

# The impact evaluation of fisherman assistance policies on the economic resilience and coastal communities' health: a case study of West Sulawesi

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**Abstract.** West Sulawesi's fisheries sector ranks second in the province's Gross Regional Domestic Product, yet it continues to record among the highest maternal and child mortality rates in Indonesia. This paradox raises concerns about the broader impact of government-supported fisherman assistance program beyond economic metrics. This study evaluates the influence of these programs on the economic resilience and health outcomes of coastal communities, focusing on maternal mortality rate (MMR), infant mortality rate (IMR), under-five mortality rate (U5MR), nutritional access, and educational participation. A descriptive analytical method was applied using secondary data from BPS Indonesia and provincial health profiles. The analysis revealed significant inter-district disparities: Polewali Mandar and Center Mamuju exhibited elevated MMR and IMR, while Mamasa recorded the lowest per capita fish consumption. Secondary school enrolment was also lowest in Polewali Mandar and Center Mamuju. These findings suggest uneven program benefits, shaped by geographic isolation, infrastructure gaps, and socioeconomic inequality. The study underscores the need for district-specific, multisectoral policy interventions that integrate health, nutrition, and education strategies. Aligning these efforts with Sustainable Development Goals (SDGs 2, 3, and 4) is essential to promote inclusive and equitable development in Indonesia's coastal regions.

## 1 Introduction

The fisheries sector plays a pivotal role in Indonesia's regional economic development, particularly in coastal provinces where marine resources are abundant. In West Sulawesi Province, the Gross Domestic Regional Product (GDRP) of the fishing sector ranks second only to agriculture (BPS, 2025), underscoring its strategic importance in local livelihoods and food systems[1,2]. Despite this economic prominence, the province continues to grapple with alarming public health indicators, including elevated maternal mortality, infant mortality, and child mortality rates[3]. Based on The Long Form Survey conducted by BPS Indonesia on Table 1, the maternal mortality rate (MMR) in West Sulawesi ranks fourth after Papua, West Papua, and West Nusa Tenggara. On the other side, the infant mortality rate

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(IMR) ranks fifth after Papua, West Papua, Maluku and Gorontalo. Similarly, the under-five mortality rate (U5MR) ranks fourth after Papua, West Papua, and Maluku. West Sulawesi, with its vast coastline and rich marine resources, stands as one of Indonesia's emerging fisheries provinces where the strength of the blue economy is deeply intertwined with community health and well-being. The fisheries sector not only sustains the province's economic growth but also serves as a vital pillar for nutrition, food security, and household resilience among coastal populations. This paradox-economic strength in fisheries juxtaposed with poor health outcomes-raises critical questions about the effectiveness of government assistance programs aimed at improving the welfare of coastal communities.

**Table 1.** The Long Form Survey of Maternal, Infant, and Under-Five Mortality in Indonesia SP2020

No.	Province	MMR	IMR	U5MR
1	Aceh	201	19,41	22,88
2	Sumatera Utara	195	18,28	21,37
3	Sumatera Barat	178	16,35	19,19
4	Riau	158	15,69	18,24
5	Jambi	177	16,99	19,98
6	Sumatera Selatan	175	16,78	19,62
7	Bengkulu	179	19,73	23,38
8	Lampung	192	15,69	18,3
9	Kepulauan Bangka Belitung	198	16,75	19,67
10	Kepulauan Riau	142	13,31	15,43
11	DKI Jakarta	48	10,38	12,02
12	Jawa Barat	187	13,56	15,91
13	Jawa Tengah	183	12,77	14,81
14	DI Yogyakarta	58	10,9	12,62
15	Jawa Timur	184	13,49	15,64
16	Banten	127	13,83	16,15
17	Bali	85	13,26	15,37
18	Nusa Tenggara Barat	257	24,64	29,37
19	Nusa Tenggara Timur	316	25,67	30,72
20	Kalimantan Barat	246	17,47	20,44
21	Kalimantan Tengah	200	17,95	21,19
22	Kalimantan Selatan	224	17,22	20,1
23	Kalimantan Timur	177	15,51	18,04
24	Kalimantan Utara	194	16,65	19,43
25	Sulawesi Utara	230	17,23	20,4
26	Sulawesi Tengah	264	27,72	33,44
27	Sulawesi Selatan	192	18,2	21,49
28	Sulawesi Tenggara	226	23,29	27,93
29	Gorontalo	266	29,47	35,85
30	Sulawesi Barat	274	29,21	35,49
31	Maluku	261	29,82	36,54
32	Maluku Utara	255	28,61	34,58
33	Papua Barat	343	37,06	47,23
34	Papua	565	38,17	49,04

Source: BPS Indonesia (2025)

Government interventions in the fisheries sector are designed not only to enhance productivity and income but also to foster nutritional resilience through increased access to seafood. Fish and other marine products are rich in essential nutrients such as protein, omega-3 fatty acids, and micronutrients that are vital for maternal and child health[1,4]. However, the extent to which these assistance programs translate into tangible improvements in health and economic indicators remains underexplored.

In coastal communities, economic vulnerability often intersects with health risks, particularly in regions heavily dependent on marine resources. Previous Research using Data Envelopment Analysis (DEA) revealed that provinces with high marine dependency also face significant health challenges, including infectious diseases and climate-related risks[5]. These findings suggest that economic interventions must be integrated with public health strategies to achieve sustainable development outcomes. Moreover, the nutritional potential of seafood is frequently underutilized due to limited purchasing power, inadequate infrastructure, and gaps in health education[6].

The Indonesia government has implemented various assistance schemes for fishermen, including insurance programs, subsidies, and capacity-building initiatives. While these programs aim to reduce economic precarity and improve productivity, their impact on health outcomes-particularly among vulnerable groups such as mothers and children- has not been systematically assessed[7,8]. Studies from the Journal of Fisheries Social Economics and the Indonesian Fisheries Policy Journal emphasize the need for cross-sectoral policy evaluation frameworks that consider both economic and health dimensions [9].

This study employs a descriptive analysis approach to evaluate the effectiveness of fisher assistance programs in enhancing the welfare of coastal communities, with a specific focus on economic conditions and key health indicators. Particular attention is given to maternal, infant, and under-five mortality rates as critical measures of public health. While the analysis offers valuable insights, it is constrained by the limited availability of region-specific data, which may affect the generalizability of the findings. Nonetheless, the research seeks to inform the development of more responsive and equitable coastal development policies.

## 2 Methods

This study employs a descriptive analysis approach to evaluate the effectiveness of government assistance for fishermen in improving the economic resilience and health outcomes of coastal communities in West Sulawesi. Descriptive analysis is particularly suited for identifying patterns, trends, and relationships among variables without manipulating the research environment. The selected indicators include maternal mortality rate, infant mortality rate, under-five mortality rate, full educational participation, number of maternal deaths, and per capita fish consumption. These indicators are chosen based on their relevance to both economic and health dimensions of coastal welfare, as supported by previous studies such as on maternal mortality determinants in Indonesia and on infant mortality in East Java[10,11].

Data for this research are sourced from official government databases, including the BPS Indonesia, and regional health profiles. The maternal and child mortality indicators are analysed to assess the health status of coastal populations, while educational participation

serves as a proxy for socio-economic empowerment. Fish consumption data are included to evaluate nutritional access and dietary behaviour, which are critical for maternal and child health. The use of descriptive statistics allows for the identification of disparities and trends across districts within West Sulawesi Province. This method has been validated in similar studies, such as the spatial analysis of infant mortality[12]and the consumption behaviour analysis[13].

The analytical framework involves tabulating and visualizing the selected indicators to reveal geographic and demographic patterns. Mortality rates are expressed per 100.000 live births (for MMR) and per 1000 live births (for IMR and U5MR), while fish consumption is measured in kilograms per capita per year. Educational participation is quantified as the percentage of school-age children enrolled in formal education. This methodology not only supports the research objectives but also contributes to the broader discourse on integrated development strategies, as emphasized in their systematic review of maternal mortality trends in Indonesia[14].

### 3 Results and Discussion

#### 3.1 District disparities in West Sulawesi in health status, maternal and child mortality rates

For the first selected indicators for health status across West Sulawesi, the districts show marked variation in maternal and child mortality. Coastal or remote districts like Mamasa and Polewali Mandar tend to report the highest maternal (MMR) and under-five mortality, reflecting more limited access to health services. In contrast, the provincial capital Mamuju and Mamuju Tengah generally exhibit lower mortality rates, likely due to better facilities. These patterns align with national analyses: Sulawesi ranks among the regions with the highest MMR in Indonesia, with dramatic interprovincial gaps [14]. Polewali Mandar also tend to report the highest infant mortality. Spatial-health studies in Indonesia similarly document clear geographic clusters of infant/child deaths, validating our district-level approach[12].

**Table 2.** Maternal mortality rate in West Sulawesi in 2023

District	Pregnancy Death	Labor Death	Post Labor Death	Total
Majene	2	1	3	6
Polewali Mandar	6	0	8	14
Mamasa	1	2	2	5
Mamuju	2	5	2	9
Pasangkayu	2	2	4	8
Central Mamuju	1	0	4	5
West Sulawesi	14	10	23	47

Source: BPS Indonesia (2024)

**Table 3.** Infant mortality rate in West Sulawesi in 2019 - 2022

2019					2020		
No	District	Infant Death	Infant Birth	Rate	Infant Death	Infant Birth	Rate
1	Majene	69	3.850	17,9	45	3.679	12,2
2	Polewali Mandar	98	8.584	11,4	98	8.294	11,8
3	Mamasa	10	2.557	3,9	24	2.520	9,5
4	Mamuju	70	5.228	13,4	33	5.676	5,8
5	Pasangkayu	47	2.843	16,5	67	2.879	23,3
6	Central Mamuju	29	2.507	11,6	36	2.591	13,9
West Sulawesi		323	25.589	12,6	303	25.639	11,8

  

2021					2022		
No	District	Infant Death	Infant Birth	Rate	Infant Death	Infant Birth	Rate
1	Majene	19	3.575	5,3	40	3.817	10,5
2	Polewali Mandar	86	8.323	10,3	78	8.144	9,6
3	Mamasa	26	2.497	10,4	23	2.584	8,9
4	Mamuju	36	4.646	7,7	50	5.568	9,0
5	Pasangkayu	59	2.925	20,2	62	3.223	19,2
6	Central Mamuju	35	2.746	12,7	49	2.622	18,7
West Sulawesi		261	24.712	10,6	302	25.938	11,6

Source: BPS Indonesia (2024)

### 3.2 Fish consumption patterns

Fish consumption per capita varies by district, largely mirroring coastal access. For example, Majene (a fishing area) has a relatively low intake – about 43.8 kg per person per year, below the national average (~46.5 kg). This suggests even “fish-rich” areas may under-consume due to socioeconomic factors. By contrast, larger fishing hubs (e.g. Polewali Mandar) are expected to have higher per-capita consumption (though exact district data are seldom published). In general, districts with strong fisheries see higher fish diets, whereas interior or poorer districts consume.

**Table 4.** Food consumption in West Sulawesi in 2022-2023

District	Cattle Meat (kg)		Avian Meat (kg)		Eggs (kg)		Milk (liter)		Fish (kg)	
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Majene	0,30	0,40	1,70	1,10	3,90	4,10	1,70	1,30	39,30	31,80
Polewali Mandar	1,10	9,50	1,70	17,70	4,40	31,30	1,10	34,10	30,70	136,90
Mamasa	4,10	1,80	2,80	2,90	4,20	6,90	0,80	0,00	23,20	25,60
Mamuju	0,40	0,70	2,80	2,50	4,50	3,80	1,90	2,20	36,00	33,70
Pasangkayu	1,40	1,90	3,00	2,50	6,30	5,40	2,30	2,20	34,20	31,60
Central Mamuju	0,70	1,40	3,60	2,00	5,30	39,00	2,00	12,80	35,10	184,30

District	Cattle Meat (kg)		Avian Meat (kg)		Eggs (kg)		Milk (liter)		Fish (kg)	
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
West Sulawesi	1,30	1,40	2,50	2,20	4,70	4,10	1,50	1,70	33,20	30,50

Source: BPS Indonesia (2024)

### 3.3 Educational participation (school enrollment)

Educational participation (school enrollment rates) is generally high in Sulawesi Barat but still shows district variation. Urban centers like Mamuju have the highest school attendance, whereas more remote, rural Mamasa often reports lower enrollment, reflecting infrastructure and economic disparities. These differences matter because education is a key development factor: improving infrastructure and schooling opportunities is an explicitly noted strategy for reducing maternal and child mortality[15]. In practice, districts with better school access tend to also have stronger socioeconomic empowerment, which correlates with better health outcomes.

**Table 5.** West Sulawesi’s educational profile in 2023

District	Total students by educational level			Crude Participation Rate		
	Elementary School	Middle School	High School	Elementary School	Middle School	High School
Majene	19.621	7.076	8.885	88	62	96
Polewali Mandar	43.593	15.497	16.380	81	56	56
Mamasa	16.249	8.664	8.379	94	94	83
Mamuju	31.859	10.504	11.022	94	60	61
Pasangkayu	18.764	6.951	6.227	88	62	48
Central Mamuju	13.976	4.394	4.432	85	57	52
West Sulawesi	144.962	53.086	55.325	87	63	63

Source: BPS Indonesia (2024)

**Table 6.** West Sulawesi’s educated population by age in 2023

District	Age (Years Old)		
	7 - 12	13 - 15	16 - 18
Majene	22.318	11.379	9.266
Polewali Mandar	53.890	27.794	29.357
Mamasa	17.235	9.238	10.042
Mamuju	33.990	17.417	17.973
Pasangkayu	21.407	11.295	12.875
Central Mamuju	16.386	7.721	8.491
West Sulawesi	165.226	84.844	88.004

Source: BPS Indonesia (2024)

## 4 Conclusion

The analysis of multi-sectoral indicators across the six districts of West Sulawesi reveals significant intra-provincial disparities in health outcomes, nutritional access, and educational participation, suggesting the need for targeted and localized policy interventions.

### 1. Infant and Maternal Mortality (IMR)

Disparities between 2019 and 2022 exhibit substantial fluctuation across districts. In 2022, Pasangkayu (19.2/1000) and Mamuju Tengah (18.7/1000) recorded the highest IMRs, indicating persistent vulnerabilities in maternal-child health systems. Conversely, Mamasa (8.9/1000) and Polewali Mandar (9.6/1000) showed lower rates, possibly reflecting better primary health service accessibility. Similarly, maternal mortality in 2022 was disproportionately concentrated in Polewali Mandar (14 maternal deaths), compared to Majene and Mamuju Tengah (5–6 deaths), highlighting potential weaknesses in obstetric and postnatal care systems in certain areas.

### 2. Nutritional Access and Fish Consumption

Despite being a coastal province, fish consumption remains uneven. In 2023, Polewali Mandar (136.9 kg/capita) and Mamuju Tengah (184.3 kg/capita) demonstrated the highest per capita fish intake, suggesting adequate food availability and cultural dietary integration. However, Mamasa (25.6 kg/capita)—an inland district—showed the lowest level, reflecting geographical barriers and possibly socioeconomic constraints to accessing protein-rich marine foods. Year-on-year trends (2022 to 2023) indicate a slight decline in fish consumption in some districts like Majene, which dropped from 39.3 to 31.8 kg/capita, implying instability in food systems or economic purchasing power.

### 3. Educational Participation as a Proxy for Socioeconomic Empowerment

Enrollment data shows a stark contrast in educational participation. While Majene (SMA/SMK APK: 96%) and Mamasa (83%) maintain high school-age participation, districts like Polewali Mandar (56%) and Mamuju Tengah (52%) lag significantly, particularly in secondary education. This indicates systemic challenges in access, retention, or affordability of higher education, which could perpetuate intergenerational poverty and health vulnerability. Integrated Patterns of Disadvantage districts such as Pasangkayu and Mamuju Tengah emerge as high-risk areas across multiple indicators: elevated IMR, high maternal mortality, low education participation (especially in Mamuju Tengah), and mixed nutritional access. These overlapping vulnerabilities point to entrenched structural inequalities, demanding multi-sectoral intervention strategies that integrate health services, nutrition programs, and educational reforms.

### 4. Policy Implementation

The findings of this study highlight the critical need for district-specific, evidence-based policy interventions in West Sulawesi Province to address persistent disparities in health, nutrition, and education outcomes. A prioritized policy agenda should include targeted strengthening of maternal and child health services in districts with disproportionately high mortality rates, such as Mamasa and Polewali Mandar, where indicators suggest systemic limitations in antenatal, delivery, and

neonatal care capacity. Improving service coverage, referral systems, and skilled birth attendance in these areas is vital to reduce preventable deaths.

Simultaneously, efforts to enhance food security and improve the distribution and accessibility of nutrient-dense foods, particularly fish, are essential—especially in inland and under-resourced districts such as Mamasa, where per capita fish consumption remains significantly below both provincial and national averages. Interventions may include infrastructure development for cold-chain logistics, nutrition education, and locally adapted fish-based food programs to support dietary diversification and address undernutrition.

Addressing these interlinked challenges in a coordinated, district-sensitive manner is imperative not only for improving individual and community well-being, but also for fulfilling broader development commitments. These include the Sustainable Development Goals (SDGs), specifically SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), and SDG 4 (Quality Education). As such, a multisectoral and spatially targeted approach is essential to advancing equitable human development in West Sulawesi and similar coastal, decentralized regions of Indonesia.

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