

NATIONAL HEALTH INSURANCE AND CATASTROPHIC HEALTH EXPENDITURE: A COMPLEMENTARY LOG-LOG APPROACH ON YOGYAKARTA'S INCIDENCE 2022

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ABSTRACT

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National Health Insurance (JKN) aims to provide health care benefits to meet people's basic health needs. However, despite the high JKN coverage in D.I.Yogyakarta Province, catastrophic health expenditure events remain high. The study examines the implementation of National Health Insurance (JKN) in D.I.Yogyakarta Province and its effectiveness in reducing devastating health expenditures in 2022. Using the Complementary Log-log approach on the 2022 National Social and Economic Survey data, the research findings reveal that the implementation of JKN has been successful, and the ownership of JKN positively affects the reduction of catastrophic health expenditure. The study also shows that the education level of household members and household size have positive effects on reducing the incidence of catastrophic health expenditures. However, the presence of babies or the elderly, household economic status, and inpatient status could increase the risk of having catastrophic health expenditures. The study highlights the need for attention to be given to implementing JKN in D.I.Yogyakarta Province and other variables to achieve universal health coverage and reduce catastrophic health expenditure.



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1. INTRODUCTION

Health is a basic human need that plays an important role in creating quality human resources. One form of seriousness by countries in the world regarding health issues is by placing health as the third goal of the Sustainable Development Goals (SDGs). Target 3.8 SDGs seeks to achieve universal health coverage (UHC). UHC is important in national development because it has a positive impact on the country's economy by improving people's quality of life and can spur a country's economic growth [1].

The notion of UHC in Indonesia is implemented in the national medium-term development plan (RPJMN) through improving health services towards universal health coverage, one of which is realized in the form of the National Health Insurance System (JKN). JKN is administered by a public legal entity, namely the Health Social Security Administering Agency (BPJS), which aims to guarantee that participants receive health care benefits and protection in meeting basic health needs.

According to data released by Badan Pusat Statistik (BPS), the number of persons joining the JKN program is increasing year after year. It is estimated that by 2022, the number of persons enrolled in the BPJS Health program will be 62,22 percent, with Jamkesda accounting for 7,65 percent of the entire population in Indonesia [2]. However, just because JKN membership is widespread does not mean that the Indonesian populace is wholly free of healthcare expenditures. Household or out-of-pocket (OOP) funding continues to dominate national health spending. According to WHO (2017), OOP expenditures are direct payments made by individuals to healthcare providers while utilizing services and are not pre-payments for healthcare services, such as insurance contributions or specific premiums [3].

Data from the Ministry of Health (2020) reveals a consistent trend of the Out-of-Pocket (OOP) financing scheme maintaining the highest share in comparison to other financing schemes over consecutive years. In 2018, the proportion of health spending covered by OOP in Indonesia stood at 31,9 percent. Although this percentage reflects a decline from previous years, it persists above the recommended threshold. According to WHO, the recommended limit for the overall fraction of OOP should not exceed 20 percent of total health spending. Too much OOP spending can worsen home financial conditions and lower fundamental requirements, resulting in household impoverishment, increased poverty rates, and poor people becoming more impoverished [4].

Households with high OOP have the potential to experience catastrophic health expenditure events. Catastrophic health expenses occur when health expenses are borne out of pocket or OOP and without reimbursement from a third party. According to WHO (2017), a household is said to experience catastrophic health expenditure when its health spending exceeds the threshold of 10 percent or 25 percent of total income, which is generally approximated by the value of expenditure or consumption [3].

Yogyakarta, an Indonesian province known for extensive health insurance coverage, ranks seventh in the percentage of the population with health insurance [2]. However, this high coverage does not correspond to perceived benefits, as Yogyakarta also leads in the percentage of families experiencing catastrophic health expenditure in Indonesia. In terms of demographic perspective, Yogyakarta stands out with a notable concentration of elderly residents. According to data from the Badan Pusat Statistik (BPS), Yogyakarta claims the top position nationwide for the highest percentage of the elderly population in 2022, reaching 16,69 percent [5]. Additionally, Yogyakarta leads among Java's provinces in terms of poverty rates, with 11,34 percent of its population experiencing economic challenges. Notably, the province also secures the second position for the highest Human Development Index (HDI) value in Indonesia, reflecting its multifaceted achievements beyond demographic and economic metrics [6].

The amount of catastrophic health expenditure can be influenced by several factors, which can be classified into enabling factors, ability factors, and need factors [7]. Enabling factors include the education level of household members, the presence of babies or elderly people in the household, the number of household members, and the marital status of household heads. Capability factors consist of ownership of health insurance, household poverty status, and regional status. Meanwhile, need factors can be the status of household members receiving inpatient care, outpatient care, and health problems experienced by the members.

While prior studies have delved into the incidence of catastrophic health expenditure, many still rely on primary data with limited estimations or outdated survey data, like the Indonesia Family Life Survey (IFLS), which may no longer align with current conditions [8]. There is a pressing need for new research utilizing nationally collected data. Focused studies on specific provinces can yield more nuanced conclusions.

On the other hand, the low incidence of catastrophic health expenditure, hovering around 2 percent, signals a necessity for methodological adjustments. Conventional approaches like logistic regression, suitable for explaining relationships in common events, may not be apt for rare events or asymmetric data conditions [9]. Hence, an alternative approach, such as modelling with the complementary log-log link function, is warranted.

Given the distinct challenges in D.I.Yogyakarta Province, investigating the incidence of catastrophic health expenditure becomes particularly intriguing. This research will provide a general picture of health insurance coverage and catastrophic health expenditures in D.I.Yogyakarta Province in 2022. Furthermore, this research aims to find influential variables and scrutinize the trends associated with catastrophic health expenditure in the province during the specified year.

This research enhances the existing body of knowledge by employing analytical methods that are particularly adept at handling data involving rare events. Beyond this methodological improvement, the study directs its focus on a specific geographic region, namely D.I.Yogyakarta Province, utilizing the most recent data from BPS, specifically the Susenas 2022 dataset.

2. RESEARCH METHODS

2.1 Andersen's Theory

The selection of variables influencing the incidence of catastrophic health expenditure is based on Andersen's theory. Although this theory is not directly related to the incidence of catastrophic health expenditure, it can explain how a person behaves when utilizing health services. Andersen's theory explains that the use of health services is influenced by three factors: predisposing factors, ability factors, and need factors. Predisposing factors encompass demographic characteristics, social structure, and trust in health services, shaping an individual's inclination to seek health services. The ability factor is contingent on a consumer's financial capacity to access and afford health services. In contrast, the need factor is the fundamental and direct stimulus compelling consumers to engage with health services.

2.2 Catastrophic Health Expenditures

Catastrophic health expenditure is a condition where a household makes OOP expenditures for health services that exceed a certain threshold, resulting in financial difficulties and reducing the household's ability to pay. The threshold set is 10 percent or 25 percent of household income, which is generally approximated to the value of expenditure or consumption or 40 percent of the ability to pay [3], [10]. In this study, the categorization of catastrophic health expenditure events was carried out using the WHO threshold of 10 percent. The use of this threshold is based on the commonly used threshold of 10 percent [11].

The process of determining whether a household experiences a catastrophic health expenditure event involves the following stages:

- a. Calculating out-of-pocket health expenses:
 - Compile health expenses, including costs for medical/curative services, drug expenditures, preventive services, as well as expenses for transportation, accommodation, and other services related to health costs.
 - Aggregate health expenditures that are directly borne by the household—payments made in cash or from personal pockets.
- b. Determining households experiencing catastrophic health expenditure events:
 - Compare the total sum of aggregated health expenditures with the overall household expenditure.
 - If health expenditures surpass 10 percent of the total household expenditure, the household is classified as having experienced a catastrophic health expenditure.

2.3 Research Scope and Data Sources

This research covers all districts and cities within D.I.Yogyakarta Province, utilizing data from the year 2022. We selected Yogyakarta as our focus due to its extensive health insurance coverage despite consistently experiencing significant catastrophic health spending events, when compared to other provinces, as shown in [Figure 1](#). The primary unit of analysis is households in Yogyakarta, with a sample size of 3,966 households. The research relies on secondary data obtained from the Central Bureau of Statistics (BPS), specifically from the March 2022 National Socio-Economic Survey (Susenas) and BPS publications [12].

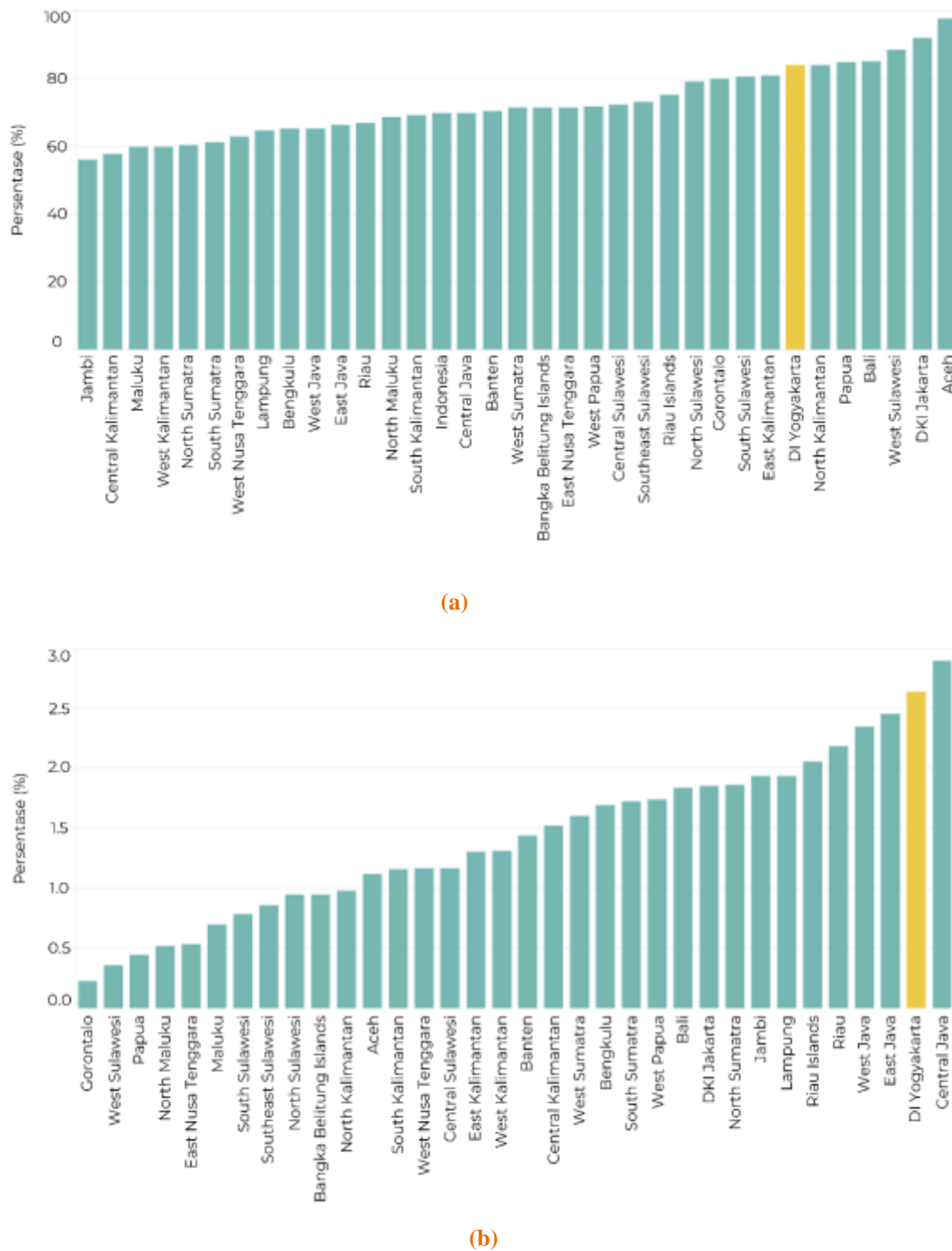


Figure 1. (a) Percentage of Population who Have Health Insurance by Province in 2022, (b) Percentage of Households Experiencing Catastrophic Health Expenditure Events by Province in 2022

The central focus of this investigation is the status of catastrophic health expenditure events, serving as the dependent variable. The independent variables include factors such as ownership of JKN, education level of household members, presence of babies or elderly people, number of household members, marital status of head of household, household economic status, regional status of household, inpatient status of household members, outpatient status of household members, and health complaint status of household members.

2.4 Empirical Strategy

The analytical method used in this research is complementary log-log regression. In general, modeling with GLM in binary logistic regression analysis uses the logit link function. However, modeling using binary logistic regression with the logit link function will bias the parameter estimation results if used on data that are rare events. Rare event data occur when the sample is in the rare category, or the response variable has a very small chance, usually below 5 percent [13]. The logit and probit link functions should be used if the proportion of the success category is the same as the proportion of the failure category [14]. Therefore, in conditions where the data is rare events, or the data is asymmetric, another link function is needed so that the GLM model can be applied. One of the link functions that can overcome this problem is the complementary log-log link function.

The complementary log-log transformation has the main difference from the logit and probit transformations, namely that the logit and probit link functions are symmetric at around probability 0.5, while the complementary log-log link function is asymmetric. The complementary log-log transformation is usually used when the response variable has a very large or very small probability in one of its categories. In conditions like this, the use of the complementary log-log link function is more appropriate than the logit and probit link function because the response variable is in a certain category group or the response variable has an asymmetrical distribution [15].

This study uses complementary log-log regression because the data used is asymmetric or the incidence of catastrophic health expenditure is a rare event. In probability form, the complementary log-log regression model can be written as follows [15]:

$$\pi(x) = 1 - \exp \left[-\exp (\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p) \right] \quad (1)$$

The formula for the complementary log-log regression model can be written as follows:

$$g(x) = \log[-\log (1 - \pi(x))] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p \quad (2)$$

This data processing step in this study was conducted using R Studio and SPSS software. The steps in carrying out complementary log-log regression analysis in this research are as follows:

1. Formation of the initial model used

Using Maximum Likelihood estimation (MLE) method, the complementary log-log regression model in this study is estimated as follows:

$$g(D) = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \dots + \beta_{11} D_{11} \quad (3)$$

Information:

$\beta_0, \beta_1, \beta_2, \beta_3, \dots, \beta_{11}$: Model parameter values

$g(D)$: Link function *complementary log-log*

D_1 : Ownership of JKN for the category not all members have JKN

D_2 : Ownership of JKN for the category of all members who do not have JKN

D_3 : Education level of household members

D_4 : Presence of babies or elderly people

D_5 : Number of household members

D_6 : Marital status of head of household

D_7 : Household Economic Status

D_8 : Regional status of household

D_9 : Inpatient status of household members

D_{10} : Outpatient status of household members

D_{11} : Health Complaint status of household members

2. Carry out parameter testing simultaneously using the likelihood ratio test statistic. Where H_0 states that there are no independent variables that influence the status of catastrophic health expenditure events. The test criteria are is to reject H_0 if $G > \chi^2_{(\alpha;p)}$ or $p - value < \alpha$.
3. Carrying out partial parameter testing using Wald test statistics. Where H_0 states that the j th independent variable has no effect on the status of catastrophic health expenditure events. The test criteria is to reject H_0 if $|W| > |Z_{\frac{\alpha}{2}}|$ or $p - value < \alpha/2$.
4. Testing the suitability of the model using the Hosmer-Lemeshow test statistics. Where H_0 states that the model used is appropriate. The criteria for the H_0 rejection test, when $\hat{C} > \chi^2_{(\alpha;(g-2))}$ or $p - value < \alpha$.
5. The selection of the best model is based on the smallest Akaike Information Criterion (AIC) value and the largest Nagelkerke R square value.
6. Interpretation of complementary log-log regression results. The probability function for the complementary log-log model can be interpreted in the following formula:

$$\frac{\log[1-\pi(x_j=1)]}{\log[1-\pi(x_j=0)]} = \exp(\hat{\beta}_j) \quad (4)$$

3. RESULTS AND DISCUSSION

3.1 Overview of Health Insurance Ownership in D.I.Yogyakarta Province for the Year 2022

Health insurance ownership in D.I.Yogyakarta Province for the year 2022 reflects a noteworthy trend within the broader context of Indonesia's health coverage landscape. Among the nation's ten provinces exhibiting high health insurance coverage, D.I.Yogyakarta stands out, showcasing a consistent annual increase in ownership. According to data from the Badan Pusat Statistik (BPS), the percentage of the population covered by health insurance in D.I.Yogyakarta Province is projected to reach 83.93 percent in 2022 [2]. This robust coverage is primarily attributed to the prevalence of BPJS Health Program Beneficiary (PBI) and BPJS Health Non-PBI, aligning with the government's strategic initiative to ensure equitable health insurance ownership across all societal strata through the Social Security Administrator (BPJS).

Looking at the consumption level, households at the first quantile of consumption demonstrate the lowest percentage (6.22 percent) of households where all members have no access to JKN. In contrast, households at the fourth quantile exhibit the highest percentage (15.94 percent) of members without JKN. Delving into the district/city breakdown within D.I.Yogyakarta, Yogyakarta City boasts the highest percentage (84.1 percent) of JKN ownership among all members. On the other hand, Sleman Regency records the highest percentage (14.3 percent) of households with members lacking JKN, illustrating that approximately 14 to 15 out of 100 households in Sleman Regency are yet to secure JKN coverage for all family members.

3.2 The Incidence of Household Catastrophic Health Expenditure in Yogyakarta in 2022

In 2022, Yogyakarta stands as the second-highest province in Indonesia in terms of the incidence of catastrophic health expenditure, registering at 2.64 percent. **Figure 2** illustrates a nuanced distribution of these incidents across districts and cities within the province during the same year. Notably, Sleman Regency emerges with the highest incidence of household catastrophic health expenditure in D.I.Yogyakarta Province, reaching 3.30 percent, while Kulon Progo Regency records the lowest incidence at 1.58 percent.

This disparity in percentages underscores the regional variability in the burden of catastrophic health expenditure. The data signals a critical need for targeted government attention, particularly in areas with heightened incidents, such as Sleman Regency. A strategic focus on these high-incidence regions can be instrumental in controlling the prevalence of catastrophic health expenditure in Yogyakarta.

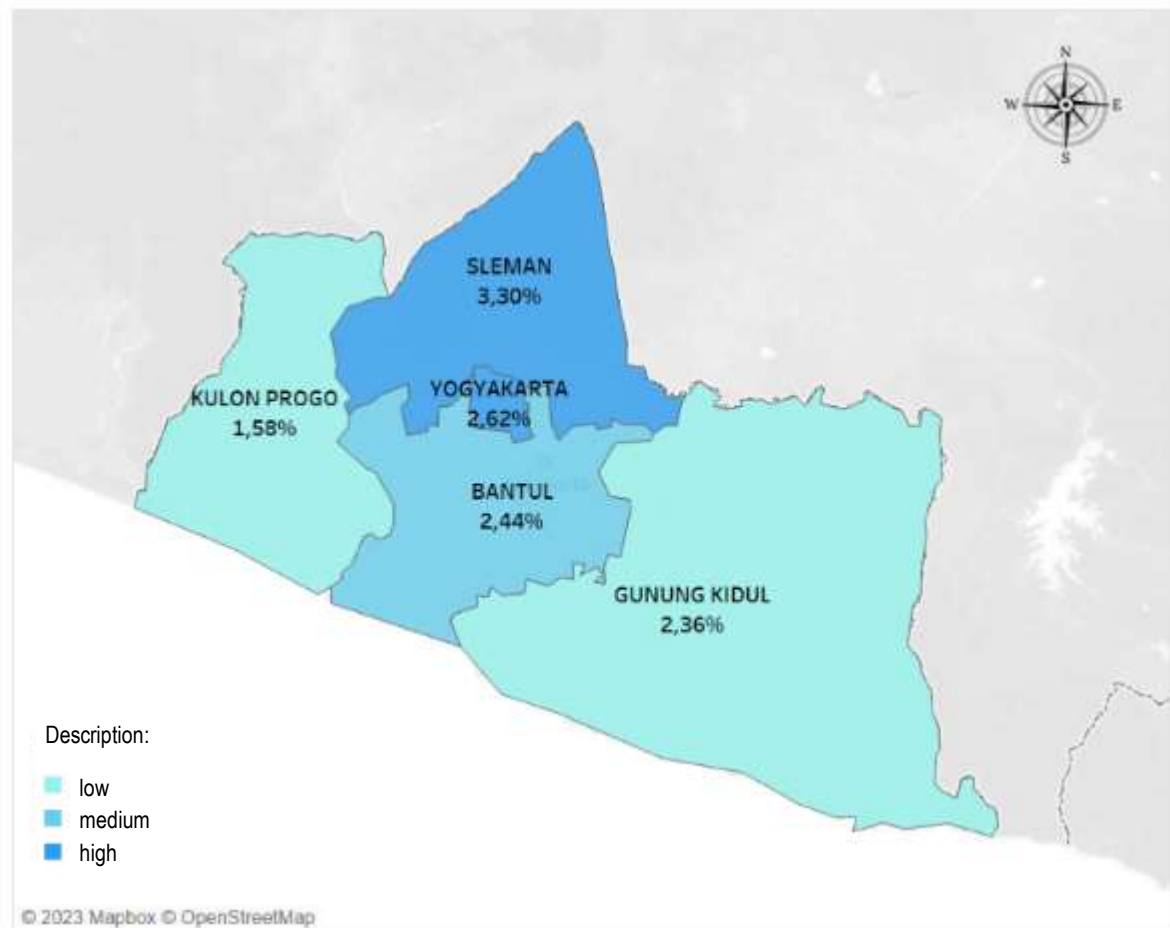


Figure 2. Distribution of Household Catastrophic Health Expenditure Incidence Rates in D.I.Yogyakarta Province in 2022

3.3 The Incidence of Household Catastrophic Health Expenditure in D.I.Yogyakarta Province in 2022 is Associated with Enabling, Supporting and Need factors

As shown in **Table 1**, the status of catastrophic health expenditure events can be assessed based on the influencing factors, categorized into enabling factors, abilities, and needs. Notably, the percentage of catastrophic health expenditure events tends to be higher in households exhibiting specific characteristics. Those are when all members lack JKN, possess an education level below junior high school, include infants or elderly members, comprise a maximum of five individuals, have a married household head, boast a non-poor economic status, reside in urban areas, and have experienced hospitalizations, outpatient care, and an absence of health complaints among household members. This insight provides a comprehensive understanding of the factors associated with increased occurrences of catastrophic health expenditure events.

Table 1. Status of Catastrophic Health Expenditure Events Based on Determining Factors

Variable	Category	Status of Health Expenditures	
		Not Catastrophic	Catastrophic
JKN ownership	Everyone has	97.47%	2.53%
	Not all have	97.35%	2.65%
	Nobody has	96.70%	3.30%
Highest level of education	Minimum graduate from JHS	97.46%	2.54%
	Graduated from ES	96.61%	3.39%
babies or elderly	No	98.38%	1.62%
	Yes	96.18%	3.82%

Variable	Category	Status of Health Expenditures	
		Not Catastrophic	Catastrophic
Household size	≤5	97.32%	2.68%
	>5	97.74%	2.26%
Marital Status of head of household	Not married	97.64%	2.36%
	Married	97.29%	2.71%
Economic status	Poor	99.69%	0.31%
	Not poor	97.08%	2.92%
Regional status	Rural	98.13%	1.87%
	Urban	97.12%	2.88%
Inpatient status	No	98.83%	1.17%
	Yes	86.93%	13.07%
Outpatient status	No	97.42%	2.58%
	Yes	97.23%	2.77%
Health Complaints	No	97.31%	2.69%
	Yes	97.50%	2.50%

3.4 Factors Affecting Household Catastrophic Health Expenditure Events in D.I.Yogyakarta Province in 2022

The result of the simultaneous parameter test shows the statistical value of the likelihood ratio test (G) was obtained at 175,47. The statistical value of the G test obtained is greater than the Chi-square table value of the $\chi^2_{(11;0,05)}$, namely 19,6751. Consequently, the decision is to reject the null hypothesis (H_0), or we have sufficient evidence for its rejection. This means that there is at least one explanatory variable that is able to explain the response variable or in other words have an influence on the health spending disaster in Yogyakarta in 2022.

Table 2. Partial Test Results

Variable Name	Category	Variable Code	Coefficient	Standard error	Wald	p-value	Exp(β)
Constant	-	Const	-7.4242	1.0610	-6.9980	0.0000	-
JKN ownership	Everyone has	-	-	-	-	-	-
	Not all have	D1	0.1246	0.2890	0.4310	0.6664	1.1327
Highest level of education	Nobody has	D2	0.6366	0.2849	2.2340	0.0255	1.8900
	Minimum graduate from JHS	-	-	-	-	-	-
Babies or elderly	Graduated from ES	D3	0.6347	0.2621	2.4220	0.0154	1.8865
	No	-	-	-	-	-	-
Household size	Yes	D4	0.6068	0.2210	2.7460	0.0060	1.8346
	≤5	-	-	-	-	-	-
Marital Status of head of household	>5	D5	-0.9335	0.4716	-1.9790	0.0478	0.3932
	Not married	-	-	-	-	-	-
Economic status	Married	D6	0.0546	0.2472	0.2210	0.8251	1.0561
	Poor	-	-	-	-	-	-
Regional status	Not poor	D7	2.3612	1.0086	2.3410	0.0192	10.6037
	Rural	-	-	-	-	-	-
Inpatient status	Urban	D8	0.3314	0.2443	1.3560	0.1750	1.3929
	No	-	-	-	-	-	-
Outpatient status	Yes	D9	2.5213	0.2142	11.7700	0.0000	12.4448
	No	-	-	-	-	-	-
Health Complaints	Yes	D10	0.1312	0.2294	0.5720	0.5674	1.1402
	No	-	-	-	-	-	-
	Yes	D11	-0.2981	0.2509	-1.1880	0.2348	0.7422

Table 2 shows that the absolute value of the Wald test statistic for each explanatory variable is 0.4310; 2.2340; 2.4220; 2.7460; -1.9790; 0.2210; 2.3410; 1.3560; 11.7700; 0.5720; -1.1880. Comparing this value with the Z-table statistic at a 5% significance level, it becomes evident that six variables exhibit Wald test statistics ($|W|$) exceeding 1.96 or falling below -1.96. Consequently, the decision to reject the null hypothesis (H_0) is warranted. This signifies that the six explanatory variables—namely ownership of JKN, education level of household members, presence of babies or elderly people, number of household members, household economic status, and inpatient status of household members—significantly influence the incidence of catastrophic health expenditure in D.I.Yogyakarta Province in 2022.

Goodness of Fit Test

Based on the existing output, the \hat{C} value is 11.521. This value is smaller when compared to the Chi-square table $\chi^2_{(8;0.05)}$, namely 15.5073, so the decision taken failed to reject H_0 . As a result, it can be inferred that the model is deemed appropriate, suggesting no substantial disparity between the predictive outcomes of the model and the observed results.

Model Selection

The comparison of complementary log-log regression and binary logistic regression can be seen through the measures below:

Table 3. Comparative Results of the Complementary log-log Regression Model

Criteria	Regresi Complementary Log-log	Regresi Logistik Biner
AIC	782.05	783.02
Nagelkerke R Square	0.20636	0.20389

Data source: Susenas 2022 (processed)

Referring to the data presented in **Table 3**, it is evident that the complementary log-log regression model emerges as the optimal choice. This determination is grounded in the model's attainment of the smallest AIC value and the highest Nagelkerke R square value [16], [17]. Following comprehensive parameter testing, model fitness assessments, and the selection of the most fitting model, the resulting equation is as follows:

$$\begin{aligned} \hat{g}(D) = & -7.4242 + 0.1246\widehat{D}_1 + 0.6366\widehat{D}_2^* + 0.6347\widehat{D}_3^* + 0.6068\widehat{D}_4^* - 0.9335\widehat{D}_5^* + 0.0546\widehat{D}_6^* \\ & (1.0610) \quad (0.2890) \quad (0.2849) \quad (0.2621) \quad (0.2210) \quad (0.4716) \quad (0.2472) \\ & + 2.3612\widehat{D}_7^* + 0.3314\widehat{D}_8^* + 2.5213\widehat{D}_9^* + 0.1312\widehat{D}_{10}^* - 0.2981\widehat{D}_{11}^* \\ & (1.0086) \quad (0.2443) \quad (0.2142) \quad (0.2294) \quad (0.2509) \end{aligned} \quad (5)$$

3.5 Risk Assessment of Variables Affecting the Events of Household Catastrophic Health Expenditure in Yogyakarta in 2022

Households experience catastrophic health expenditures when health expenditures originating from direct costs exceed the household's financial capabilities. In this study, households whose health expenditures account for more than 10 percent of total household expenditures are categorized as households that experience catastrophic health expenditure events. Catastrophic health expenditures result in household financial difficulties and impoverishment.

JKN serves as a pivotal health insurance program integral to the National Social Security System (SJSN). It is implemented through an insurance mechanism. JKN endeavors to extend guaranteed health coverage to all segments of Indonesian society. Its presence is anticipated to alleviate household health financing burdens. According to previous research, ownership of JKN can reduce the likelihood of catastrophic health expenditure [18] – [20].

D.I.Yogyakarta Province is one of the provinces with good health insurance coverage in Indonesia. From year to year, health insurance coverage in D.I.Yogyakarta Province tends to increase. In 2022, D.I.Yogyakarta Province ranks seventh as the province with the highest health insurance coverage in Indonesia. Our data processing unveils a crucial insight: we obtained that ownership of JKN by all household

members was able to reduce the risk of catastrophic health expenditure. Based on **Table 2**, the $exp(\hat{\beta})$ value is 1,89 for the category of all members who do not have JKN in the household. This means that households whose members do not all have JKN are at risk of experiencing catastrophic health expenditures that are 1,89 times greater than households whose members all have JKN, assuming other independent variables are held constant. Meanwhile, from **Table 2** it can also be seen that households where not all members have JKN have an $exp(\hat{\beta})$ value of 1,1327. This means that households whose members do not all have JKN are at risk of experiencing catastrophic health expenditures that are 1,1327 times greater than households whose members all have JKN, assuming other independent variables are held constant.

However, the high coverage of JKN ownership in D.I.Yogyakarta Province has not been able to reduce the incidence of catastrophic health expenditures in the province. In 2022, D.I.Yogyakarta Province ranks second as the province with the highest incidence of catastrophic health expenditure in Indonesia. The high incidence of catastrophic health expenditure in D.I.Yogyakarta Province indicates a weakening of household financial capacity due to large health expenditure.

The high incidence of catastrophic health expenditure in D.I.Yogyakarta Province could be influenced by other factors that cannot be covered by JKN. According to Andersen's theory, there are several factors that can increase the utilization of health services. These factors are grouped into three, namely enabling factors, supporting factors, and need factors. By knowing the factors that influence the incidence of catastrophic health expenditure, it will make it easier for policy makers to reduce the risk of catastrophic expenditure in D.I.Yogyakarta Province.

Enabling factors are characteristics that illustrate that each individual has different tendencies in using health services. Enabling factors can include education level, age, number of household members, and marital status. Based on **Table 2**, the enabling factors that have a significant influence on the incidence of catastrophic health expenditure are the education level of ART members, the presence of babies or the elderly, and the number of ART members.

Education level is one of the enabling factors for a household to use health services. In this study, education level was approached by the highest level of education completed by household members. Based on **Table 2**, it can be seen that the $exp(\hat{\beta})$ value for the members' education level variable is 1.8865. This means that households that have members with the highest education level of elementary school are at risk of experiencing catastrophic health expenditures that are 1.8865 times greater than households that have members with the highest level of education of at least junior high school, assuming that other independent variables remain constant. In other words, the lower the level of education completed by household members, the more likely the household is to experience catastrophic health expenditure. Households with a high level of education tend to be competitive in job positions and earn a decent living, thereby protecting households from catastrophic health expenses [21], [22].

The next enabling characteristic is age, which in this study is approached by the presence of babies or elderly people in the household. Based on **Table 2**, the $exp(\hat{\beta})$ value for the variable presence of babies or elderly is 1.8346. This means that households that have infants or elderly members are having the risk of being in catastrophic health spending 1.8346 times greater than households that do not have infants or elderly members, assuming that other variables are constant. These results are similar to a study which states that elderly ART members experience health problems more often than young ART members [18], [23], [24].

Furthermore, the enabling characteristic can be the household size. From **Table 2** it can be seen that the $exp(\hat{\beta})$ value for the variable household size is 0.3932. This implies that households with more than 5 members face a risk of catastrophic health expenditures that is 0.3932 times smaller compared to households with a maximum of 5 members, assuming other independent variables remain constant. In simpler terms, households with a maximum of 5 members are at a risk of 2.5429 times greater of experiencing catastrophic health expenditures compared to households with more than 5 members, assuming other independent variables are held constant. This finding deviates from prior research, which suggested that an increasing number of ART members elevates household health expenditures. The observed phenomenon in D.I.Yogyakarta Province can be attributed to households with a maximum of 5 members having lesser access to JKN than those with more than 5 members. Additionally, a higher proportion of households with a maximum of 5 people reside in urban areas. Urban-dwelling households exhibit a higher frequency of accessing health facilities, given the greater availability of such facilities in urban compared to rural areas [18].

The effectiveness of the previously outlined enabling factors hinges on the ability of individuals or households to procure them. Thus, the accessibility to health services is contingent upon consumers' financial capacity, categorized here as supporting factors. These supporting factors encompass elements such as ownership of JKN, the economic status of the household, and the regional status of the household. Notably, as per **Table 2**, the supporting factor that exerts a substantial influence on the incidence of catastrophic health expenditure is the economic status of the household [11], [25].

The actualization of enabling and supporting factors relies on households taking proactive measures and recognizing them as essential. This acknowledgement is rooted in the need, serving as the foundation and impetus for engaging with health services. The need for health services falls under the category of need factors, encompassing aspects such as inpatient status, outpatient status, and health complaint status. As indicated in **Table 2**, the need factor that significantly shapes the incidence of catastrophic health expenditure is inpatient status [26], [27].

4. CONCLUSIONS

- This study shows that the coverage of health insurance ownership in D.I. Yogyakarta Province has been increasing every year. Sleman Regency is the district/city with the highest percentage of households whose members do not have JKN and high incidences of catastrophic health expenditure.
- It is found that ownership of JKN indeed influences the incidence of catastrophic health expenditure. Other variables found influential are the education level of household members, the presence of babies or the elderly, household size, and the household's economic status. Thus, we suggest that the government increase the coverage of JKN ownership in D.I. Yogyakarta Province and carry out promotive and preventive efforts to prevent catastrophic health expenditure incidents.
- However, this study comes with several limitations. Our scope is restricted to just one province, limiting the generalizability of findings to a broader context. Moreover, although it aims to target individuals across all income groups, the focus might not adequately capture the diversity present within those groups. Lastly, the study solely explores a single alternative method to address imbalanced data, potentially overlooking other effective strategies. For future research, further research is needed to examine the incidence of catastrophic health expenditure in community groups with high levels of consumption using other alternative methods.

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