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Research article

Reducing Catastrophic Health Costs: The Role of Public Insurance in Eastern Indonesia

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ABSTRACT

Catastrophic expenditure, defined as health care expenditure exceeding 10% of household income, remains prevalent in eastern Indonesia, highlighting the urgent need for targeted health policy and infrastructure interventions. This study investigates the impact of the Community Health Insurance Scheme (Jamkesmas) in reducing catastrophic healthcare expenditure in eastern Indonesia offering a new perspective by focusing on areas with lower Universal Health Coverage (UHC) and higher poverty rates. Using data from the 2012 Eastern Indonesia Family Life Survey covering a sample of 1,105 working-age individuals, logit and probit regression methods were applied. The findings revealed that Jamkesmas significantly reduced the likelihood of catastrophic health care expenditure, with effectiveness 1.8 times higher than that of individuals without health insurance. Exogenous factors such as age, urban residence, male gender, and marital status further supported this reduction. In contrast, barriers such as long distances to health facilities and limited knowledge of public hospitals increased the risk of catastrophic expenditure among workers. These results underscore the importance of expanding access to health services and improving the implementation of Jamkesmas in eastern Indonesia. By addressing disparities in health insurance coverage and healthcare facility distribution, the government can better mitigate catastrophic expenditures, supporting the achievement of the demographic bonus by 2045.

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1. INTRODUCTION

Health is a fundamental human need crucial in creating high-quality resources capable of competing nationally and internationally. Therefore, health issues are a serious concern for every country, in line with the formulation of the third goal of the Sustainable Development Goals (SDGs), which aims to achieve Universal Health Coverage (UHC) (Reid et al., 2020). The implementation of the UHC concept is manifested in the form of health insurance subsidized by the government as a commitment to expanding healthcare services. This insurance aims to ensure that the Indonesian population receives protection for their basic health needs.

However, the fact remains that the proportion of healthcare expenses borne by patients (out-of-pocket) as a part of their income is still relatively high. This condition is known as catastrophic expenditure, where healthcare spending exceeds the threshold of 10% or 25% of income or expenditure (Wagstaff et al., 2018; and Opeloyeru et al., 2023). Based on Aji et al. (2017), catastrophic events often occur in low-income countries due to payment systems being vulnerable to fraud. This contrasts with the principles of Universal Health Coverage, which state that every individual, whether rich or poor, is entitled to the healthcare services they need, and the patients' families should not face financial difficulties (Horgan et al., 2018). Based on data released by the Social Security Administration of Health (2023), the number of participants in the National Health

Insurance has increased from 156.8 million to 254.9 million people from 2015 to 2023. However, this increase does not fully indicate an improvement in the existing system, as out-of-pocket expenses still dominate.

The proportion of per capita healthcare expenditure per month in 2023 is predominantly from out-of-pocket expenses, accounting for 61.8%. This percentage still exceeds the threshold the World Health Organization recommended for the overall out-of-pocket expenditure fraction, which should not exceed 20% of total healthcare costs. Excessive out-of-pocket expenditures can worsen household financial conditions and reduce basic needs, resulting in poverty, increased poverty rates, and exacerbating poverty among the poor (Karan et al., 2017). This can be understood as households experiencing catastrophic events.

The participation rate in the National Health Insurance in Eastern Indonesia shows a positive trend from 2016 to 2021, reaching 19.5 million individuals in 2021 across the seven provinces (Social Security Administrating Agency of Health, 2022). In line with the national trend, this increase has not yet been accompanied by a decrease in catastrophic events in the Eastern Indonesian region, with an average incidence rate of 40% (Ministry of Health, 2022). However, despite the lower figure compared to the national average of around 60%, most people in the eastern region still do not receive the required medical care. This limitation is due to the low access to healthcare facilities caused by demographic disparities. This situation is further supported by the low coverage of UHC services, with an average UHC index of 50, below the national average of around 60 in 2018 (Herawati et al., 2020).

The occurrence of catastrophic events in Eastern Indonesia can potentially exacerbate poverty. According to data from Statistics Indonesia (2018), the poverty rate in this region remains at the top position, averaging 16%. Meanwhile, poverty in the same year is influenced by out-of-pocket expenditures of $1.90 in seven provinces of Eastern Indonesia, which accounts for 0.15%, and the percentage of the population pushed into poverty at the poverty line of $3.10 is 0.5%. As for the national poverty line stands at 0.35% (Herawati et al., 2020). If various parties do not address these facts appropriately, the complexity of healthcare issues will lead to poverty. However, Indonesia is predicted to face a demographic bonus from 2030 to 2045, meaning that the proportion of the productive-age population will be higher than the non-productive population.

Based on Statistics Indonesia (2023), the total population aged 20 to 35 years has reached 24% in 2022. Unequal access to healthcare services and high occurrences of catastrophic events can hinder productivity development among the younger generation. Without adequate human resources, the opportunity to achieve demographic bonuses becomes challenging. This aligns with Groth & May (2017), who state that investments in education and health are considered critical factors in determining a country's ability to achieve demographic bonuses.

The novelty of this study lies in its focus on Eastern Indonesia, a region that remains underrepresented in existing health economics literature. This research examines this region's socio-economic and healthcare challenges and integrates a more nuanced methodological approach through instrumental variable probit regression. This allows the study to address endogeneity issues effectively and explore complex interactions between individual characteristics, healthcare accessibility, and catastrophic expenditures. Additionally, the study adopts a threshold of 10% of income for defining catastrophic expenditures, contrasting with the expenditure-based thresholds commonly used in previous studies, thereby offering new insights into healthcare financing in underdeveloped regions.

Implementing health insurance programs to achieve UHC and address catastrophic events needs to be re-evaluated for effectiveness. Previous studies in Indonesia, using cross-sectional data from the Indonesian Family Life Survey in 2014, stated that the implementation of the National Health Insurance System affected the occurrence of catastrophic expenditures, with other determinants including educational attainment, residential location, health, and the economy of Indonesian society (Nugraheni & Hartono, 2017). Utami & Mutiarin (2016) also highlighted administrative inefficiencies and limited public awareness as barriers to the effectiveness of Jamkesmas. In contrast to previous studies, this research utilizes data from the Indonesian Family Life Survey East 2012, focusing on eastern Indonesia. Additionally, this study applies the calculation

of catastrophic expenditures by dividing them by 10% of respondents' income, compared to previous research that used a threshold of 40% of expenditures. Based on this dataset, the study uses the type of insurance valid at that time, namely the Public Health Insurance Scheme (Jamkesmas). This insurance is believed to encourage the reduction of catastrophic expenditure burdens (Solida et al., 2021). However, studies still state that Jamkesmas is ineffective in reducing catastrophic healthcare expenditure burdens due to weak administration and education in the community (Utami & Mutiarin, 2016).

This study to provide a general overview of the impact of implementing the Public Health Insurance Scheme (Jamkesmas) on the reduction of catastrophic healthcare expenses in eastern Indonesia. It is expected that the findings of this study can enrich the literature on the effectiveness of health insurance in reducing the risk of catastrophic expenditures, thus providing input to the relevant government authorities for policy formulation purposes, such as strengthening the integration between the central government and regions in providing health insurance subsidies and expanding healthcare services. This paper is structured as follows. Section 2 outlines the materials and methods, detailing the dataset, variables, and econometric approach. Section 3 presents the results and discussion, including descriptive statistics and regression findings. Finally, Section 4 concludes with policy implications and recommendations for future research.

2. RESEARCH METHODS

2.1. Data

The data used in this study were sourced from the Indonesian Family Life Survey East (IFLS-EAST) 2012. According to Sikoki et al. (2013), the IFLS-East survey is a comprehensive multi-topic dataset on household and community living conditions across seven provinces in eastern Indonesia, such as East Nusa Tenggara, East Kalimantan, Southeast Sulawesi, Maluku, North Maluku, West Papua, and Papua, encompassing 1,015 working-age respondents aged between 16 and 64. Data were also collected from community healthcare and educational facilities to capture the broader social context. The operational definition of variables is presented in Table 1 as follows.

Table 1. The Operational Definitions of Variables

Variables	Operational	Measurements
Catastrophic	Total of out-of-pocket expenses	Exceeds 10% of income is valued at 1, and less than 10% of income is valued at 0
Jamkesmas	Ownership of the Jamkesmas program	Valued at 1 if joined and 0 otherwise
Health	Level of respondent health	Level 1 = unhealthy; 2 = quite healthy; 3 = healthy; and 4 = very healthy
Educ	The education attainment of respondents	Years of study
Age	Age of respondents	Years
Urban	Location of the respondent's residence	Valued at 1 if living in an urban area and 0 in the rural area
Gender	Gender of respondents	The male has a value of 1, and the female has 0
Marital	Marital status of respondents	Valued 1 if married and 0 otherwise
Job-status	The working status of the respondent	If the respondent is employed will be valued at 1 and valued at 0 otherwise
Distance	Distance between residence and health facility	Kilometers (KM)
Facility	Knowledge of the location of public hospitals	Having a knowledge = 1; do not have knowledge = 0
Poor	The level of poverty perceived by respondents	Level 1=very rich, level 2=rich, level 3=somewhat rich, level 4=moderately poor, level 5=poor, and level 6=very poor
Outpatient	Outpatient history	Having a history is valued at 1 and valued at 0 if not
Inpatient	Inpatient history	Having a history is valued at 1 and valued at 0 if not

2.2. Model Specification

The structural model consists of two equations. The first stage models the determinants of Jamkesmas participation using the instrumental variables of health status and years of education. In contrast, the second stage analyzes the impact of Jamkesmas participation on catastrophic expenditures. The Wald test confirms the non-exogeneity of the Jamkesmas variable, and the Sargan test validates the instruments' relevance and exogeneity. The results reinforce the necessity of using an IV approach to obtain unbiased estimates, aligning with the recommendations of previous econometric studies (Gujarati, 2004; and Wooldridge, 2010). The dependent variable, "catastrophic expenditures," is the out-of-pocket health expenditures (OOP) ratio to annual individual income. If OOP exceeds the threshold of 10%, the individual is considered to have experienced a catastrophic health event, following established benchmarks in health economics research (Xu et al., 2003). The calculation of OOP includes all direct healthcare costs, such as transportation, administration, treatment, and medication. By focusing on this measure, the study aims to assess the financial burden of healthcare expenses on individuals and their households in eastern Indonesia.

The study incorporates Jamkesmas as the primary independent variable to explore the impact of participation in the Public Health Insurance Scheme (Jamkesmas) on catastrophic expenditures. However, due to endogeneity—likely caused by reverse causality and omitted variable bias—this variable was instrumented using health status and educational attainment. Endogeneity arises because healthier or more educated individuals might be more likely to participate in the program, potentially confounding the results (Wooldridge, 2010). The instrumental variable probit (IV-Probit) model was employed to address this issue, as it is suitable for binary dependent variables and accounts for endogeneity (Newey, 1987). The structural equation model in this study follows the study conducted by Xu et al. (2003); and Wooldridge (2010), the equation model constructed is as follows:

$$\widehat{\text{Jamkesmas}}_i = \beta_0 + \beta_1 \text{health}_i + \beta_2 \text{educ}_i + \beta_3 \text{age}_i + \beta_4 \text{age}^2{}_i + \beta_5 \text{urban}_i + \beta_6 \text{gender}_i + \beta_7 \text{marital}_i + \beta_8 \text{jobstatus}_i + \beta_9 \text{distance}_i + \beta_{10} \text{facility}_i + \beta_{11} \text{poor}_i + \beta_{12} \text{outpatient}_i + \beta_{13} \text{inpatient}_i + \varepsilon_i \quad (1)$$

$$\text{Catastrophic}_i = \beta_0 + \beta_1 \widehat{\text{Jamkesmas}}_i + \beta_2 \text{age}_i + \beta_3 \text{age}^2{}_i + \beta_4 \text{urban}_i + \beta_5 \text{gender}_i + \beta_6 \text{marital}_i + \beta_7 \text{jobstatus}_i + \beta_8 \text{distance}_i + \beta_9 \text{facility}_i + \beta_{10} \text{poor}_i + \beta_{11} \text{outpatient}_i + \beta_{12} \text{inpatient}_i + \mu_i \quad (2)$$

Exogenous variables included in the model provide a broader understanding of the factors influencing catastrophic expenditures. These variables span individual characteristics (e.g., age, gender, marital status, and poverty level), healthcare access variables (e.g., distance to healthcare facilities and knowledge of facility location), and treatment history (e.g., outpatient and inpatient care). The inclusion of these variables ensures that the analysis captures the multidimensional nature of financial health burdens, as suggested by previous studies (Xu et al., 2003). The geographic component, distinguishing between urban and rural respondents, highlights the disparities in healthcare access and financial burdens across different regions of eastern Indonesia.

3. RESULTS AND DISCUSSION

3.1. Descriptive Statistic

Table 2 shows the summary statistics of all the variables used, with 1,015 observations from individuals in eastern Indonesia. Among the respondents, 31% experienced catastrophic events, with a 38% participation rate in the Jamkesmas program. The perceived health level of the community was at level 3, which is considered relatively healthy. The average education level attained was 9 years, equivalent to the 3rd year of middle school. The average age of respondents

participating in the study was 36 years, with 50% living in urban areas and 27% being male. Other characteristics show that 51% of the sample were married, and 43% were employed. The perceived poverty level in eastern Indonesia was still quite high, at level 4, which indicates moderately poor. On average, healthcare facilities in the region were 3 km away, and 80% of respondents were aware of the existence of public hospitals. Additionally, an average of 17% of the sample had a history of outpatient care, and 23% had received inpatient care.

Table 2. Descriptive Statistics

Variables	Mean	Standard Deviation	Min	Max
Catastrophic	0.31	0.46	0	1
Jamkesmas	0.38	0.49	0	1
Health	2.84	0.61	1	4
Educ	9.42	4.39	0	16
Age	36.5	12.83	16	64
Urban	0.50	0.50	0	1
Gender	0.27	0.44	0	1
Marital	0.51	0.50	0	1
Job-status	0.43	0.49	0	1
Poor	4.24	0.90	1	6
Distance	3.36	16.24	0	200
Facility	0.80	0.40	0	1
Outpatient	0.17	0.37	0	1
Inpatient	0.23	0.42	0	1

3.2. Regression Estimation Result

Table 3 shows the results of the probit and instrumental variable probit (IV Probit) analyses. The probit regression found that the ownership of public health insurance could produce biased and inconsistent results due to endogeneity issues. Therefore, this was addressed by using IV Probit through the correlation check of potential instrumental variables (Gujarati, 2004). Applying the IV-Probit method, the Wald test results showed a p-value less than 0.05, indicating that the Jamkesmas variable is not exogenous. Additionally, the Sargan test results showed a p-value exceeding 0.05, indicating that "educ" and "health" are valid instruments. The p-value from the Hausman test less than 0.05 indicates that the Jamkesmas variable is endogenous.

Participation in the Jamkesmas program has the potential to reduce catastrophic expenditures by 1.8 times compared to the absence of the program. It aligns with the intention to implement Jamkesmas, indicating that the underprivileged communities in eastern Indonesia have benefited from the program. This finding is consistent with Fattah et al. (2023), who stated that households with insurance participants reduce the incidence of catastrophic expenditure through government subsidies for accessing adequate healthcare services. However, despite the implementation of Jamkesmas in eastern Indonesia, catastrophic expenditures remain relatively high. One reason is that medical procedure costs often exceed payment capacities and the rates of the Indonesian Case Base Groups for upgrades to executive clinics or VIP rooms (Satibi et al., 2019). Consequently, households or individuals still face out-of-pocket expenses even if they are Jamkesmas participants.

Each additional year of productive age can contribute to a 7.5% reduction in the incidence of catastrophic expenditures in eastern Indonesia. It is because older individuals are more health-conscious and have a health-oriented mindset. With increasing age, individuals tend to gain more experience and knowledge about health, enabling them to recognize early symptoms and seek early treatment. It aligns with Rolindrawan (2015), who noted that the elderly take a higher role in healthcare than productive age groups and children. Respondents living in urban areas can reduce the likelihood of catastrophic expenditure in eastern Indonesia by 45.6%. It is considered significant because access to healthcare facilities and infrastructure in urban areas is easier. Consequently, people are encouraged to adopt healthier lifestyles. Conversely, rural residents incur higher costs to access comprehensive healthcare services in urban areas. This disparity is due to rural inhabitants' generally lower income than urban dwellers (Husna & Sukartini, 2021).

Table 3. Estimation Result of the Probit & IV Probit Method

Variables	Probit	*First-Stage*	IV-Probit
	Catastrophic	Jamkesmas	catastrophic
Constant	-1.089**	0.932***	1.110**
	(0.470)	(0.140)	(0.483)
Jamkesmas	0.117	-	-1.850***
	(0.101)		(0.209)
age	0.039*	-0.0505***	-0.075***
	(0.023)	(0.00613)	(0.023)
age2	-0.000	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
urban	0.418***	-0.333***	-0.456***
	(0.104)	(0.032)	(0.146)
gender	0.009	-0.098***	-0.203**
	(0.099)	(0.032)	(0.089)
marital	-0.121	-0.069**	-0.188**
	(0.106)	(0.035)	(0.095)
jobstatus	0.925***	0.106***	0.711***
	(0.107)	(0.036)	(0.128)
poorest	-0.206***	0.071***	0.034
	(0.051)	(0.013)	(0.054)
distance	0.003	0.002	0.004***
	(0.002)	(0.001)	(0.001)
facility	0.018	0.422***	0.728***
	(0.125)	(0.040)	(0.133)
outpatient	0.013	0.017	0.037
	(0.117)	(0.035)	(0.095)
inpatient	-0.060	-0.039	-0.124
	(0.106)	(0.031)	(0.083)
health	-	0.0404***	-
		(0.015)	
educ	-	-0.015***	-
		(0.004)	
Observations	1,015	1,05	1,015
Quality			
Chi-Square			21.36
p-value			0.000
Validity (Sargan test)			
Sargan Statistic			3.2423
p-value			0.0718
Relevance (Hausman test)			
F statistic			17.768
p-value			0.000

In this case, male residents play a more significant role in reducing the incidence of catastrophic expenditures, with a probability of 20.3%. Men in eastern Indonesia engage more in outdoor physical activities such as hunting, farming, and sailing. These activities can enhance physical strength, leading to better health. The more physical activities individuals engage in, the stronger and more disease-resistant they become. Additionally, women tend to incur higher healthcare costs for childbirth or personal care (Rinasih, 2019). Married individuals can also reduce the likelihood of catastrophic expenditures in eastern Indonesia, with an 18.8% probability. Marriage encourages individuals to share health risks, allowing them to plan their needs more effectively. According to Gotsadze et al. (2015), households with married couples can better manage and reduce healthcare costs due to financial sharing.

Employed individuals tend to increase the incidence of catastrophic expenditures in eastern Indonesia by 71.1%. In eastern Indonesia, most people work in the informal sector with unstable

incomes, making it likely that they cannot afford healthcare services. Informal sector jobs do not come with worker health insurance, resulting in a lack of financial protection (Wagstaff et al., 2018).

An increase in the distance to healthcare facilities can increase the incidence of catastrophic expenditures by 0.4%. Access to facilities in eastern Indonesia is still quite challenging due to the considerable distance to healthcare facilities. Therefore, the costs incurred to reach these facilities will increase. Greater distances reduce the utilization of healthcare services (Quattrochi et al., 2020). Lastly, knowing the location of public hospitals can also increase catastrophic expenditures by 72.8%. This is because public hospitals in eastern Indonesia are often located far away, so when people are aware of their locations, they tend to choose them for treatment. According to Rahman et al. (2024), formal healthcare institutions for underserved communities can increase the financial burden of medical expenses.

3.3. Discussion

The findings of this study underscore the significant role of public health insurance, specifically the Jamkesmas program, in reducing catastrophic health expenditures in eastern Indonesia. IV-Probit regression effectively addresses the endogeneity issue, confirming the program's positive impact in lowering the likelihood of catastrophic expenditures. It highlights the program's success in providing financial protection for underprivileged communities, aligning with its primary goal of reducing the financial burden of healthcare (Sparrow et al., 2013). However, despite this achievement, catastrophic expenditures remain high in the region. It can be attributed to gaps in coverage, particularly for medical procedures and services that exceed the regulated payment caps under the Indonesian Case Base Groups system (Satibi et al., 2019). These findings indicate the need for policy improvements, such as increasing the scope of coverage, regulating healthcare costs more effectively, and enhancing reimbursement schemes to minimize out-of-pocket expenses.

In addition to the role of public health insurance, various demographic and geographic factors influence catastrophic expenditures. Urban residents benefit from better access to healthcare facilities and infrastructure, leading to a lower incidence of catastrophic spending than rural residents. This disparity highlights the importance of improving healthcare access in rural areas, where residents face significant barriers, such as higher travel costs and fewer healthcare options (Quattrochi et al., 2020). Furthermore, the findings show that older and married individuals are less likely to face catastrophic expenditures, reflecting greater health awareness and the financial stability associated with shared responsibilities in married households (Rolindrawan, 2015; Gotsadze et al., 2015). However, employment in the informal sector, characterized by income instability and a lack of employer-provided insurance, increases the risk of catastrophic expenditures, emphasizing the need for targeted interventions to support this vulnerable group (Wagstaff et al., 2018).

Lastly, the study reveals that access-related challenges, such as the considerable distance to healthcare facilities and the location of public hospitals, further exacerbate financial burdens. Limited proximity to healthcare services increases transportation costs and reduces the likelihood of seeking timely care, which may lead to more severe health conditions and higher expenses later (Quattrochi et al., 2020). Additionally, while public hospitals provide affordable care, their often remote locations make them less accessible to many residents. These findings highlight the necessity of addressing structural barriers, such as improving healthcare infrastructure, decentralizing services, and enhancing transportation networks, to ensure equitable access to healthcare and reduce financial hardships in eastern Indonesia (Rahman et al., 2024).

4. CONCLUSIONS

This study finds that the Jamkesmas public health insurance program significantly reduces the risk of catastrophic healthcare expenditures in eastern Indonesia. Key supporting factors include being in a productive age group, urban residence, male gender, and married status. However, challenges such as long distances to healthcare facilities and limited knowledge about hospital locations increase healthcare costs, particularly for working individuals. To address these issues, the government should prioritize equitable distribution of health insurance subsidies and ensure

accessibility for underprivileged populations in eastern Indonesia. This effort must be accompanied by expanding healthcare facilities, improving infrastructure, and increasing the availability of skilled medical personnel. While this study provides valuable insights, its findings are based on data from the 2012 IFLS-EAST and the Jamkesmas program. Future research should utilize more recent data or primary sources to evaluate newer health insurance schemes and provide broader insights.

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Author contributions: I.S.I and R.B.H contributed equally to this paper. I.S.I conceptualized the study framework, conducted the primary data analysis using the instrumental variable probit method, and interpreted the statistical results. R.B.H focused on the literature review, contextualized the findings within the broader policy implications, and drafted the sections on practical recommendations. I.S.I and R.B.H collaborated to refine the research objectives, finalize the manuscript, and respond to reviewer feedback. I.S.I and R.B.H jointly reviewed and approved the final version of the paper.

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