

# Poverty Profile and Health Dynamics of Indigenous People

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## Abstract

This paper examines the critical aspect of health dynamics in the context of poverty and development of Indigenous people (Agta Isarog & Agta Tabangnon) in Mt. Isarog, Southern Luzon, the Philippines. The datasets were gathered from the Community-Based Monitoring System (CBMS) of Goa Municipality, complemented by IP Censuses of 2018-2019. The core poverty indicators were analyzed in aggregated and disaggregated approaches. The poverty of each locality differs yet a large portion of the entire households and population of indigenous people are living below the poverty and food thresholds. In addition, the poverty incidence, gap, and severity using headcount ratios, gap metrics, squared gap statistics, and Watts indices were evaluated. It has been revealed that the poverty of Indigenous people is moderate to intense and manageable through intervention programs and policy initiatives. It then subsequently characterized the variables of health dynamics which vary per locality, and have been impacting poverty across all barangays. To confirm whether health dynamics predict poverty occurrences, Logistic regression models were estimated in an individual and consolidated manner. Results confirm that health dynamics significantly predict poverty outcomes.

**Keywords:** *indigenous people, community-based monitoring system, health dynamics, poverty, economic development*

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## 1. Introduction

Deleterious impacts of poverty on people's health and development have been asserted through important empirical findings. Poverty, according to Aber et al. (1997), leads to higher infant and child mortality rates, a higher risk of injuries from accidents or physical abuse and neglect, a higher risk of asthma, and lower developmental scores in a variety of tests at different ages. As a result, children's health and development deteriorate. Haan et al. (1987) verified that lower socioeconomic statuses and higher mortality on health show significant associations. Moreover, developing countries have worse health outcomes than developed countries (Wagstaff, 2002). It confirms that poverty is positively linked to ill-health; poverty levels and income inequality have had a significant role in poor health.

Poverty is one of the oldest social problems that has ever occurred in history and continues to exist today. According to Haughton and Khandker (2009), it has a negative association with societal development and economic growth. It's essential to measure poverty since only the results of a poverty analysis can be used to design and implement developmental interventions. Health and nutrition, housing and households, water and sanitation, education, income and hunger, employment, and peace and order are all core indicators of poverty. The community-based monitoring system (CBMS) census was used to identify these indicators and collect data on them. The CBMS is a system of collecting and analyzing data at the local level. The CBMS' outputs are used in policymaking, local planning, service delivery, and impact evaluation (Reyes, 2014). This database offers crucial information about health dynamics and poverty issues.

Studies showed that poverty incidence is higher in indigenous people (Waxman, 2016; Gordon & White, 2014; Hall & Gandolfo, 2016; United Nations, 2020; International Labour Organization, 2020; Arriagada et al., 2020). For instance, Tindowen (2016) disclosed in a study of 25 families of Aetas in Northern Philippines that they have low access to technology and their socioeconomic characteristics differ from people living in rural and urban areas. As to livelihood, they rely on farming and agriculture yet some families are benefiting from government transfers that have already reached the society. Indigenous peoples are those who follow their traditions and have social, cultural, economic, and political traits that differ from the dominant societies in which they reside (Beteille, 1998). In Camarines Sur, indigenous people known as Agta Isarog and Agta Tabangnon have been living peacefully since the pre-colonial

era. They are situated on the footstep to mountain ridges of Mt. Isarog, the largest mountain and widest forest in the Bicol Region. Indigenous people have human rights and are entitled to freedom, property, improved socioeconomic conditions, and health welfare (UNHR, 2013).

Very little literature on health dynamics and how they affect poverty cases, economic progress, and sociological development have been documented. In 1996, Barro investigated the relationship between health and economic growth. Health has been modeled as a private good, a publicized private good, and a public good, all of which have contributed to economic growth. Similarly, Bloom et al. (2004) discovered that health had a direct and significant impact on economic growth as measured by aggregate output. According to Well's accounting and research, the impact of health on growth is enormous (2007). Considering the foregoing, it is logical to infer that poverty leads to ill health. Conversely, poor health contributes to poverty.

Using econometric analysis and CBMS data, this research investigates the relationship between health dynamics and poverty indicators of indigenous people. The driver factors are health dynamics, whereas the driven variables are poverty measurements. Specifically, it describes the general profile of localities involved, characterize the poverty cases and core poverty indicators, analyze the health dynamics through various parameters, examine the extent of poverty through health dynamics, and evaluate the impact of health dynamics on poverty cases.

## **2. Literature Review**

### ***2.1. Indigenous People in the Philippines***

The National Commission on Indigenous Peoples (NCIP) AO No. 1, s. 1998 Rules and Regulations Implementing Republic Act No. 8371, often known as "The Indigenous Peoples' Rights Act of 1997," provides rights and safeguards to indigenous peoples in the Philippines. Indigenous peoples have rights to ancestral domains and ancestral lands, as well as self-governance and empowerment, social justice and human rights, and cultural integrity. As a result, native communities must be respected by society and protected by the state. Their poverty must be addressed and development promoted while their culture and customs are preserved. Furthermore, the Integrated History Act of 2019 (RA10908) mandates the inclusion of Indigenous Peoples in Relevant Higher Education Curricula, which was also prescribed by CHED CMO No.2, s. 2019. Throughout the Archipelago, Indigenous people are dispersed. In

Southern Luzon, the Agta villages are predominantly found on the slopes of Mount Mount Isarog and Mt. Asog. Aetas of Mt. Isarog are called Agta Isarog or Agta Tabangnon, and Aetas of Mt. Asog are known as Agta Cimmarons. Furthermore, in the mountain range that separates Camarines Sur and Camarines Norte, there are a variety of villages, mainly in Ragay. The Kabihug is the name given to the Agta in these locations.

Agta Tabangnons are dwelling along the slopes of Mt. Isarog. They are endemic to this area. However, while hunting for animals, members of both Agta villages in Mt. Isarog and Mt. Asog routinely travel between the aforementioned two mountains. In all likelihood, some of the Agta people from Mount Asog migrated to Mount Isarog and were assimilated into the community. The Agta-Tabangnon were the original residents of Mount Isarog's forest-edge settlements, mainly in the municipalities of Ocampo, Tigaon, Sagnay, and Goa. In 2019, there are 12 Agta Communities in the Municipality of Goa (NCIP, 2019, LGU Goa, 2021).

The overriding physical characteristics of Agta Tabangnon are short in stature, dark-skinned, with kinky hair, large noses, thick lips, and deep-set eyes. Inter-marriage with lowlanders and outsiders has resulted in changes to these characteristics (Gerona, 2010). A Tabangnon's cabin is composed of light materials (nipa, sawali, coconut leaves, abaca). A typical hut consists of four robust poles, secondary growth tree rafters, and a thatched roof. A section of the house is raised three feet from the ground, with a bamboo slatted floor that also serves as a sleeping and eating platform. The Agta's average home is modest and fleeting, much like their outlook on life. Balakbak, pineapple fibers, and balete tree bark make up the Agta's traditional clothing. The bahag and tapis were originally worn by Agta men and women. Women began concealing their breasts and wearing longer tapis after becoming Christians (Calleja, 1992; Gerona, 2005; Obias, 2009; Ragragio, 2012).

## ***2.2. Economic Activity of Indigenous People in Southern Luzon***

The Agta Tabangnons are engaged in various economic activities. Summer is when most hunting and agricultural operations are carried out. Fishing can be done at any time of day or night. Corn, coconut, banana, and upland rice are among the root crops grown by the Tabangnons. Major crops such as abaca, sugarcane, coconut, corn, vegetables, and fruit trees are concentrated in some areas of Mount Isarog. Land preparation, harvesting, abaca-stripping, and construction operations frequently employ men as laborers. Small-scale trading and food processing are carried out by women. A number of them work as farm workers or on haciendas

and coconut plantations. The trapichi (sugar grinder), basisi (planting tool), and laya are examples of work instruments (fishing net). When the forest and wali-wali (hunting games) began to diminish, most Tabangnons moved to upland farming. They have a lot of hunting experience. They hunt with a bow and arrow, a sumbiling (harpoon), bitik or lit-ag (traps), and an ayam (dog). They are also engaged in weaving, pottery, and processing wild crops (Calleja, 1992; Gerona, 2005; Obias, 2009; Ragragio, 2012).

### ***2.3. Poverty and Economic Development of Indigenous People***

In the Philippines, no study has been conducted yet about the quantitative evaluation of poverty among indigenous communities. However, in developed countries such as Australia, an evaluation was made and it has been claimed that Indigenous people have significant constraints in selecting appropriate economic and commercial development options that will benefit their economic and human development within the community (Fuller et al., 2007). Another study focused on four countries: Bolivia, Guatemala, Mexico, and Peru, which account for 81% of the continent's indigenous population. The majority of indigenous people in Latin America live in extreme poverty (Psacharopoulos et al., 1994). Poverty among indigenous peoples varies greatly around the globe, so poverty reduction efforts must be tailored accordingly (Hall et al., 2012). According to a World Bank study, poverty may be reduced by focusing on human capital, particularly education, which promotes economic development. Policymakers can assist in increasing income, which will help to alleviate poverty (Griffiths, 2005; Davis, 2002).

### ***2.4. Health Dynamics of Indigenous People***

Indigenous people over the world are marginalized and discriminated and their health is consistently less than that of majority groups (Ijjasz-Vasquez et al., 2017; Lastra-Bravo, 2021; Minority Rights Group International, 2017). In Africa, poor health in the general population is well acknowledged, but Indigenous peoples' continually poorer health and social conditions are usually ignored (Willis et al., 2006). Around 400 million indigenous people across the globe are suffering from poor health status. Poverty, starvation, overcrowding, poor hygiene, environmental degradation, and frequent illnesses are all linked to poor health. This scenario is made worse by insufficient clinical care and health promotion, as well as poor disease prevention programs (Gracey et al., 2009).

Indigenous child mortality is linked to poor living circumstances, malnutrition, and lack of education (Wilk, et al., 2017). However, national interventions have only had a minor impact on mortality disparities (Heaton et al., 2007). Literacy, prenatal screening, hospital births, and economic development all played a role in determining child mortality and life expectancy (Li, 2008). Indigenous women in Mexico and Central America face a higher risk of pregnancy complications, such as maternal death, as a result of poverty and inequality (Schwartz, 2018). According to Cumming et al. (2014), access to safe drinking water and sanitation are key determinants of human health and well-being, and the international community has lately deemed their human rights. Poor health and lack of access to safe water and sanitation often lead to malnutrition. A low level of income has also been contributing to malnourished children (Ramirez et al., 2014; Dinachandra et al., 2015). In Indonesia, households without access to safe water and sanitation are more likely to suffer from diseases (Patunru, 2015). Moreover, housing characteristics have a significant relationship with health outcomes (Heywood, 2004; Rauh, 2008; Gibson, 2011).

### 3. Methodology

The study utilized mixed-method design using secondary data. The secondary data on individual and household levels of indigenous people were obtained from the CBMS of Goa, Camarines Sur. Furthermore, document review was steered to collect extensive data that might be used to compare study findings to existing assertions on a certain issue.

To establish the characteristics of variables that influence a household's income-based poverty status, this paper has adopted the model of Reyes et al. (2011) and Sobreviñas (2020). The dependent variable is the poverty status of households, while independent variables are the health indicators. Various control variables were also incorporated into the model.

$$Y = \alpha + X\beta + \mu$$

where:

$Y = \text{logit}(p) = \log[p / (1 - p)]$ ,  $p$  = probability of being poor of respondent households;

$\alpha$  = the intercept or individual effects of health dynamics, which is assumed to be constant;

$X$  = vector of independent variables or characteristics of health dynamics;

$\beta$  = vector of coefficients, intercepts, or effects of health characteristics on poverty status; and

$\mu$  = error term.

*Logit Regression.* It was employed to reveal the link of health dynamics on poverty cases. The Econometric Model was used for logit regression analysis. This is an econometric design concerned with establishing cause and effect between given variables.

*Logit Model*

$$POVOUTCOCC = \beta_0 + \beta_1 CDEATH5 + \beta_2 WDEATHPC + \beta_3 CMALNO5 + \beta_4 MSHDWELL + \beta_5 SQUATH + \beta_6 WATACCESS + \beta_7 STFACCESS + \beta_8 TNOHHM + \mu$$

Where:

*POVOUTOCC* = the Poverty Classification/Status/Occurrence/outcomes of indigenous people;

*CDEATH5* = the Children under 5 who died;

*WDEATHPC* = the Women who died due to pregnancy related cases;

*CMALNO5* = the Children aged 0-5 who are malnourished;

*MSHDWELL* = Dwellers in Makeshift housing;

*SQUATH* = Informal Settlers;

*WATACCESS* = the Access to Safe Water;

*STFACCESS* = the Access to sanitary toilet facilities;

*TNOHHM* = Total Number of Household Members;

$\beta I$  = the coefficient for independent variables;

$\mu$  = Error Term.

**Table 1**

*List of Variable Descriptions and Sources*

	<b>Variables</b>	<b>VAR</b>	<b>Description</b>
Dependent Variables	Poverty Classification/Status/Occurrence/Outcomes	<i>POVOUTOCC</i>	1 (Yes/Poor/HH Living below Poverty Threshold), 0 (No/Non-Poor/HH Not Living below Poverty Threshold)
Independent Variables	Child Mortality	<i>CDEATH5</i>	1 (HH with Children under 5 who died), 0 (HH without Children under 5 who died )
	Maternal Mortality	<i>WDEATHPC</i>	1 (HH with Women who died due to pregnancy related cases), 0 (HH without Women who died due to pregnancy related cases )
	Malnutrition of Children	<i>CMALNO5</i>	1 (HH with children aged 0-5 who are malnourished), 0 (HH without children aged 0-5 who are

			malnourished )
	Type of Housing	<i>MSHDWELL</i>	1 (HH who are living in Makeshift Housing), 0 (HH who are not living in Makeshift Housing )
	Type of Settlement	<i>SQUATH</i>	1 (HH who are informal settlers), 0 (HH who are not living in Makeshift Housing )
	Access to Safe Drinking Water	<i>WATACCESS</i>	1 (HH without Access to Safe Drinking Water), 0 (HH with Access to Safe Drinking Water)
	Access to Sanitary Toilet Facility	<i>STFACCESS</i>	1 (HH without Access to Sanitary Toilet Facility), 0 (HH with Access to Sanitary Toilet Facility)
	Total Number of Household Members	<i>TNOHHM</i>	The total number of members of Indigenous People Households
Interacting Variables	Type of Settlement and Total Number of Household Members	<i>SQUATH#TNOHHM</i>	Households who are informal settlers x Household Members
	Type of Housing and Child Mortality	<i>MSHDWELL#CDEATH5</i>	Households living in makeshift housing x Children under 5 years old who died
	Access to Safe Drinking Water and Child Mortality	<i>WATACCESS#CDEATH5</i>	Households without access to safe water x Children under 5 years old who died
	Access to Safe Drinking Water and Total Number of Household Members	<i>WATACCESS#TNOHHM</i>	Households without access to safe water x Household Members
	Access to Safe Drinking Water and Type of Settlement	<i>WATACCESS#SQUATH</i>	Households without access to safe water x Households who are informal settlers
	Access to Safe Drinking Water and Type of Housing	<i>WATACCESS#MSHDWELL</i>	Households without access to safe water x Households living in makeshift housing
	Access to Sanitary Toilet Facility and Type of Settlement	<i>STFACCESS# SQUATH</i>	Households without access to sanitary toilet facility x Households who are informal settlers
	Access to Sanitary Toilet Facility and Type of Housing	<i>STFACCESS#MSHDWELL</i>	Households without access to sanitary toilet facility x Households living in makeshift housing
	Children Malnutrition and Child Mortality	<i>CMALNO5#CDEATH5</i>	Malnourished children 0-5 years old x Children under 5 years old who died

Sources: CBMS Database 2018-2019

To evaluate the extent of poverty the following measures were utilized and generated:

A. *Headcount Ratio*

$$P_0 = \text{Headcount Ratio}$$

$$P_0 = \frac{1}{N} \sum_{i=1}^N (y_i < z)$$



$$P_0 = \frac{N_p}{N} \text{ Where, } N_p = \text{Number of poor; and } N = \text{Total Population (or sample)}$$

The headcount ratio (HCR) is the percentage of the population that falls below the poverty line. The  $i$  is an indicator function that returns 1 if the bracketed expression is true and 0 if it is not. So, if the household's income ( $y_i$ ) is less than the poverty threshold ( $z$ ), the  $i$  equals 1 and the household is considered poor. The headcount index's main strengths are its ease of construction and comprehension. However, one of the drawbacks of the head count ratio is that it ignores the depth of poverty; as the poor get poorer, the headcount index stays the same (Haughton et. al., 2009).

### B. Poverty Gap Metrics

$P_1$  = Poverty Gap Index

$$P_1 = \frac{1}{N} \sum_{i=1}^N \frac{G_i}{z} \text{ Where, } G_i = (z - x_1) \times I(y_i < z)$$

The poverty gap index is a metric for determining the intensity of poverty. It is defined as the population's average poverty gap expressed as a percentage of the poverty line and where the poor has none or 0 poverty gap. It calculates the degree of poverty by looking at how far the poor are from the poverty line on average. The closer the index is to 0, the lower the percentage of the population living in poverty, and the closer it is to 1, the higher the percentage of the population living in poverty (Haughton et al., 2009).

### C. Poverty Severity

$P_2$  = Squared Poverty Gap Index

$$P_\alpha = \frac{1}{N} \sum_{i=1}^N \left( \frac{G_i}{z} \right)^\alpha, (\alpha \geq 0) \text{ Where}$$

$\alpha$  = sensitivity of index to poverty;

$z$  = poverty line;

$x_1$  = value of expenditure (income) per capita for  $i$ th person's HH; and

$G_i = z - x_1$  (with  $G_i = 0$  when  $x_i > z$ ) = poverty gap for individual  $i$ .

The poverty gap index is connected to the squared poverty gap index, also known as the poverty severity index. It's calculated by taking the square of the poverty gap ratio and averaging it. The measure gives more weight to a poor person's observed income as it goes below the poverty line by squaring each poverty gap statistic. The squared poverty gap index is a type of

weighted sum of poverty gaps in which the weight is proportional to the size of the gap. It also takes inequality among the poor (Foster et. al.,1984).

#### *D. Watts Index*

$W = \text{Watts Index}$

$$W = \frac{1}{N} \sum_{i=1}^q [\ln(z) - \ln(y_i)] = \left(\frac{1}{N}\right) \sum_{i=1}^q \ln\left(\frac{z}{y_i}\right) \text{ Where}$$

$N$  individuals in the population are indexed in ascending order of income (or expenditure), and the sum is taken over  $q$  individuals whose income  $y_i$  falls below the poverty threshold  $z$ . The index is calculated by dividing the poverty line by income, taking logs, summing the poor, and then dividing by the total population. This is one of the first poverty measurements that is sensitive to distribution (Haughton et al., 2009).

## **4. Results and Discussion**

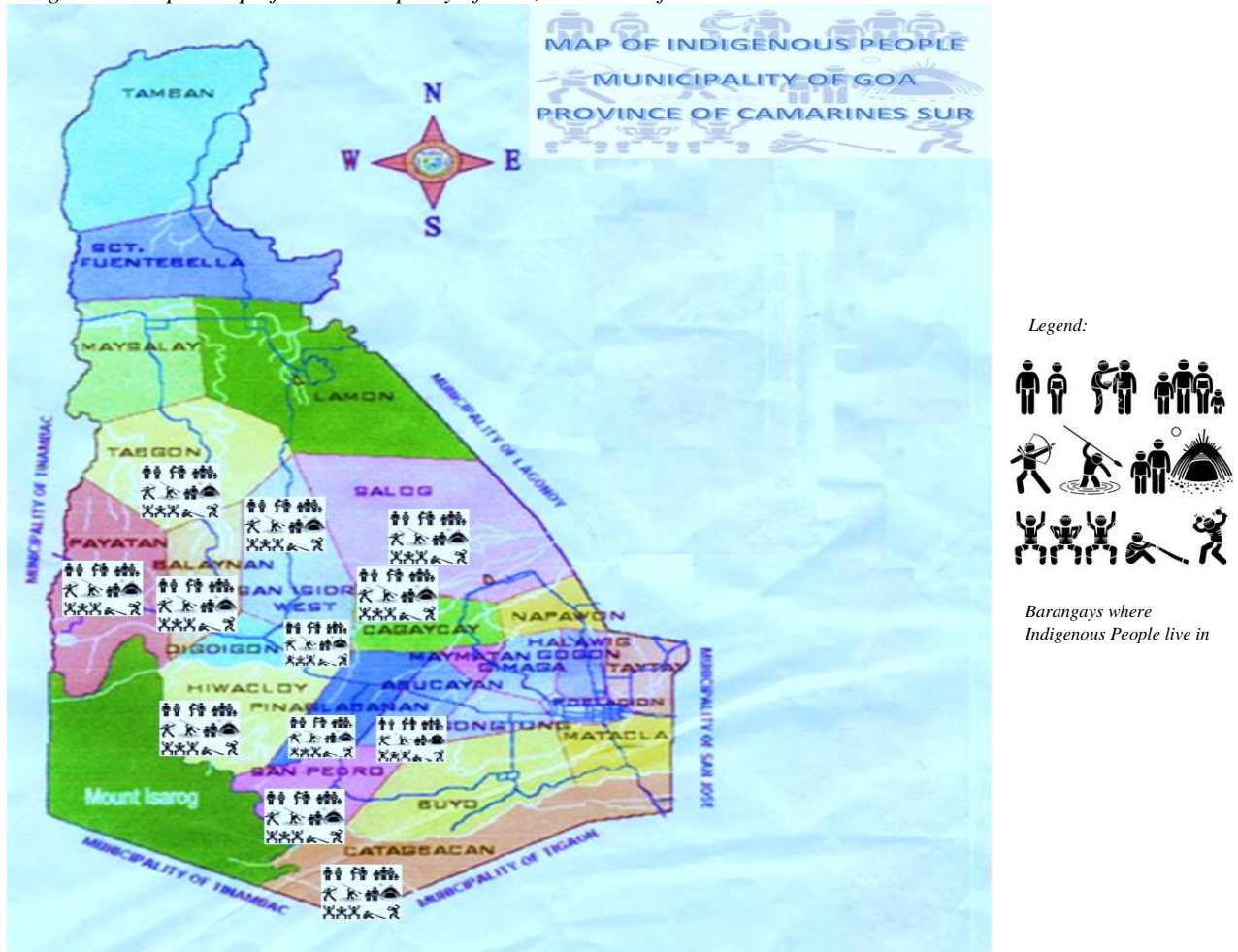
### ***4.1. General Profile of Goa***

The locale of the study was the Municipality of Goa, Camarines Sur, which is considered a second-class municipality in the province of Camarines Sur. In 2018, it has a population of 63,749 (CBMS, 2018) and in 2020, it has a population of 71,368 (PSA, 2020). Goa is surrounded by the municipalities of Tinambac, Lagonoy, Tigaon, and San Jose, and is 288.36 kilometers (179.18 miles) to the West-Northwest (N70°W) of Manila (PhilAtlas, 2021). According to PSA (2015), Goa has a total land area of 20,618 hectares or about 3.99 percent of the province's land area. The municipality has a good environment for agricultural and business activities, some of which are used for farming crops like corn, kalamansi, abaca, rice, coconut, and cassava. It has a Type II Climate characterized by dry and wet seasons. From October to December, tropical cyclones usually occur, increasing the rainfall in the area (DOST-PAGASA, 2020).

Goa is one of the six municipalities and a city that has territorial jurisdiction over Southern Luzon's highest forested peak, Mt. Isarog. These municipalities and city are Calabanga, Tinambac, Ocampo, Tigaon, Goa, Pili, and Naga City. Mt. Isarog is a stratovolcano and is 1,966 meters above sea level (DENR, 2020). In 2002, Proclamation No. 214 was signed by Pres. Arroyo declaring the Mt. Isarog Natural Park. Such area contains different endemic and endangered flora and fauna and is home to Indigenous People (or Aetas) of the Southern Luzon locally known as Agta Isarog, Agta Tabangnon, or Inagta Partido. Goa is consisting 34

barangays, 12 of which are being inhabited by Indigenous People. The Map of Goa (Figure 1) shows the 12 barangays within the footsteps of Mt. Isarog where culture and traditions are being maintained and nurtured.

**Figure 1**  
*Indigenous People Map of the Municipality of Goa, Province of Camarines Sur*



*(Courtesy of LGU Goa Base Map and Modified by E. Onsay, 2021)*

Table 2 shows the total households and population of indigenous people relative to the total number of households and population of 12 localities of Mt. Isarog, Goa, Camarines Sur. This information was generated by manipulating the CBMS databases.

**Table 2***Household and Population of Indigenous people in Goa, Camarines Sur (2018-2019)*

<b>Locality</b>	<b>Indigenous People HH</b>	<b>Total Number of HH</b>	<b>Distribution of IP HH</b>	<b>Indigenous People Population</b>	<b>Total Number of Population</b>	<b>Distribution of IP Population</b>
Abucayan	102	515	19.8058	426	2041	20.8721
Balaynan	130	307	42.3453	656	1417	46.2950
Cagaycay	16	510	3.1373	67	2324	2.8830
Catagbacan	123	842	14.6081	603	3833	15.7318
Digdigon	115	639	17.9969	557	2980	18.6913
Hiwacloy	101	453	22.2958	451	2037	22.1404
Payatan	295	436	67.6606	1503	2189	68.6615
Pinaglabanan	153	468	32.6923	741	2290	32.3581
Salog	106	441	24.0363	478	1859	25.7127
San Isidro West	114	581	19.6213	564	2405	23.4511
San Pedro Aroro	287	320	89.6875	1308	1414	92.5035
Tabgon	118	429	27.5058	668	2252	29.6625
<b>TOTAL</b>	<b>1,660</b>	<b>5,941</b>	<b>27.9414</b>	<b>8,022</b>	<b>27,041</b>	<b>29.6661</b>

The figures reveal that approximately 11.84% of the entire households in Goa, Camarines Sur account for Indigenous people, tantamount to 12.58% relative to the total population in the municipality. In reference to the total households of 12 localities where indigenous people are situated, 27.94% are attributed to Indigenous People with total members constituting 29.67% of the total population. Among the 12 barangays, the most populated localities of indigenous people are San Pedro Aroro, Payatan, and Balaynan with a total population distribution of 92.50%, 68.66%, and 46.30%, respectively. Out of 12 localities, the less populated of Indigenous People are Cagaycay, Catagbacan, and Digdigon with a total population distribution of 2.88%, 15.73%, and 18.69%, respectively.

#### ***4.2. Poverty Profile of Goa Municipality and Indigenous People Locality***

The poverty in the Municipality of Goa and 12 localities was analyzed through the core poverty indicators based on the CBMS. The data were examined in a holistic approach and then disaggregated to determine each locality's poverty profile. In Goa, 63.70% of the total households are living below the poverty threshold and 55.80% of the total population are living below the food threshold. The mortality rate of children and pregnant women is low, while

malnourishment of children from 0-5 years old is not pervasive. Poverty is not also apparent in housing indicators as can be seen from table 3 where only 6.80% of the total households are informal settlers and only 2.70% of the total households are living in makeshift housing.

**Table 3**

*Poverty Profile of Goa, Camarines Sur, Philippines (2018-2019)*

Poverty Indicators		Household		Population	
		Magnitude	Proportion	Magnitude	Proportion
Health and Nutrition	<b>Children under 5 years old who died</b> *Total HH with children under 5 years old=5,309 *Total population of children under 5 years old =7,378	34	0.60	34	0.50
	<b>Women who died due to pregnancy related causes</b>	0	0.00	0	0.00
	<b>Malnourished children 0-5 years old</b> *Total number of children 0-5 years old=5,966 *Total population of children aged 0-5 years old=9,010	369	6.20	489	5.40
Housing	<b>Households living in makeshift housing</b>	384	2.70	1,723	2.70
	<b>Households who are informal settlers</b>	947	6.80	4,614	7.30
Water and Sanitation	<b>Households without access to safe water</b>	2,869	20.50	13,018	20.60
	<b>Households without access to sanitary toilet facility</b>	1,740	12.40	7,795	12.30
Basic Education	<b>Children aged 6-11 years old who are not attending elementary</b> *Total # of HH with children aged 6-11=6,065 *Total population of children aged 6-11 years old=9,867	1,528	25.20	1,765	17.90
	<b>Children aged 12-15 years old who are not attending Junior High School</b> *Total # of HH with children aged 12-15 years old=4,498 *Total population of children aged 12-15 years old=6,277	2,059	45.80	2,462	39.20
	<b>Children aged 16-17 years old not attending Senior High School</b> *Total # of HH with children aged 16-17=2,523 *Total population of children aged 16-17=2,763	1,903	75.40	2,037	73.70
Income and Livelihood	<b>Households with income below poverty threshold</b>	8,930	63.70	43,268	68.50
	<b>Households with income below food threshold</b>	7,168	51.10	35,271	55.80
	<b>Households who experienced food shortage</b>	69	0.50	375	0.60
	<b>Unemployed members of the labor force</b> *Total # of HH with members of the labor force=11,883 *Total population of members of the labor force=18,220	451	3.80	497	2.40
Peace and Order	Victims of crime	84	0.60	89	.10

*Total number of households= 14,021; Resident Population=63,168; Total population=63,749*

Moreover, 1/5 of the entire population has no access to safe water and 3/25 of the entire population has no access to a sanitary toilet. Concerning basic education, poverty is evident due to the high proportion of out-of-school children ranging from 25%-75% of the total households with children aged 6-17 years old. Food shortage is not rampant and the unemployment rate is low. However, 84 households experienced crime. In the entirety, the core poverty indicators suggest that the incidence of poverty in the municipality of Goa is evident in income and livelihood, basic education, and water and sanitation.

**Table 4**

*Aggregated Poverty Profile of Indigenous People in Goa, Camarines Sur, the Philippines (2018-2019)*

Poverty Indicators		Household		Population	
		Magnitude	Proportion	Magnitude	Proportion
Health and Nutrition	<b>Children under 5 years old who died</b> *Total HH with children under 5 years old=757 *Total population of children under 5 years old =1,066	11	1.45	11	1.03
	<b>Women who died due to pregnancy related causes</b>	0	0.00	0	0.00
	<b>Malnourished children 0-5 years old</b> *Total number of children 0-5 years old=843 *Total population of children aged 0-5 years old=1,297	104	12.34	109	8.40
Housing	<b>Households living in makeshift housing</b>	80	4.82	381	4.75
	<b>Households who are informal settlers</b>	183	11.02	904	11.27
Water and Sanitation	<b>Households without access to safe water</b>	374	22.53	1,863	23.22
	<b>Households without access to sanitary toilet facility</b>	448	26.99	2,068	25.78
Basic Education	<b>Children aged 6-11 years old who are not attending elementary</b> *Total # of HH with children aged 6-11=831 *Total population of children aged 6-11 years old=1,430	278	33.45	562	39.30
	<b>Children aged 12-15 years old who are not attending Junior High School</b> *Total # of HH with children aged 12-15 years old=606 *Total population of children aged 12-15 years old=854	342	56.44	529	61.94
	<b>Children aged 16-17 years old not attending Senior High School</b> *Total # of HH with children aged 16-17=331 *Total population of children aged 16-17=352	271	81.87	288	81.82
Income and Livelihood	<b>Households with income below poverty threshold</b>	1,428	86.02	7,223	90.04
	<b>Households with income below food threshold</b>	1,230	74.10	6,301	78.55
	<b>Households who experienced food shortage</b>	17	1.02	102	1.27
	<b>Unemployed members of the labor force</b> *Total # of HH with members of the labor force=1,423 *Total population of members of the labor force=1,979	44	3.09	46	2.32
Peace and Order	Victims of crime	14	0.84	14	0.17

*Total number of households = 1,660; Total Population= 8,022*

According to CBMS and Indigenous People Censuses, there are 1,660 indigenous people households with a total population of 8,022 as shown in Table 4. Approximately 86.02% and 74.10% of the population live in poverty and lack access to food, respectively. Food scarcity and

unemployment have been reported, albeit only on a minor scale. Throughout the census period, there were 14 counts of crimes committed against indigenous people. In terms of health and nutrition, 1.45 percent of total households with children under 5 years old and 12.34% of all households with children aged 0-5 years old have died and are malnourished, respectively. Only 4.82% of total households and 11.02% of informal settlers live in makeshift housing and are informal settlers, respectively. According to the figures, only 22.53% and 26.99% of all households have access to safe drinking water and sanitary toilet facilities, respectively. In terms of education, evaluation results across barangays are generally consistent, indicating that as educational levels rise, most children in the community are not enrolled or have stopped enrolling in schools. Based on the findings, the information may deduce that income and livelihood, as well as Basic Education, are the primary causes of poverty among indigenous people in Goa's 12 localities. Moreover, Poverty has also been evident in health and nutrition, housing, and access to good water and sanitation, all of which have played a role in health dynamics.

#### ***4.3. Characterization of Health Dynamics***

Health dynamics were characterized through child mortality, maternal mortality, children malnutrition, type of housing, type of settlement, access to safe water, and access to a sanitary toilet facility.

Table 5 shows that among the 12 barangays, San Isidro west has the greatest child mortality, followed by Pinaglabanan and Payatan. Furthermore, there have been no documented cases of child mortality in six barangays, indicating good health and nutrition. In the 34 barangays of Goa, no case of pregnancy-related mortality has been observed. When it comes to malnutrition, Payatan has the highest number of cases, followed by San Isidro West and San Pedro Aroro. In Abucayan and Catagbacan, however, no cases have been documented. Only a few indigenous people in Payatan and Hiwacloy live in temporary housing since their homes are sturdier. However, indigenous people in Tabgon and Catagbacan have a higher standing in terms of formal settlement than those in other barangays. Access to safe water is a major issue for indigenous people in Hiwacloy, although it is not a concern in San Pedro Aroro. The majority of Indigenous People in Salog and Pinaglabanan have access to sanitary toilet facilities, however, this is a serious issue in Hiwacloy and Catagbacan, where a large portion of the population does not. Moreover, the average household size is 5.

**Table 5***Health Dynamics of Indigenous People Households in Goa, Camarines Sur, the Philippines (2018-2019)*

Locality	Children under 5 years old who died	Women who died due to pregnancy related causes	Malnourished children 0-5 years old	Households living in makeshift housing	Households who are informal settlers	Households without access to safe water	Households without access to sanitary toilet facility
Abucayan	0.00	0.00	0.00	2.94	7.84	44.12	25.49
Balaynan	1.61	0.00	8.33	2.31	10.77	30.77	21.54
Cagaycay	0.00	0.00	11.11	6.25	25.00	25.00	12.50
Catagbacan	0.00	0.00	0.00	4.07	2.44	27.64	43.90
Digdigon	1.92	0.00	5.45	5.22	4.35	20.00	39.13
Hiwacloy	0.00	0.00	6.25	1.98	9.90	63.37	67.33
Payatan	2.22	0.00	31.17	0.68	14.92	16.27	24.07
Pinaglabanan	2.70	0.00	3.80	1.96	48.37	24.84	7.84
Salog	0.00	0.00	10.26	1.87	5.66	3.77	7.55
San Isidro West	3.70	0.00	18.33	13.16	7.02	21.05	14.91
San Pedro Aroro	1.47	0.00	15.89	11.50	2.09	0.70	24.40
Tabgon	0.00	0.00	1.56	4.24	0.85	40.68	39.83
<b>TOTAL</b>	1.45	0	12.34	4.82	11.02	22.53	26.99

#### 4.4. Extent of Poverty

Poverty is multidimensional and cannot be captured easily by a single indicator. Thus, various indices were generated to determine the incidence, gap, severity, and extent of poverty.

**Table 6***Extent of Poverty of Indigenous People in Goa, Camarines Sur, the Philippines (2018-2019)*

Locality	Headcount Ratio	Poverty Gap Index	Poverty Severity Index	Watts Index
Abucayan	99.02	0.2228	0.0723	0.2724
Balaynan	83.55	0.2189	0.0716	0.2676
Cagaycay	81.25	0.1744	0.0545	0.2112
Catagbacan	78.05	0.1917	0.0615	0.2331
Digdigon	86.09	0.2096	0.0647	0.2533
Hiwacloy	81.19	0.1801	0.0584	0.1932
Payatan	96.61	0.2120	0.0687	0.2592
Pinaglabanan	96.73	0.2083	0.0675	0.2201
Salog	67.89	0.1503	0.0487	0.1837
San Isidro West	85.96	0.1896	0.0615	0.2317
San Pedro Aroro	74.22	0.1663	0.0540	0.2033
Tabgon	78.81	0.2025	0.0656	0.2475
<b>TOTAL</b>	<b>86.02</b>	<b>0.1948</b>	<b>0.0837</b>	<b>0.2332</b>



The headcount ratio was estimated as follows  $P_0 = \frac{1}{N} \sum_{i=1}^N (y_i < z)$   $P_0 = \frac{N_P}{N}$  Where,  $P_0$  = Headcount Ratio,  $N_P$  = Number of poor; and  $N$  = Total Population (or sample). It is the percentage of the population that falls below the poverty line. Based on the computation as shown in table 6, data infer that all barangays where Indigenous people live in are poor based on total household count. Abucayan is the poorest locality which is being followed by Pinaglabanan and Payatan, while Salog and Catagbacan have the least number of poor households relative to the 12 barangays. However, one of the drawbacks of the head count ratio is that it ignores the depth of poverty; as the poor gets poorer, the headcount index stays the same. Thus, Poverty gap index was derived as follows  $P_1 = \frac{1}{N} \sum_{i=1}^N \frac{G_i}{z}$  Where,  $P_1$  = Poverty Gap Index and  $G_i = (z - x_1) \times I(y_i < z)$ . The poverty gap index is a metric for determining how intense poverty is. It is defined as the population's average poverty gap expressed as a percentage of the poverty line. It calculates the degree of poverty by looking at how far the poor are from the poverty line on average. The indices are ranging from .15 to .22, the closer it is to 0, the lesser the population below the poverty line, but the closer it is to 1, the more of the population below the poverty line. An index of 0.15 is equivalent to 15% and .22 is equivalent to 22%, which is relatively closer to 0 than to 100%. Thus, poverty is moderate to intense among indigenous people. However, Abucayan has the highest poverty gap index being followed by Balaynan and Payatan. On the other hand, the Salog and San Pedro Aroro have the least poverty gap index which reflects better income relative to other barangays. To determine the severity of poverty, the poverty severity indices were calculated as follows  $P_\alpha = \frac{1}{N} \sum_{i=1}^N \left(\frac{G_i}{z}\right)^\alpha$ , ( $\alpha \geq 0$ ) Where  $P_2$  = Squared Poverty Gap Index  $\alpha$ =sensitivity of index to poverty;  $z$ =poverty line;  $x_1$ =value of expenditure (income) per capita for  $i$ th person's HH; and  $G_i = z - x_1$ (with  $G_i = 0$  when  $x_i > z$ ) = poverty gap for individual  $i$ . The poverty gap index is connected to the squared poverty gap index. It is calculated by taking the square of the poverty gap ratio and averaging it. The measure gives more weight to a poor person's observed income as it goes below the poverty line by squaring each poverty gap statistic. The squared poverty gap index is a type of weighted sum of poverty gaps in which the weight is proportional to the size of the gap. The poverty is more severe in Abucayan, Balaynan, Payatan, and Pinaglabanan. Yet, it is less severe in Salog, Hiwacloy, and San Pedro Aroro. Moreover, the Watts Indices were also estimated through the equation  $W = \frac{1}{N} \sum_{i=1}^N [\ln(z) - \ln(y_i)] = \left(\frac{1}{N}\right) \sum_{i=1}^q \ln\left(\frac{z}{y_i}\right)$  Where  $W$  = Watts Index;  $N$  individuals in the population are indexed

in ascending order of income (or expenditure), and the sum is taken over  $q$  individuals whose income (or expenditure)  $y_i$  falls below the poverty line  $z$ . The index is computed by dividing the poverty line by income, taking logs, and taking the sum over the poor, then dividing it by the entire population. The results show that poverty is extensive in Abucayan, Balaynan, Digdigon, Payatan, and Tabgon while less extensive in Salog, Hiwacloy, San Pedro Aroro, and Cagaycay.

#### 4.5. Impact of Health Dynamics on Poverty

**Table 7**

*Consolidated Results of Logistic Regression of Health Dynamics and Poverty Cases of Indigenous People in Goa, Camarines Sur, the Philippines (2018-2019)*

Locality	Poverty Class	Odds Ratio	Coefficient	Standard Error	z	p> z	[95% Conf. Interval]
Abucayan	Malnourished children 0-5 years old	2.0381	0.4285	0.9676	1.5000	0.1340	0.8038 5.1679
Balaynan	Children under 5 years old who died	0.9359	-0.1282	1.0259	-0.0600	0.9520	0.1092 8.0220
Cagaycay	Women who died due to pregnancy related causes	1.0000	0.0000				
Catagbacan	Households who are informal settlers	1.6839	1.4063	0.4609	1.9000	0.0570	0.9847 2.8795
Digdigon	Households living in makeshift housing	0.9390	0.3991	0.3274	-0.1800	0.8570	0.4741 1.8595
Hiwacloy	Households without access to safe water	1.7541	0.3200	0.3791	2.6000	0.0090	1.1485 2.6792
Payatan	Households without access to sanitary toilet facility	1.3992	0.4204	0.2629	1.7900	0.0740	0.9681 2.0223
Pinaglabanan	Household Members	1.4608	0.3864	0.0623	8.8800	0.0000	1.3436 1.5882
Salog	Households who are informal settlers x Household Members	0.8151	-0.2078	0.1160	-1.4400	0.1510	0.6167 1.0774
San Isidro West	Households living in makeshift housing x Children under 5 years old who died	1.0000	0.0000				
San Pedro Aroro	Households without access to safe water x Children under 5 years old who died	1.0000	0.0000				
Tabgon	Households without access to safe water x Household Members	1.0785	0.0756	0.1311	0.6200	0.5340	0.8499 1.3687
	Households without access to safe water x Households who are informal settlers	0.7321	-0.3118	0.6753	-0.3400	0.7350	0.1201 4.4643
Pseudo R2 = 0.0942	Households without access to safe water x Households living in makeshift housing	0.7095	-0.3433	0.6108	-0.4000	0.6900	0.1313 3.8345
	Households without access to sanitary toilet facility x Households who are informal settlers	1.0910	0.0871	0.9926	0.1000	0.9240	0.1834 6.4897
Log likelihood = -591.5760	Households without access to sanitary toilet facility x Households living in makeshift housing	0.3326	-1.1010	0.2518	-1.4500	0.1460	0.0754 1.4669
	Malnourished children 0-5 years old x Children under 5 years old who died	1.0000	0.0000				
Prob>chi2 = 0.0000	Constant	0.9408	-0.0611	0.1943	-0.3000	0.7670	0.6276 1.4102

To investigate the impact of health dynamics on poverty cases and test whether health dynamics can predict poverty outcomes, *ceteris paribus*, logistic regression was used. Results of the calculation are shown in table 7.

The results reveal that there are only three indicators that significantly predict the poverty outcome variable, namely: *Households who are informal settlers*, *Households without access to safe water*, and *Household Members*, with p-values of 0.0567, 0.009, and 0.000, respectively. Regarding coefficients, these are the values for the logistic regression equation for predicting the dependent variable from the independent variable. They are in log-odds units. The prediction equation is expressed as  $\log(p/1-p) = \beta_0 + \beta_1 CDEATH5 + \beta_2 WDEATHPC + \beta_3 CMALNO5 + \beta_4 MSHDWELL + \beta_5 SQUATH + \beta_6 WATACCESS + \beta_7 STFACCESS + \beta_8 TNOHHM + \mu$ . where  $p$  is the probability of being poor, poverty incidence, or poverty outcomes.

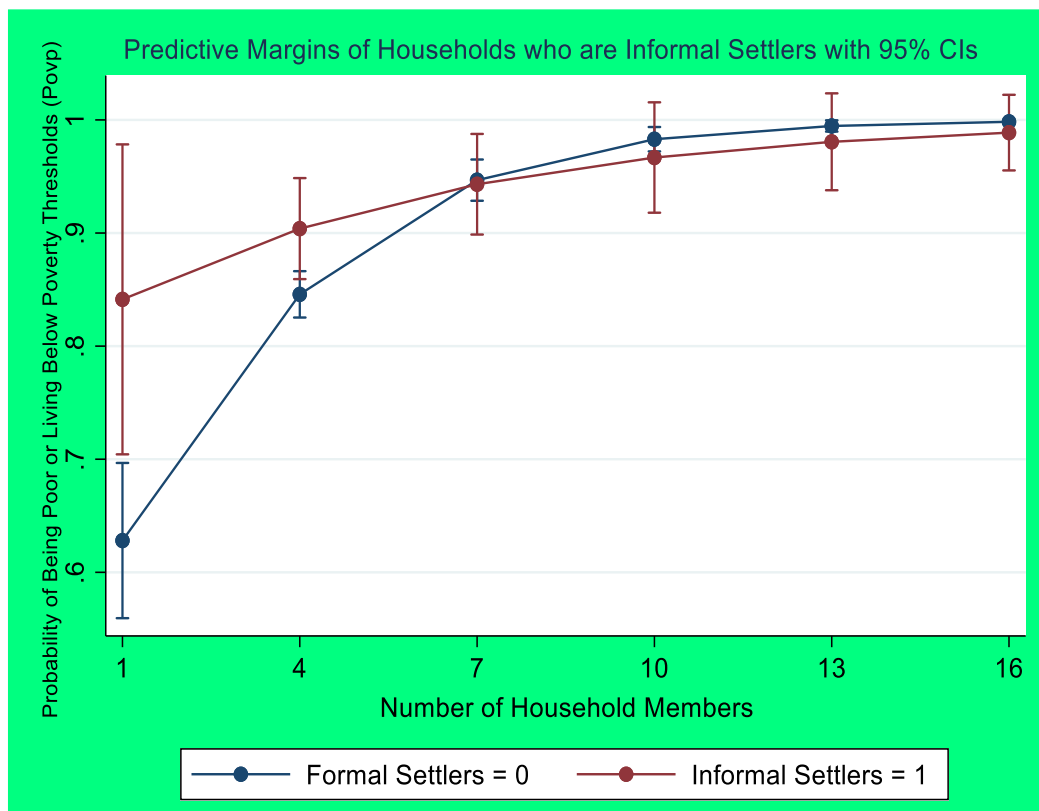
$$\log(p/1-p) = -0.0610574 + \beta_1 * 0.4285075 + \beta_2 * -0.1281599 + \beta_3 * 0 + \beta_4 * 1.406319 + \beta_5 * 0.3991358 + \beta_6 * 0.3199608 + \beta_7 * 0.4203754 + \beta_8 * 0.3864454$$

The relationship between the independent factors and the dependent variable, where the dependent variable is on the logit scale, is described by these estimations. These estimates show how much a 1-unit increase in the predictor would increase the expected log chances of poverty = 1 while keeping all other predictors constant. The coefficients for the non-significant independent variables are not substantially different from 0, which should also be considered when interpreting the results. Because these coefficients are often difficult to interpret because they are in log-odds units, they are frequently transformed into odds ratios. For instance, the coefficient of Households without access to safe water is 0.3991358. This means that for a one-unit increase in Households without access to safe water, an expected 39.91% increase in the log-odds of the dependent variable poverty, holding all other independent variables constant. Another one, Household Members, for every one-unit increase in the household members, an expected 38.64% increase in the log-odds of poverty outcomes, holding all other independent variables constant. The analysis also applies to all other variables, but only the aforementioned indicators are significant predictors based on p-values. Moreover, the constant -0.0610574 represents the expected value of the log-odds of poverty when all of the predictor variables equal zero.

Regarding the odds ratio, it can be generated by dividing the number of households who are not living below the poverty threshold by the number of households who are living below the poverty thresholds. The same procedure applies to all indicators. Another significant observation, significant variables have a confidence interval at 95% that does not include 1.0, possibly because the lower bound of the 95 percent confidence range is so near to 1, and the p-value is so close to .05. The researcher also utilized various interacting variables which can be seen from the table. The 8 variables do not significantly interact with the poverty outcomes. However, 4 variables have a negative effect on poverty outcomes, namely: Households who are informal settlers x Household Members; Households without access to safe water x Households who are informal settlers; Households without access to safe water x Households living in makeshift housing; and Households without access to sanitary toilet facility x Households living in makeshift housing. It is indicative that if housing and water and sanitation indicators are better, the likelihood of a household to get poorer declines.

**Figure 2**

*Predictive Margins of Households who are informal settlers and Household Members as Interacting Variables*



When compared to formal settlers, informal settlers have a larger likelihood of living below the poverty line as indicated in figure 2. Furthermore, as the number of household members grows, so does the likelihood of being impoverished.

**Figure 3**

*Predictive Margins of Households without Access to Sanitary Toilet Facility and Household Members as Interacting Variables*

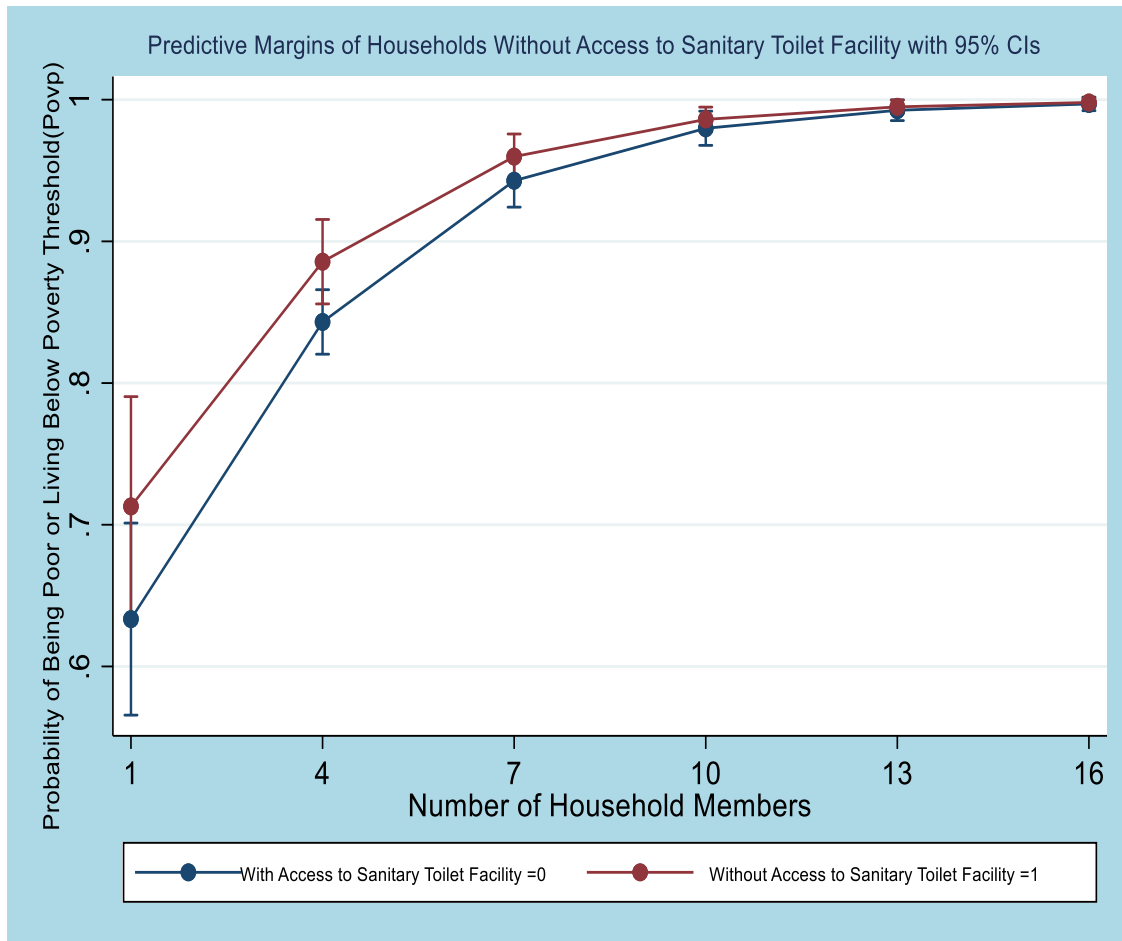


Figure 3 shows the predictive margins of households without access to sanitary toilet facility and household members as interacting variables. Households with Access to Sanitary Toilet Facility and Households with Fewer members have the least chances of living below the poverty threshold, it is being followed by Households with Access to Sanitary Toilet Facility and have a high number of members, then by Household without Access to Sanitary Toilet Facility and with fewer household members, and lastly by households without access and with a higher number of members. The result asserts that the number of household members as a component of health dynamics is a significant predictor of poverty. The overall model has a P-Value of 0.0000,

which implies significance at a .05 alpha level. Moreover, the goodness-of-fit test was performed as indicated.

*Logistic model for Probability of Poverty Occurrence, goodness-of-fit test*

Number of observations = 1623  
 Number of covariate patterns = 145  
 Pearson chi2(131) = 95.76  
 Prob > chi2 = 0.9911

The goodness-of-fit shows Prob > chi2 of 0.9911 which is greater than 0.05 Alpha level. The model's goodness-of-fit test is not significant, however, a test of *estat classification* is performed.

**Table 8**  
*Estat Classification of Logistic Regression Model*

Classified	TRUE		Total
	Poor	Non-Poor	
+	1398	225	1623
-	0	0	0
Total	1398	225	1623

---

Classified + if predicted Pr(D) >= .5  
 True D defined as povp != 0

---

Sensitivity	Pr( + D)	100.00%
Specificity	Pr( ~D)	0.00%
Positive predictive value	Pr( D +)	86.14%
Negative predictive value	Pr(~D -)	.%
False + rate for true ~D	Pr( +~D)	100.00%
False - rate for true D	Pr( - D)	0.00%
False + rate for classified +	Pr(~D +)	13.86%
False - rate for classified -	Pr( D -)	.%

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Correctly classified 86.14%

Table 8 shows the result of *estat classification*. The *true* means the binary outcomes whether a household is poor or non-poor. There are 1,398 samples who are poor and 225 who are

non-poor. Out of 1,623 observations, all of them are correctly classified by the model, thus sensitivity is 100%. The Specificity is zero because none of 225 observations were correctly classified to be living below the poverty threshold. Hence, all households living below the poverty threshold were correctly predicted by the model. The overall correctly classified is 86.14%. Thus, the models or alternative specifications correctly classify the household observations in the logistic model.

## 5. Conclusion

Within the 12 localities of the Goa municipality, indigenous people known as Agta Isarog or Agta Tabangnon dwell. The CBMS and IP Census datasets were used to assess poverty across barangays, and several policy proposals for economic development were outlined. Because poverty determinants differ and assessment is multifaceted, data were disaggregated to analyze each locality. It makes the following claims: First, the majority of Indigenous Peoples' households and populations live below the poverty and food thresholds. Second, there have been reports of food scarcity and unemployment, although only on a modest scale. Malnutrition, child mortality, and a crime against Indigenous peoples have all been reported, although they are not the primary drivers of poverty in all areas. Third, the majority of indigenous people are poor, and poverty is pervasive, according to headcount indices. Fourth, poverty intensity differs by locality based on poverty gap metrics. However, the overall index indicates that poverty levels are manageable and can be lowered through a variety of policies and efforts. Fifth, the squared poverty gap indices represent the severity of tolerable poverty, which differs by location. Sixth, the Watts indicators are comparable to the severity indices, which reflect the intensity and severity of moderate to severe poverty across barangays. Seventh, health dynamics variables were described in order to gain valuable insights from them and to see if they could predict poverty incidences or occurrences. Every community's health dynamics are distinct from one another. As a result, different policy measures for economic development are required in each community. Furthermore, based on the provided findings of the logistic regression model for individual and consolidated approaches, it can be inferred that health dynamics strongly predict poverty outcomes. Poverty among indigenous peoples in Southern Luzon is mostly caused by a lack of income and livelihood, as well as a lack of access to basic education. Poverty has also been visible in health and nutrition, housing, and access to safe drinking water and sanitation, all

of which have comprised health dynamics. The null hypothesis should be rejected since it implies that there are no differences or relationships between the data's features. There are significant associations between health dynamics indicators and poverty consequences. In Southern Luzon, the Philippines, health has a substantial impact on poverty classifications and statuses of households and indigenous people.

Cooperation between indigenous people, private institutions, and government agencies is necessary to alleviate poverty, improve the welfare of households, reducing risks and vulnerabilities, and promote socio-economic and community development. The results suggest a strong need for policy mapping in order to establish which aspects of each barangay's vulnerabilities and poverty occurrence should be targeted. The results of policy targeting must be employed to properly allocate resources and achieve economic development objectives, especially for health dynamics. Government initiatives must ensure indigenous people are always included in poverty-reduction plans and impart them with professional skills so that they can become well-rounded individuals who are competent, confident, value-laden, and dependable in a local, national, and global setting.

These statistics and econometrics of indigenous people can be integrated in economic studies and courses and present data quantitatively within Bicol Region. Further studies on cross-sectional, repeated cross-sectional, and panel data may be utilized to determine the level of poverty across periods, and the identification of chronic and transient poor households may be made possible when the succeeding CBMS data becomes available.

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