that contribute to malnutrition in children under five. Low coverage of Complete Basic Immunization (IDL) and Complete Toddler Immunization (IBL) is closely associated with an increased risk of recurrent infectious diseases that directly worsen children's nutritional status. Based on data from the Rote Ndao District Health Office in 2025, IDL coverage in Rote Ndao District reached only 58.09% against a target of 80%, while IBL coverage was 68.32% against a target of 70%. Simultaneously, the prevalence of undernutrition (WAZ < -2 SD) in children under five was recorded at 22.7% out of 11,067 children weighed, and severe malnutrition (WHZ < -3 SD) at 0.5%. This study aims to analyze the description of immunization coverage and nutritional status of children under five in Rote Ndao District in 2025 using a descriptive-analytic approach based on secondary data analysis. Results show a consistent pattern: health centers with low IDL and IBL coverage tend to be in areas with higher prevalence of undernutrition and severe malnutrition. Batutua Health Center recorded the lowest IDL coverage (24.56%) and very low IBL coverage (27.97%), while its service area in Rote Barat Daya District had 362 undernutrition cases (16.7%). Strengthening immunization programs integrated with nutritional interventions is needed to improve children's health status in Rote Ndao District.*

Keywords: *Complete Basic Immunization, Complete Toddler Immunization, Undernutrition, Severe Malnutrition, Children Under Five, Rote Ndao*

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INTRODUCTION

The nutritional status of toddlers is a key indicator of public health and the quality of a nation's human resources. Nutritional issues in toddlers, particularly underweight (weight/age <-2 SD) and wasting (weight/height <-3 SD), impact not only child growth and development but also future human resource productivity and competitiveness. In Indonesia, efforts to reduce the prevalence of undernutrition and severe malnutrition in toddlers are a top priority in the National Action Plan for the Acceleration of Stunting Reduction in Indonesia (RAN-PASTI) and the 2020–2024 National Medium-Term Development Plan (RPJMN) (Sukmalalana et al., 2022; Andayani et al., 2022; Lailiyah, 2023; Ramlan, 2025; Azlina et al., 2025).

Immunization is one of the most cost-effective public health interventions in reducing childhood morbidity and mortality from vaccine-preventable diseases (VPD). Solis-Soto et al. (2020), Feikin et al. (2024), Calder et al. (2020) said that, beyond simply preventing specific diseases, immunization is closely linked to children's nutritional status through its mechanism of

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preventing recurrent infections. Infectious diseases such as diarrhea, pneumonia, and measles, which are preventable by vaccination, are among the leading causes of malnutrition in children under five in developing countries (Checkley et al., 2008; Prendergast & Humphrey, 2014; Rahmonova et al., 2026; Adepoju & Allen, 2019). This mutually reinforcing cycle of infection and malnutrition explains why low immunization coverage indirectly contributes to the high prevalence of undernutrition and severe malnutrition.

Complete Basic Immunization (IDL) is the provision of basic immunizations consisting of BCG, DPT-HB-Hib, Polio, and Measles/MR, which must be received by infants before 12 months of age. Meanwhile, Complete Childhood Immunization (IBL) includes IDL plus a booster of DPT-HB-Hib and Measles/MR at 18 months of age. These two indicators are measures of the performance of the national immunization program, regularly monitored by the Indonesian Ministry of Health (Suwantika et al., 2023).

Rote Ndao Regency, as an island regency in the southern tip of Indonesia, faces dual challenges in achieving immunization coverage and improving the nutritional status of children under five. Based on data from the Rote Ndao District Health Office in 2025, the district's IDL coverage only reached 58.09% of the national target of 80%, and IBL coverage was 68.32% of the 70% target. This condition coincided with a prevalence of malnutrition among toddlers of 22.7% of 11,067 toddlers weighed, and a prevalence of severe malnutrition of 0.5% (53 cases). These undernutrition figures place Rote Ndao District in the 'serious' nutritional problem category according to the WHO classification (prevalence of 20–29% = serious) (WHO, 2000).

This study aims to: (1) describe the coverage of IDL per community health center in Rote Ndao District in 2025; (2) describe the coverage of IBL per community health center in Rote Ndao District in 2025; (3) describe the distribution of the prevalence of undernutrition (weight/age) and severe malnutrition (weight/height) per sub-district in Rote Ndao District in 2025; and (4) analyzing the relationship patterns between immunization coverage and the nutritional status of toddlers, and providing evidence-based recommendations for program improvement.

METHODS

This study employed a descriptive secondary data analysis design to describe the distribution of immunization coverage and nutritional status among children under five years of age in Rote Ndao Regency in 2025. This approach was selected because secondary data analysis enables researchers to systematically examine existing information to describe health conditions and program performance without intervention or primary data collection (Creswell & Creswell, 2018). In accordance with the descriptive nature of the study, the analysis was not intended to establish a statistically significant association or causal relationship between immunization coverage and nutritional status. The data were obtained from the Rote Ndao Regency Health Office and consisted of Complete Basic Immunization (Imunisasi Dasar Lengkap/IDL) coverage, Complete Under-Five Immunization (Imunisasi Baduta Lengkap/IBL) coverage, prevalence of undernutrition, and cases of severe malnutrition recorded in 2025. The data represented routinely reported health program indicators from community health centers (Puskesmas) and their respective service areas. To ensure consistency in the interpretation of the variables, the immunization and nutritional indicators were operationally defined based on the applicable health program standards and official records. IDL coverage was defined as the proportion of eligible infants who had received the required complete basic immunization series relative to the corresponding target population in the respective service area. IBL coverage was defined as the proportion of eligible children under two years of age who had received the required complete immunization according to the applicable immunization schedule relative to the corresponding target population. The implementation of immunization services in Indonesia is regulated through national immunization policies issued by the Ministry of Health (Wahab et al., 2023; Azizatunnisa et al., 2021). Nutritional status was assessed using anthropometric indicators based on the WHO Child Growth Standards, which provide standardized growth indicators for children from birth to five years of age. Undernutrition was operationally defined as a weight-for-age Z-

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score (WAZ) below −2 standard deviations (SD), while severe undernutrition was defined as a weight-for-height Z-score (WHZ) below −3 SD. The nutritional status data were obtained from the official nutritional surveillance recapitulation maintained by the Rote Ndao Regency Health Office.

Because the secondary datasets were reported at different geographic levels, the unit of analysis was standardized before comparison. Immunization coverage data were reported by Puskesmas, whereas nutritional status data were available at the sub-district and/or Puskesmas level. Therefore, data were matched according to the corresponding Puskesmas service areas using official administrative and health service-area records maintained by the Rote Ndao Regency Health Office. Only data for geographic units that could be reliably matched were included in direct comparisons. No individual-level linkage was performed between immunization and nutritional status records. Accordingly, the unit of analysis was the geographic or Puskesmas service area rather than the individual child, and the findings were interpreted as area-level patterns rather than individual-level relationships. Given that the study relied entirely on secondary health service data, data quality control was conducted before analysis. The datasets were reviewed for completeness, consistency of geographic units, consistency of denominators, missing observations, and potential duplication. Immunization coverage figures were checked against the reported target populations and official health office recapitulations, while nutritional status data were reviewed for consistency with the corresponding Puskesmas or service-area records. When discrepancies were identified, the official recapitulation maintained by the Rote Ndao Regency Health Office was used as the basis for verification. Records that could not be reliably matched or verified were excluded from direct comparison. This procedure was undertaken because differences in reporting completeness, target population denominators, and recording practices may affect the interpretation of routinely collected immunization and nutritional data.

After data verification, descriptive analysis was performed using tabulation, frequency distribution, percentage calculation, and comparison across Puskesmas service areas. The analysis was used to describe the distribution of IDL and IBL coverage, undernutrition prevalence, and severe malnutrition cases across the study areas. A gap analysis was subsequently conducted by comparing the reported achievements with the applicable national program targets obtained from relevant official health program documents. The gap was calculated as the difference between the reported achievement and the corresponding target, and the results were categorized descriptively according to whether the specified target was achieved or not achieved. The achievement categories were used to assess program performance and were not interpreted as the results of an inferential statistical test (Sussman & Wilson, 2019; Kates et al., Ismail et al., 2022). To identify geographical patterns, immunization coverage indicators were descriptively compared with nutritional status indicators within the same Puskesmas service areas. The comparison was intended to identify differences and patterns of co-occurrence across areas rather than to demonstrate a statistically confirmed relationship. Therefore, no Pearson or Spearman correlation, chi-square test, regression analysis, or other inferential statistical test was performed. The results were consequently interpreted in terms of distribution, comparison, and program gaps, and not as evidence of a statistically significant association or causal effect between immunization coverage and nutritional status. This distinction was maintained because aggregate area-level data cannot determine whether children with incomplete immunization were the same individual children who experienced undernutrition or severe malnutrition.

In addition to the secondary data analysis, a narrative literature review was conducted to support the interpretation and discussion of the findings. Relevant scientific publications published between 2018 and 2025 were identified through relevant scientific databases and search engines using combinations of keywords related to immunization coverage, childhood immunization, nutritional status, undernutrition, severe malnutrition, and children under five years of age. Publications were considered relevant when they provided evidence concerning immunization, child health, nutritional status, or factors associated with childhood

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undernutrition (Adedokun & Yaya, 2021; Morales et al, 2023). The literature was used to provide scientific context for the findings and was not treated as a separate systematic review or meta-analysis. This terminology was selected because the present study did not employ a formal systematic review protocol involving predefined database-specific search strategies, duplicate screening, formal inclusion and exclusion procedures, or a systematic review flow diagram. Finally, the ecological nature of the data was considered in the interpretation of the findings. Because the study used aggregate data at the Puskesmas or geographic-area level, the findings cannot establish an individual-level relationship between immunization status and nutritional status. A higher prevalence of undernutrition in an area with lower immunization coverage, for example, does not demonstrate that the children who were incompletely immunized were the same children who experienced undernutrition. Therefore, the findings should be interpreted as descriptive area-level patterns and program performance indicators. Further analytical studies using individual-level data and appropriate inferential statistical methods would be required to assess the association between individual immunization status and nutritional status.

RESULT AND DISCUSSION

Complete Basic Immunization Coverage (IDL) per Community Health Center

Rote Ndao Regency's IDL coverage as of December 2025 was 58.09%, still far below the national target of 80%. The distribution of IDL coverage per community health center (Puskesmas) shows significant variation, as presented in Table 1.

Table 1. Complete Basic Immunization (IDL) Coverage per Community Health Center in Rote Ndao Regency in 2025

No	Community Health Center	IDL Coverage (%)	Target (%)	Status
1	Delha	86,85	80	Achieved Target
2	Sotimori	86,44	80	Achieved Target
3	Oelaba	84,53	80	Achieved Target
4	Sonimanu	75,00	80	Not Yet Achieved Target
5	Feapopi	68,66	80	Not Yet Achieved Target
6	Busalangga	64,41	80	Not Yet Achieved Target
7	Eahun	60,80	80	Not Yet Achieved Target
8	Korbafo	58,00	80	Not Yet Achieved Target
9	Oele	55,15	80	Not Yet Achieved Target
10	Baa	54,37	80	Not Yet Achieved Target
11	Ndao	36,90	80	Not Yet Achieved Target
12	Batutua	24,56	80	Very Low
Rote Ndao		**58,09**	**80**	**Not Yet Achieved Target**

Source: Rote Ndao District Health Office, 2025

Table 1 shows that, by district, Rote Ndao District's IDL coverage only reached 58.09%, far below the national target of 80%. Of the 12 community health centers (Puskesmas), only three (25%) achieved the IDL target: Delha (86.85%), Sotimori (86.44%), and Oelaba (84.53%). The other nine (75%) health centers failed to achieve their target. Batutua Community Health Center even recorded a very low coverage of only 24.56%, or less than a third of the target. Sonimanu, Feapopi, Busalangga, Eahun, Korbafo, Oele, Baa, and Ndao Community Health Centers each recorded coverage ranging from 36.90% to 75.00%, all below the 80% target. The large disparity between community health centers (range 24.56%–86.85%) indicates significant heterogeneity in service capacity and immunization accessibility in Rote Ndao Regency.

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Complete Childhood Immunization Coverage (CBW) per Community Health Center

CBW coverage in Rote Ndao Regency reached 68.32% as of December 2025, still below the target of 70%. The distribution of CBW coverage per community health center is presented in Table 2.

Table 2. Complete Childhood Immunization Coverage (CBW) per Community Health Center in Rote Ndao Regency in 2025

No	Community Health Center	IBL Coverage (%)	Target (%)	Status
1	Korbafo	99,25	70	Achieved Target
2	Ndao	95,45	70	Achieved Target
3	Delha	92,90	70	Achieved Target
4	Baa	82,08	70	Achieved Target
5	Oelaba	81,55	70	Achieved Target
6	Sonimanu	79,67	70	Achieved Target
7	Feapopi	75,62	70	Achieved Target
8	Oele	74,36	70	Achieved Target
9	Sotimori	71,63	70	Achieved Target
10	Busalangga	67,50	70	Not Yet Reached Target
11	Eahun	64,25	70	Not Yet Reached Target
12	Batutua	27,97	70	Very Low
Rote Ndao		**68,32**	**70**	Not Yet Reached Target

Source: Rote Ndao District Health Office, 2025

Table 2 shows that the overall coverage of the IBL in Rote Ndao District was 68.32%, falling short of the 70% target. Of the 12 community health centers (Puskesmas), 9 (75%) achieved the IBL target, with Korbafo Community Health Center recording the highest coverage (99.25%), followed by Ndao (95.45%) and Delha (92.90%). However, two community health centers failed to achieve the target: Busalangga (67.50%) and Eahun (64.25%), while Batutua Community Health Center recorded a 'Very Low' status with coverage of only 27.97%. An interesting pattern is that several community health centers that did not achieve the IDL actually achieved the IBL target (e.g., Korbafo, Ndao, Baa, and Oelaba), which may indicate improved coverage in the under-five cohort or differences in recording methods between cohorts.

Distribution of Underweight (W/A) Toddler Status by District

Data on toddler weighing results from the Rote Ndao Regency Health Office in 2025 presents the distribution of the prevalence of underweight in toddlers (Z-score <-2 SD) by district, as presented in Table 3.

Table 3. Distribution of Underweight Toddlers (W/A) by District in Rote Ndao Regency in 2025

No	District	Community Health Center	Children Weighed	Number of Underweight Children	Underweight Prevalence (%)
1	East Rote	Eahun	1,271	302	23.8
2	Landu Leko	Sotimori	402	58	14.4
3	Pantai Baru	Korbafo	643	167	26.0
4	Pantai Baru	Sonimanu	395	126	31.9
5	Central Rote	Feapopi	576	51	8.9
6	Lobalain	Ba'a	1,965	373	19.0
7	South Rote	Oele	418	122	29.2
8	Northwest Rote	Busalangga	1,171	323	27.6

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9	Loaholu	Oelaba	1,073	385	35.9
10	Southwest Rote	Batutua	2,165	362	16.7
11	West Rote	Delha	762	200	26.2
12	Ndao Nuse	Ndao	226	44	19.5
Rote Ndao Regency			**11,067**	**2,531**	**22.7**

Source: Rote Ndao District Health Office, 2025

Table 3 shows that of the 11,067 toddlers weighed in Rote Ndao District, 2,531 (22.7%) were underweight (BW/A <-2 SD). This figure places Rote Ndao District in the 'serious' nutritional problem category according to the WHO classification. Cases were unevenly distributed across sub-districts, with prevalence varying from 8.9% (Central Rote/Feapopi) to 35.9% (Loaholu/Oelaba). Loaholu District recorded the highest prevalence (35.9%), followed by Pantai Baru-Sonimanu (31.9%) and South Rote (29.2%). These three sub-districts fall into the 'critical' nutritional problem category (≥30%). In absolute terms, Lobalain District had the highest number of cases (373 cases) due to its largest toddler population (1,965 toddlers weighed), while Central Rote District had the lowest prevalence (8.9%), categorized as 'moderate'.

Distribution of Malnutrition Status (W/H) of Toddlers per Community Health Center

Data on malnutrition status of toddlers based on weight-for-height (W/H) indicators with a Z-score <-3 SD (severe wasting) per community health center area in Rote Ndao Regency in 2025 is presented in Table 4.

Table 4. Malnutrition Status (W/H <-3 SD) of Toddlers per Community Health Center in Rote Ndao Regency in 2025

No.	District	Community Health Center	Number of Children Weighed	Severe Malnutrition (Weight-for-Height < -3 SD) – Number	Percentage (%)
1	East Rote	Eahun	1,271	5	0.4
2	Landu Leko	Sotimori	402	3	0.7
3	Pantai Baru	Korbafo	643	0	0.0
4	Pantai Baru	Sonimanu	395	0	0.0
5	Central Rote	Feapopi	576	1	0.2
6	Lobalain	Baa	1,965	4	0.2
7	South Rote	Oele	418	7	1.7
8	Northwest Rote	Busalangga	1,171	12	1.0
9	Loaholu	Oelaba	1,073	7	0.7
10	Southwest Rote	Batutua	2,165	12	0.6
11	West Rote	Delha	762	0	0.0
12	Ndao Nuse	Ndao	226	2	0.9
Rote Ndao Regency			**11,067**	**53**	**0.5**

Source: Rote Ndao District Health Office, 2025

Table 4 shows that, by district, the prevalence of malnutrition (weight/height <-3 SD) among toddlers in Rote Ndao District was 0.5% (53 cases out of 11,067 toddlers). Although this

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figure is relatively small in absolute terms, there was significant variation between community health centers. Busalangga and Batutua Community Health Centers each recorded 12 cases of malnutrition (prevalence of 1% and 0.6%, respectively), followed by Oele (7 cases, 1.7%) and Oelaba (7 cases, 0.7%). Oele Community Health Center (South Rote) recorded the highest percentage of malnutrition (1.7%), while simultaneously having very low IDL coverage (55.15%). Three community health centers (Korbafo, Sonimanu, and Delha) recorded no cases of malnutrition at all, with Delha having high IDL and IBL coverage.

The findings of this study provide a descriptive overview of immunization coverage and nutritional status across Puskesmas service areas in Rote Ndao Regency in 2025. Overall, IDL coverage remained below the national target, with substantial variation between Puskesmas. Several areas with relatively low immunization coverage also showed a higher prevalence of undernutrition or a greater number of severe malnutrition cases. However, this pattern was not consistent across all Puskesmas. Because this study used aggregate secondary data and descriptive comparisons, these findings should be interpreted as area-level patterns rather than evidence of a statistically confirmed or causal relationship between immunization coverage and nutritional status. Nevertheless, the observed differences provide important information for identifying areas that may require strengthened immunization and nutrition interventions.

Immunization Coverage and Vulnerability to Infection

The relatively low IDL coverage observed in Rote Ndao indicates that a considerable proportion of infants may not have received complete protection against vaccine-preventable diseases. In nutritional terms, incomplete immunization may contribute to greater vulnerability to infectious diseases, which can in turn worsen nutritional status through reduced appetite, increased metabolic requirements, nutrient losses, and impaired nutrient absorption (Rytter et al., 2014; Prendergast & Humphrey, 2014). Recurrent infections and undernutrition can therefore interact in a reinforcing cycle, particularly among children living in environments where access to health services, adequate food, sanitation, and clean water is limited.

However, the findings of the present study should not be interpreted as demonstrating that low IDL coverage directly causes undernutrition or severe malnutrition. The absence of individual-level data and inferential statistical analysis means that it is not possible to determine whether children who were incompletely immunized were the same children who experienced poor nutritional outcomes. Rather, the geographic coexistence of lower immunization coverage and poorer nutritional indicators suggests that inadequate immunization may represent one component of a broader vulnerability profile that includes infectious disease exposure and other social and environmental determinants.

The considerable variation in IDL coverage between Puskesmas also suggests that immunization performance is not uniform across Rote Ndao Regency. In an archipelagic and geographically dispersed setting, distance to health facilities, transportation availability, socioeconomic conditions, and the capacity of health services to conduct outreach can influence access to immunization. Studies from geographically challenging settings in Indonesia have similarly identified distance, transportation barriers, and health-service accessibility as important determinants of childhood immunization uptake (Fauk et al., 2021). Therefore, the particularly low coverage observed in Puskesmas such as Batutua and Oele should be viewed not only as an immunization program issue but also as a potential indicator of broader service-access challenges.

IBL Coverage and the IDL-IBL Gap

The IBL findings provide an important additional perspective. Although IBL coverage was generally closer to the target than IDL coverage, the difference between the two indicators requires careful interpretation. In several Puskesmas, IBL coverage exceeded the corresponding IDL coverage despite the expectation that children receiving complete immunization at the under-two age group would generally form part of the cohort that had previously received basic

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immunization. This discrepancy should therefore not automatically be interpreted as evidence of better immunization performance among toddlers.

Several explanations are possible, including catch-up immunization, differences in the target populations used as denominators, migration between Puskesmas service areas, differences in birth cohorts, delayed immunization, or inconsistencies in recording and reporting. Consequently, the difference between IDL and IBL coverage may reflect both actual program performance and characteristics of the underlying data. Similar discrepancies between primary and subsequent immunization indicators have been described in settings where improvements in recording and catch-up activities affect reported coverage independently of earlier cohort performance (Moturi et al., 2025; Wagai et al., 2021).

This finding highlights the importance of strengthening immunization recording and cohort tracking rather than interpreting coverage indicators independently. In particular, Puskesmas with low IDL but relatively high IBL coverage may have successfully reached children through catch-up services, but this does not necessarily mean that primary immunization coverage among infants was adequate. Conversely, areas with low coverage for both indicators may require more comprehensive investigation of service accessibility, vaccine availability, outreach capacity, health-worker workload, community demand, and continuity of immunization services.

Patterns of Undernutrition Across Puskesmas

The comparison between immunization coverage and undernutrition prevalence revealed a number of notable geographic patterns (Santos et al., 2024; Chuang et al., 2020). Some Puskesmas with lower IDL coverage also had relatively high undernutrition prevalence, suggesting that these areas may experience overlapping vulnerabilities related to infectious disease prevention and child nutrition. However, the relationship was not consistent across all service areas, and several findings demonstrate why nutritional status cannot be explained by immunization coverage alone.

One particularly important finding was observed in Oelaba, which achieved the IDL target but recorded the highest prevalence of underweight. This apparent contradiction is epidemiologically important. If immunization coverage alone were sufficient to explain nutritional status, an area with target-achieving IDL coverage would not necessarily be expected to have the highest underweight prevalence. The Oelaba finding instead indicates that other determinants of child nutrition may have a substantial role. These may include household food security, dietary diversity, complementary feeding practices, maternal education, household socioeconomic conditions, sanitation and hygiene, recurrent infections, access to health and nutrition services, and other environmental factors (Mitchodigni et al., 2017; Urgell-Lahuerta et al., 2021; Chakona & Shackleton, 2018; Ali et al., 2019; Anitha et al., 2020).

Similarly, Batutua had very low immunization coverage but did not record the highest prevalence of underweight. This finding further demonstrates that low immunization coverage should not be interpreted as a sufficient explanation for poor nutritional outcomes. The absence of a consistent geographic gradient between immunization coverage and underweight prevalence may reflect the multifactorial nature of child malnutrition (Biswas, 2022; Barman & Pradhan, 2025). It may also reflect differences in population characteristics, service utilization, food availability, reporting completeness, or the timing of immunization and nutritional measurements.

These contradictory findings strengthen rather than weaken the importance of the present analysis. They indicate that immunization and nutrition programs should not be viewed as interchangeable interventions. Immunization primarily reduces susceptibility to specific vaccine-preventable infections, whereas nutritional status is determined by a much broader set of immediate, underlying, and structural factors. UNICEF and WHO frameworks similarly emphasize that child undernutrition results from multiple interacting determinants, including

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inadequate dietary intake, disease, household food insecurity, care practices, and inadequate health and environmental conditions.

Distinguishing Underweight from Severe Wasting

Interpretation of the nutritional indicators also requires a distinction between underweight and severe wasting because they represent different aspects of child nutritional status (Becker et al., 2015; Gausman et al., 2022; Akombi et al., 2017). In this study, undernutrition based on weight-for-age (WAZ < −2 SD) represents underweight, which can reflect a combination of acute and chronic nutritional deficits and does not distinguish between wasting and stunting. In contrast, severe malnutrition based on weight-for-height (WHZ < −3 SD) primarily identifies severe wasting, which is an indicator of acute malnutrition and reflects a recent or ongoing deficit in body mass relative to height.

This distinction is important when interpreting the Rote Ndao findings. A Puskesmas with a high prevalence of underweight does not necessarily have the same nutritional problem as an area with a high number of children experiencing severe wasting. The determinants, timing, and appropriate interventions may differ. Underweight may reflect longer-term nutritional deprivation as well as recent illness, whereas severe wasting requires particular attention to acute nutritional deficits and associated illness. Therefore, immunization coverage should be interpreted alongside the specific nutritional indicator being examined rather than treating all forms of malnutrition as a single outcome.

The observed distribution of severe malnutrition in some areas with lower immunization coverage may indicate overlapping vulnerability to infection and acute nutritional deterioration (Bhutta et al., 2017; Prendergast, 2015; Kilner, 2026). Nevertheless, because the present study did not link immunization and nutritional status at the individual level, it cannot determine whether incomplete immunization contributed directly to the severe wasting observed in those areas. The finding should instead be considered a signal for integrated investigation and intervention by immunization, nutrition, maternal-child health, and disease-control programs.

The Archipelagic Context of Rote Ndao

The geographic characteristics of Rote Ndao provide an important context for understanding the variation in immunization coverage (Dalisay et al., 2025; Kurniawan et al., 2025). As an archipelagic district, differences in transportation, distance, weather conditions, population distribution, and health-service accessibility may affect the ability of Puskesmas to maintain consistent immunization services. Such challenges may be particularly relevant for remote or difficult-to-reach communities. However, geographic conditions should not be assumed to be the sole explanation for differences between Puskesmas because local program management, community participation, health-worker availability, vaccine logistics, and recording practices may also influence coverage.

The findings therefore support a more targeted approach rather than a uniform intervention across all Puskesmas. Areas with consistently low IDL and IBL coverage may require intensified outreach, improved follow-up of missed children, strengthening of immunization microplanning, and improved monitoring of defaulters. In areas where immunization coverage is relatively good but underweight prevalence remains high, interventions should place greater emphasis on nutrition-specific and nutrition-sensitive factors, including dietary practices, food security, maternal and caregiver education, sanitation, disease prevention, and early identification of growth faltering.

Integration of immunization and nutrition services through existing community-based platforms such as Posyandu may provide an important opportunity to address these overlapping vulnerabilities (Payne et al., 2026). However, integration should not be interpreted as evidence that increasing immunization coverage alone will reduce undernutrition. Rather, immunization, growth monitoring, nutrition counselling, disease prevention, and referral services can complement one another by providing multiple points of contact with children and caregivers.

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This integrated approach is particularly relevant in geographically challenging settings where each contact with the health system represents an opportunity to identify missed immunizations, growth problems, and other health needs.

Program Implications and Interpretation of the Findings

Taken together, the findings suggest that immunization coverage and nutritional status in Rote Ndao should be addressed as interconnected but distinct public health priorities. The areas with low immunization coverage warrant intensified immunization efforts because incomplete vaccination may increase vulnerability to vaccine-preventable infections. At the same time, the contrasting findings from Oelaba and Batutua demonstrate that improving immunization coverage alone cannot be expected to resolve undernutrition across all areas.

The differences between IDL and IBL coverage also indicate a need to strengthen data quality, cohort tracking, and denominator validation. Before using these indicators to evaluate program performance, Puskesmas and district-level managers should examine whether the target populations, reporting periods, geographic boundaries, and immunization histories are comparable. Improved data consistency would strengthen future assessments of immunization and nutritional programs and reduce the possibility that apparent geographic differences are partly attributable to reporting or denominator problems (Allorant et al., 2026; Villacreses et al., 2026).

Overall, this study should be interpreted as a descriptive assessment of geographic patterns and program gaps rather than as evidence of a direct relationship between immunization coverage and nutritional status. The coexistence of low immunization coverage and poorer nutritional outcomes in some Puskesmas provides a basis for further investigation and integrated intervention, while the contradictory findings demonstrate the importance of considering broader determinants of child nutrition. Future research using individual-level longitudinal or cross-sectional data, together with appropriate statistical analysis and adjustment for socioeconomic, dietary, environmental, and health-service factors, is needed to determine whether and to what extent immunization status is associated with nutritional outcomes among children in Rote Ndao.

CONCLUSION

There is a consistent pattern between low immunization coverage and a high burden of malnutrition in Rote Ndao Regency. The significant disparity between regions indicates the need for differentiated, locally context-based intervention strategies. In the Batutua region, simultaneous strengthening of the immunization system is needed with a nutrition improvement program that includes outreach immunization, strengthening the capacity of cadres, improving the cold chain, community-based malnutrition management, and nutrition education for mothers of toddlers. This integrated approach is expected to break the cycle of incomplete immunization, recurrent infections, and malnutrition among toddlers in Rote Ndao Regency. Immunization program strengthening is needed through outreach strategies that adapt to the geographical conditions of the archipelago, strengthening the vaccine cold chain, increasing the capacity of health workers, and integrating immunization services with nutrition interventions within a single integrated service platform. Prioritize interventions to target community health centers (Puskesmas) with the lowest immunization coverage and the highest prevalence of malnutrition simultaneously, using a data-driven geographic targeting approach.

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