

# Determinants of Catastrophic Health Expenditure (CHE): An Indonesian Family Life Survey (IFLS) 2007 & 2014

Afanin Husna\*, Ni Made Sukartini

Universitas Airlangga, Surabaya, East Java, Indonesia

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## ABSTRACT

This study aims at finding and analyzing the determinants of catastrophic health expenditure (CHE) and its impact on the household economy in Indonesia, using pooled cross section data from IFLS 2007 and 2014. The study used binary logit regression for analyzing the determinants of CHE and OLS regression to see the impact of CHE on household economy. It was found that the occupational status of the head of household, size of the household, age, ownership of insurance, visits to health centers, location of residence, and the interaction variable of educated household heads with chronic disease affect the occurrences of CHE with various threshold. The OLS regression results found that households who experienced CHE with a threshold of 10% and 40% made a reduction in their basic needs (food expenditure). It implies that households that experienced CHE also experienced economic shocks and they are eventually forced to reduce their basic needs (food expenditure) to meet health needs.

## ABSTRAK

Tujuan dari studi ini adalah mencari dan menganalisis determinan dari catastrophic health expenditure (CHE) dan dampaknya pada kondisi ekonomi rumah tangga di Indonesia, dengan menggunakan data berjenis pooled cross section dari IFLS tahun 2007 dan 2014. Studi ini menggunakan metode regresi logit biner untuk menganalisis determinan dari CHE dan menggunakan regresi OLS untuk melihat dampak CHE pada kondisi ekonomi rumah tangga. Studi ini menemukan bahwa status pekerjaan kepala rumah tangga, ukuran rumah tangga, usia, kepemilikan asuransi, tipe fasilitas kesehatan yang dikunjungi, lokasi tempat tinggal, dan variabel interaksi antara tingkat pendidikan kepala rumah tangga dengan penyakit kronis berpengaruh pada terjadinya CHE dengan berbagai ambang batas. Hasil regresi OLS menunjukkan bahwa rumah tangga yang mengalami CHE dengan ambang batas 10% dan 40% dari total pengeluaran rumah tangga, terpaksa mengurangi kebutuhan dasar khususnya pada pengeluaran makanan. Implikasinya adalah bahwa rumah tangga yang mengalami CHE, juga mengalami guncangan ekonomi dan akhirnya memilih untuk mengurangi pengeluaran makanan untuk menutup biaya kesehatan.

## 1. INTRODUCTION

Catastrophic Health Expenditure (CHE) is a condition, in which, the out-of-pocket (OOP) of health expenditures are approaching a certain threshold of total household expenditure or annual non-food expenditure and. Due to this condition, they are forced to sacrifice their basic needs, sell assets, owe money, or become poor (Aregbeshola & Khan, 2018). In addition, the household expenditure threshold has no special conditions. In connection

with this CHE, Wagstaff and van Doorslaer (2003); Su,Kouyaté, and Flessa (2006), Kim and Kwon (2015), Kimani,Mugo, and Kioko (2016),and Fuady *et al.* (2018) use a 10% threshold of total household expenditure. Even, Gotsadze, Zoidze, and Rukhadze (2009), Kimani et al. (2016), Lee and Yoon (2019), Somkotra and Lagrada (2008), and Xu et al. (2003) use a 40% threshold of non-food expenditure. This study uses a threshold of 10%, 25%, and 40% of total household expenditure. The use of these

\* Corresponding author, email address: afaninh@gmail.com

thresholds is based on the CHE incidence provisions used in the Sustainable Development Goals (SDGs) (World Health Organization, 2017).

Again, OOP health expenditure is household expense that is used to pay for health care costs (promotional, preventive, curative, rehabilitative, and long-term care) to obtain supporting health services, medicines and other health products. Furthermore, health expenditures classified as OOP are financed by income, savings, loans or debt. Meanwhile, health expenditures financed by insurance are not included in OOP health expenditures (World Health Organization, 2019). Thus, OOP health expenditure is mainly used to pay health care costs and it has its sources of finances.

In general, many households have become poor because of CHE. Based on data from the World Health Organization in 2015, 208.7 million people experienced CHE and 89.7 million of them became poor. Gertler and Gruber (2002) stated that the biggest and most unpredictable economic shocks in the family are caused by illness. Household that experiencing CHE will experience financial shocks, so that they have to reduce spending on other basic needs, owe, or sell assets to cover their health expenditures (Choi et al., 2016). This statement is reinforced by the opinion of Mwai and Muriithi (2016) that household experiencing CHE will have an impact on basic expenditures.

In Indonesia there are differences in CHE percentages which are evidenced by some of the proponents. For example, the prevalence of CHE in Indonesia is about 5,38% (Nugraheni & Hartono, 2017). Based on publication from PRAKARSA, about 13 million spend more than 10% from their total expenditure and about 2.5 million spend more than 25% from their total expenditure for health care in Indonesia (Herawati, Franzone, & Chrisnahutama, 2020).

The percentage of households experiencing CHE in Indonesia is quite high when compared to other developing countries. This condition can illustrate the lack of financial protection, which causes a high percentage of households experiencing CHE. Research by Kimani et. al. (2016) in Kenya shows that 4 % of households experience CHE and it causes 2.5 million people to become poor. Narci, Şahin, and Yıldırım (2015) in Turkey found that the prevalence of households experiencing CHE 10 % was 5.7 % and households experiencing CHE 40 % was 0.75%. The prevalence of CHE in several countries in Latin America and Caribbean shows a lower percentage, including: Peru at 5%, Colombia 2.8%, Mexico 2.4%, and Brazil

at 2.2% (Knaul et al., 2011).

High prevalence of CHE in Indonesia can be caused by the low health insurance coverage. World Health Organization (2017) reported that health coverage only owned by less than 20% of the world's population. This statement reinforced by opinion that most of health care costs in low-middle income countries are paid from OOP health expenditure (Gotsadze et al., 2009). The high OOP expenditure can lead to CHE and household economic shocks. Seeing the impact of CHE on household economic conditions, makes the discussion about CHE interesting to study.

Previous research on CHE has been conducted in Indonesia with a focus on looking at the impact of CHE on the likelihood of individuals and households becoming poor, using panel data and the CHE calculation method from Wagstaff (2008). Other studies focus on looking the impact of health insurance on CHE (Aizawa, 2019; Nugraheni and Hartono, 2017). Most of the studies related to the determinant of CHE found that the determinants of CHE consisted of the characteristics of the head of the household, the characteristics of the household, and the characteristics of the individual.

Based on the description above, this study tries to fill in the gap. It also looks at the CHE determinants of the three characteristics (head of household, household, and individual) and add interaction variables. CHE in this study is obtained by using the method of calculating the budget share and seeing its impact on the domestic economy which is still rare in Indonesia. The budget share approach is a method of calculating CHE by looking at the proportion of health expenditures to total household expenditures. If this proportion exceeds the predetermined threshold, it is categorized as a household experiencing CHE.

This study empirically examines the determinants of CHE in Indonesia, which consists of the characteristics of the head of the household, the characteristics of the household, the characteristics of the individual, and the addition of interaction variables. This study also looked at the impact of CHE with a threshold of 10 percent, 25 percent, and 40 percent on the household economy, especially on household food expenditure. This study uses pooled cross-section data obtained from the Indonesian Family Life Survey (IFLS) in 2007 and 2014. The researchers used binary logit regression to see the determinants of CHE and OLS regression to see the impact of CHE on the household economy.

## **2. THEORETICAL FRAMEWORK AND HYPOTHESES**

### **Catastrophic Health Expenditure (CHE)**

Catastrophic Health Expenditure (CHE) is a condition when the out-of-pocket health expenditure (OOP) exceeds a certain threshold of total household expenditure. In this case, OOP expenditures are household expenses that are used to pay for health care costs (promotive, preventive, curative, rehabilitative, and long-term care) to obtain supporting health services, medicines, and other health products. Health expenditures classified as OOP are financed by income, savings, loans or debt. Meanwhile, health expenditures financed by insurance are not included in OOP health expenditures (World Health Organization, 2019). The consequence of CHE is that households are forced to sacrifice their basic needs. The basic needs referred to are, for example, selling assets or assets that are owned, owed, and / or becoming poor.

The threshold for household expenditure used in previous studies to estimate CHE varies (Xu et al., 2007). Research conducted by Su et al. (2006) and Wagstaff and van Doorslaer (2003) use a threshold of 10 percent of total household expenditure. Somkotra and Lagrada (2008) and Xu et al. (2003) use a 40 percent threshold of non-food expenditure. Meanwhile, research before the 2000s used a threshold that varied from 5 percent to 20 percent of total household income (Berki, 1986; Wyszewianski, 1986). This study uses a threshold of 10 percent, 25 percent, and 40 percent of total household expenditure. The selection of this threshold is in accordance with the CHE incident provisions used in SGDs.

### **Grossman's Theory of Demand for Health**

Grossman's health demand theory originated from the human capital theory put forward by Becker. Becker (1967) states that human productivity is determined by human capital as stock of knowledge and stock of skills. Grossman proposes a health demand theory which is a development of Becker's theory, which states that health capital is different from human capital (Grossman, 1972). Human capital is generally in the form of a stock of knowledge that affects individual productivity, while health capital in the form of a health stock is the total time that can be used or spent to earn money.

Grossman developed a model that views health as a stock of capital with a healthy output of

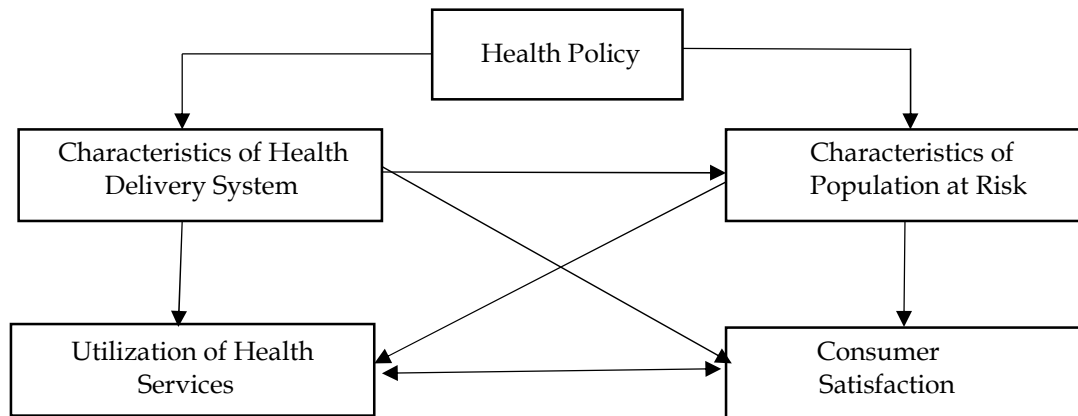
life. The net investment in the health capital stock equals the gross investment in the health capital stock minus depreciation. Consumers generate gross investment in health and other commodities through the utility function based on the household production function. The input of this household production function is time spent on health care, eating (diet), exercise or sports, recreation or entertainment, and the home or environment. This production function also depends on "environmental variables" that are able to influence productivity by changing the marginal product of the input in the household production function. Environmental variables can be race, gender, and human capital. In general, the environmental variable used is the level of education, because high levels of education are expected to shift human capital and change household productivity, just as changes in technology change the efficiency of the production process in the market.

The demand for individual health arises for two reasons, namely: (1) Health as a consumption commodity. The health variable is included in the preference function that affects individual utility or considers sick time as a deduction from utility (disutility); (2) Health as an investment commodity which determines the amount of time available to carry out activities. Increasing health capital will reduce time lost due to illness, so that individuals can move and earn income that is considered a return on health investment.

### **Andersen's Behavioral Model**

Aday and Andersen (1974)'s research focuses on health policies that aim to achieve equality in access to health. Health access is referred to as financial capability (household income, insurance ownership, etc.) and availability of health resources (health facilities, doctors, paramedics, etc.) in an area.

Figure 1 illustrates the concept of health access viewed through a framework viewing that a health policy is designed to influence the health care system and the characteristics of the population at risk. Health policy is the starting point of the health access framework because the impact of the policy is to facilitate access to health services through education, training, and reorganization of medical personnel. Health policies affect the delivery of the health system and the population sub groups at risk.



**Figure 1: Access of Healthcare**

Source: Andersen, 1974

The health delivery system as referred to this framework describes the process of distribution of resources and the health organization system to achieve consumer satisfaction with the health care system. The main components in the health delivery system are resources (educated and experienced medical personnel and complete equipment in health services) and the organizational system (the karma of medical personnel and the waiting time of the health service process). The resource component also includes the volume and distribution of medical resources in an area.

The characteristics of the population at risk are divided into three main components. First is predisposing factors. They are a tendency to use services; these components have been around since the beginning before an individual was attacked by disease. The variables in the predisposing factors are age, gender, race, religion, and the characteristics of the head of the household. Second is enabling factors. They describe the abilities or resources that individuals have to use health services. The resources in question can be in the form of household income, insurance ownership, location of residence, and education. Last is need factors. They refer to the conditions of the disease that most require the use of health services. The need for health services can be in the form of a disease condition that is felt by the individual, diagnosis of the disease by a doctor or other medical personnel, and being overweight.

The success of health policies can be seen from the achievement of utilization in health services and consumer satisfaction with health services. The type of utilization in health services refers to the type of service received and who provides it, namely hospital, doctor, dentist, pharmacist, etc. (Aday and Andersen, 1974). The main components in the

utilization of health services include the type, location, destination, and time interval for visiting health services. Consumer satisfaction in question can be in the form of health care costs, the ease of information received by patients regarding the condition of the disease and the comfort obtained during treatment.

It can be concluded that health policy can be considered an effort to influence the characteristics of the health delivery system (increasing the number of doctors in an area) or by programs aimed at changing the characteristics of the population at risk (the availability of insurance and education). The delivery of the health system can affect the pattern of utilization and consumer satisfaction with the health service system. The characteristics of the population at risk also can affect consumer satisfaction with the health care system. For the details, the two-way arrow between utilization of health services and consumer satisfaction in Figure 1 shows how utilization of health services can affect consumer satisfaction in the system which can affect further use of health services.

### 3. RESEARCH METHOD

#### Sampling and Data Collection Techniques

This study uses a quantitative approach that aims to determine the relationship between variables, test and prove the hypotheses, and produce conclusions. The researchers used the type of pooled cross-section, sourced from the Indonesian Family Life Survey (IFLS) in 2007 and 2014. According to Woolridge (2013), a pooled cross section is a set of data that has a cross section and time series characteristics with variable the same, but have different numbers and objects. IFLS data is a micro data survey that includes data on individuals, households and communities in Indonesia that were

collected and compiled by the RAND Corporation. This data covers 13 provinces in Indonesia. The sample used in this study was 148,826 people. The distribution of the number of samples used was 69,439 people in 2007 and 79,573 people in 2014.

### Data Analysis

This study consists of two models, namely the binary logit regression model to determine the determinants of CHE and the OLS regression model to see the impact of CHE on the household economy. The binary logit regression model uses catastrophic health expenditure (CHE) as the dependent variable with a threshold of 10%, 25%, and 40% of total household expenditure. Catastrophic health expenditure is a condition when the out-of-pocket health expenditure exceeds a certain threshold of total household expenditure. The following is the formula used to calculate CHE adopted from the

research of Kimani et al. (2016):

$$CHE = 1 \text{ if } \frac{OOP \text{ Health Expenditure}}{Total \text{ Expenditure}} \geq 10\%; 25\%; 40\%$$

$$CHE = 0 \text{ if } \frac{OOP \text{ Health Expenditure}}{Total \text{ Expenditure}} < 10\%; 25\%; 40\%$$

This study uses a binary logit regression model and ordinary least square (OLS) regression. Binary logit regression is used to determine the determinants of CHE in Indonesia. The binary logit regression model refers to the research model used by Aregbeshola and Khan (2018). The following is an empirical model used to determine the determinants of CHE in this study:

$$CHE_{-i} = \beta_0 + \beta_1 HHHchar + \beta_2 HHchar_i + \beta_3 Indivchar_i + \beta_4 Interactionvar_i + u_{it} \quad (1)$$

Equation 1 shows the model used to determine the determinants of CHE. This model used CHE with various thresholds (10%; 25%; 40%) as dependent variable. Independent variables consist of the characteristics of head of household, characteristics of household, individual characteristics, and interaction variables. This study also looks at the effect of CHE on household

economic conditions, especially on basic expenditure, namely food expenditure using the Ordinary Least Square (OLS) method. The effect of CHE with various thresholds on household economic condition can be shown in equation 2. This model used food expenditure as dependent variable, because this expenditure is the basic needs for every human being. The following is the empirical model:

$$Foodexp_i = \beta_0 + \beta_1 CHE_{10i} + \beta_2 CHE_{25i} + \beta_3 CHE_{40i} + u_i \quad (2)$$

### Variables

The independent variables in the binary logit regression model (Equation 1) consist of household head characteristics, household characteristics, individual characteristics, and interaction variables. Characteristics of the head of the household consist of the level of education of the head of the household (Uneducated, Elementary education equivalent, Junior high school, Senior high school equivalent, and Higher education), sex of the head of the household (Male/Female), and the occupational status of the head of the household (Working/not working). Household characteristic variables consist of the location of residence (village/city) and the size of the household as seen from the number of members in the household (person). Individual characteristic variables consist of age (years), type of illness (chronic/non-chronic), ownership of health insurance (Having health insurance/Not having health insurance), and the type of health service facility visited (Government Hospital/Public Health

Center Private Hospital/Clinic/Doctor's practice/Nurse practice/Traditional medicine). The interaction variable used in this study is the interaction variable between the type of illness suffered by the ownership of health insurance and the interaction variable between the types of illness suffered by the level of education of the head of the household.

The dependent variable used in the OLS regression model (Equation 2) is household food expenditure (Rupiah). Food expenditure for households includes expenses for staple food, vegetables, dry food, meat/ fish, other side dishes, milk/ eggs, spices, as well as food and beverage ingredients/other consumption materials. The independent variables used in this model are catastrophic health expenditure with a threshold of 10%, 25%, and 40% of total household expenditures.

#### 4. DATA ANALYSIS AND DISCUSSION

Table 1 provides a statistical description of the determinants of CHE. This study uses three different dependent variables that are analyzed to see the determinants of CHE with various thresholds. The 10 percent CHE variable has an average value of 0.223, 25 percent CHE has an average value of 0.068, and 40 percent CHE has an average value of 0.015. Therefore, it can be concluded that households in Indonesia experience CHE of 10 percent more than CHE with other thresholds.

The education level variable for the head of household has a proportion value of 2.017, which indicates that most household heads in Indonesia have the elementary education level. The variable of the sex of the head of the household has a proportion of 0.817, which indicates that the majority of household heads in Indonesia are male. The occupational status variable for the head of household has a proportion of 0.824, which indicates that most of the head of household in Indonesia has a job.

The age variable has a minimum value of 0 and

a maximum value of 120. The age variable has an average value of 29.72 which indicates that household members in Indonesia have an average adult age of around 30 years. The household size variable has a minimum value of 1 and a maximum value of 13, which indicates that households in Indonesia consist of a minimum of 1 person and a maximum of 13 people. This variable has an average value of 2.952 which indicates that most households in Indonesia consist of 3 people.

The location variable that is residence has a proportion of 0.559 which indicates that the location of household residence in Indonesia is fairly evenly distributed between urban and rural areas. The variable type of disease suffered has a proportion of 0.336 which indicates that most household members in Indonesia have a non-chronic disease. The insurance ownership variable has a proportion of 0.382 which indicates that most household members in Indonesia do not have insurance. The variable for the type of health facility visited has a proportion of 3,578, which indicates that most household members in Indonesia seek medical treatment or receive health services at a doctor's practice.

Table 1. Statistical descriptions for the determinants of CHE

Variable	Description	Obs	Mean/ Proportion	SD.	Min	Max
<b>Dependent Variable</b>						
CHE_10	The proportion of health expenditure to total household expenditure that exceeds 10 percent	33,110	0.223	0.416	0	1
CHE_25	The proportion of health expenditure to total household expenditure that exceeds 25 percent	10,046	0.068	0.251	0	1
CHE_40	The proportion of health expenditure to total household expenditure that exceeds 40 percent	2,187	0.015	0.120	0	1
<b>Independent Variable</b>						
<b>Characteristics of Head of Household (HHHchar)</b>						
Head of Household Education Level	0 = Not attending school 1 = Elementary School 2 = Junior High School 3 = Senior High School 4 = Higher Education	25,089	2,017	1,191	0	4
Sex of Head of Household	1 = Male 0 = Female	25,089	0.817	0.387	0	1
Occupational Status of Head of Household	1 = Working 0 = Not Working	25,078	0.824	0.381	0	1

Variable	Description	Obs	Mean/ Proportion	SD.	Min	Max
<b>Household Characteristics (HHchar)</b>						
Household Size	Number of household members (person)	65,339	2,952	1,418	1	13
Residence Location	1 = Urban 0 = Rural	153,149	0.559	0.496	0	1
<b>Individual Characteristics (Indivchar)</b>						
Age	Age (Years)	143,213	29.72	18.49	0	120
Type of Disease Suffered	1 = Chronic 0 = Not Chronic	44,821	0.336	0.472	0	1
Insurance Ownership	1 = Have insurance 0 = Do not have insurance	62,987	0.382	0.486	0	1
Type of Health Facility Visited	0 = Government Hospital 1 = Public health center 2 = Private hospital 3 = Polyclinic 4 = Doctor's Office 5 = Nurse Practice 6 = Traditional medicine	10,474	3,578	1,945	0	6
<b>Interaction Variables (Interaction var)</b>						
Chronic Insurance	1 = Have chronic disease and insurance 0 = Have a chronic disease but do not have insurance	44,821	0.164	0.37	0	1
Chronic_eduhhh	0 = Have a chronic disease and are not attending school 1 = Having a chronic disease with an elementary education level 2 = Have a chronic disease with a junior high school education level 3 = Have a chronic disease with a senior high school education level 4 = Have a chronic disease with a higher level of education	19,807	0.648	1,169	0	4

Source: Research data, tabulated (2020)

Table 2 shows the statistical description of the impact of CHE on the household economy. The dependent variable is household food expenditure. The household food expenditure has a minimum value of IDR 0 and a maximum value of IDR 37,000,000. This variable has an average value of 338,785 and a standard deviation of 618,625. This value shows that the average household in Indonesia

spends IDR 338,785 a month on food expenditure. The higher the standard deviation value than mean indicates variations in the data. The independent variables are catastrophic health expenditures with a threshold of 10 percent, 25 percent, and 40 percent. Statistical descriptions for these three variables have been previously described in Table 1.

Table 2 Statistical Description for the Impact of CHE on the Household Economy

Variable	Description	Obs	Mean/ Proportion	SD.	Min	Max
<b>Dependent Variable</b>						
Foodexp	Household food expenditure (Rupiah)	151,995	338,785	618,625	0	37.000.000
<b>Independent Variable</b>						
CHE_10	The proportion of health expenditure to total household expenditure that exceeds 10 percent	33,110	0.223	0.416	0	1
CHE_25	The proportion of health expenditure to total household expenditure that exceeds 25 percent	10,046	0.068	0.251	0	1
CHE_40	The proportion of health expenditure to total household expenditure that exceeds 40 percent	2,187	0.015	0.120	0	1

Source: Research data, tabulated (2020)

### Binary Logit Regression Results

Binary logit regression is used to determine the determinants of CHE with thresholds of 10%, 25%, and 40%. The researchers test the simultaneous significance of coefficients on logit regression for all CHE thresholds by using the Likelihood Ratio (LR) which is seen through the Prob> chi2 value of 0.0000. The probability value is less than the level of significance ( $\alpha$ ) = 0.001, therefore, it can be said that H0 is rejected and H1 is accepted. The estimation results show that the independent variables simultaneously have a significant effect on the dependent variable at the 1 percent level on all CHE thresholds.

Logit regression result of the CHE with a threshold of 10% shows the value of Pseudo R2 of 0.0688. This means that the independent variable is able to explain the dependent variable by 6.88% and the rest is explained outside the model. The pseudo value R2 at the CHE with a threshold of 25% is equal to 0.1095. That is, the independent variable is able to explain the dependent variable by 10.95% percent and the rest is explained outside the model. Pseudo value R2 at the CHE with a threshold of 40% is equal to 0.1315. This also means that the independent variable is able to explain the dependent variable by 13.15% percent and the rest is explained by others outside the model. Although the Pseudo R2 value in this study is quite low, this is not a problem. In the binary logit regression model, testing goodness of fit is not the main

requirement. This test is the second most important requirement after testing the significance of the variables (Gujarati, 2021).

In CHE with a threshold of 10%, there are seven independent variables that have an effect. The variables of the occupational status of the head of the household, household size, and insurance ownership have an effect on decreasing the probability of households experiencing CHE with a threshold of 10% at p-value <0.01. Working head of household will decrease the probability of households experiencing 10% CHE by 70.6%, rather than not working head of household. The bigger the household (indicated by the number of person) will decrease the probability of households experiencing 10% CHE by 88.4%. Household with member who has health insurance will decrease the probability of households experiencing 10% CHE by 67.1%. Residential location variables and visits to health centers have an effect on reducing the probability of households experiencing CHE with a threshold of 10% at a p-value <0.05. Household who live in city have lower probability experiencing 10% CHE by 82.5% rather than household who lived in village. Household who visited public health care have lower probability experiencing 10% CHE. Age and the interaction variable of the head of the household with an education equivalent to elementary school and having chronic disease will increase the probability experiencing 10% CHE.



Table 3 Binary Logit Regression Results for 10%, 25%, and 40% CHE Determinants

Independent Variable	CHE 10%		CHE 25%		CHE 40%	
	Logit Coef.	Odds Ratio	Logit Coef.	Odds Ratio	Logit Coef.	Odds Ratio
Constant	-1,408 *** (0.377)	0.245 *** (0.0922)	-3,822 *** (0.558)	0.0219 *** (0.0122)	-4,519 *** (0.967)	0.0109 *** (0.0105)
<b>Characteristics of Head of Household (HHHchar)</b>						
<b>Head of Household Education Level (Not school as a reference)</b>						
1.Elementary School (ES)	-0.336 (0.244)	0.714 (0.174)	-0.104 (0.357)	0.901 (0.322)	-0,797 (0.630)	0.451 (0.284)
2.Junior High School (JHS)	-0.175 (0.290)	0.839 (0.243)	-0.137 (0.463)	0.872 (0.404)	0.00584 (0.732)	1,006 (0.736)
3.Senior High School (SHS)	-0.0769 (0.272)	0.926 (0.252)	-0.00545 (0.419)	0.995 (0.417)	-0.437 (0.745)	0.646 (0.481)
4. Higher Education (HE)	-0.0269 (0.303)	0.973 (0.295)	0.0665 (0.487)	1,069 (0.520)	-13.81 (665.3)	1.01e-06 (0.000669)
<b>Sex of Head of Household</b>	-0.115 (0.103)	0.892 (0.0921)	0.222 (0.154)	1,249 (0.193)	0.617 ** (0.304)	1,854 ** (0.564)
Male = 1						
<b>Occupational Status</b>	-0.348 *** (0.0973)	0.706 *** (0.0687)	-0.470 *** (0.140)	0.625 *** (0.0872)	-0.305 (0.263)	0.737 (0.194)
Work = 1						
<b>Household Characteristics (HHchar)</b>						
<b>Household Size (Person)</b>	-0.123 *** (0.0362)	0.884 *** (0.0320)	-0.129 ** (0.0529)	0.879 ** (0.0465)	-0.248 ** (0.107)	0.780 ** (0.0831)
<b>Residence Location</b>	-0.192 ** (0.0916)	0.825 ** (0.0756)	0.0250 (0.136)	1,025 (0.139)	0.299 (0.257)	1,348 (0.346)
City = 1						
<b>Individual characteristics (Indivchar)</b>						
<b>Age (Years)</b>	0.0303 *** (0.0035 )	1,031 *** (0.0036 )	0.0442 *** (0.0053 )	1,045 *** (0.0055 )	0.0484 *** (0.01 )	1,050 *** (0.011 )
<b>Type of Disease Suffered</b>	-0.0870 (0.282)	0.917 (0.258)	0.267 (0.384)	1,305 (0.501)	-0,600 (0.683)	0.549 (0.375)
Chronic = 1						
<b>Insurance Ownership</b>	-0.399 *** (0.142)	0.671 *** (0.0950)	-0.623 ** (0.246)	0.536 ** (0.132)	-1,094 ** (0.540)	0.335 ** (0.181)
Have insurance = 1						
<b>Type of Health Facility Visited (Government Hospital as reference)</b>						
1.Public Health Center	-0.474 ** (0.195)	0.623 ** (0.122)	-0.710 *** (0.271)	0.492 *** (0.133)	-1,851 *** (0.468)	0.157 *** (0.0736)
2.Private Hospital	0.0625 (0.262)	1,065 (0.279)	0.156 (0.349)	1,169 (0.408)	-0.466 (0.561)	0.628 (0.352)
3. Polyclinic	0.0712 (0.234)	1,074 (0.251)	-0.0962 (0.335)	0.908 (0.304)	-0,888 (0.562)	0.411 (0.231)
4.Practice Doctors	0.0199 (0.193)	1,020 (0.197)	-0.111 (0.259)	0.895 (0.232)	-0,894 ** (0.391)	0.409 ** (0.160)
5. Practice Nurse	-0.114 (0.201)	0.892 (0.179)	-0.450 (0.278)	0.638 (0.177)	-1,123 *** (0.431)	0.325 *** (0.140)
6. Traditional Medicine	-0.00591 (0.199)	0.994 (0.198)	-0.0932 (0.275)	0.911 (0.251)	-1.037 ** (0.445)	0.354 ** (0.158)
<b>Interaction Variables (Interaction var)</b>						
<b>Chronic Insurance</b>	0.0619 (0.178)	1,064 (0.190)	0.206 (0.288)	1,229 (0.354)	0.503 (0.604)	1,654 (0.998)
1 = Have a chronic disease and health insurance						
<b>Chronic_EduHHH</b>						
1.Chronic_ES	0.631 ** (0.304)	1,880 ** (0.571)	0.357 (0.423)	1,429 (0.604)	1,394 * (0.790)	4,033 * (3,185)
2.Chronic_JHS	0.495 (0.356)	1,641 (0.584)	0.272 (0.537)	1,313 (0.705)	0.457 (0.919)	1,580 (1,452)
3.Chronic_SHS	0.323 (0.329)	1,381 (0.454)	-0.0704 (0.487)	0.932 (0.454)	0.942 (0.893)	2,565 (2,291)
4.Chronic_HE	0.214 (0.367)	1,239 (0.454)	-0.144 (0.565)	0.866 (0.490)	13.78	967,855
<b>Observation</b>	<b>3,011</b>		<b>3,011</b>		<b>3,011</b>	
<b>Prob &gt; chi<sup>2</sup></b>	<b>0.0000</b>		<b>0.0000</b>		<b>0.0000</b>	
<b>Pseudo R<sup>2</sup></b>	<b>0.0688</b>		<b>0.1095</b>		<b>0.1315</b>	

In CHE with a threshold of 25%, there are five independent variables that have an effect. The variables of the occupational status of the head of the household, household size, insurance ownership, and visits to the health center have an effect on reducing the probability of households experiencing CHE with a threshold of 25%. Working head of household will decrease the probability e.g., it experiences 25% CHE by 62.5%. The bigger the household, the lower the probability is, which experiencing 25% CHE by 87.9%. Having health insurance will decrease the probability experiencing 25% CHE by 53.6%. Household who visited public health care have lower probability experiencing 25% CHE by 49.2%. Otherwise, age have a positive effect. Increasing age will increase the probability of household such as experiencing 25% CHE.

In CHE with a threshold of 40%, there are nine independent variables that have an effect. The variable of age have a positive and significant effect at  $p\text{-value} < 0.01$  and sex of head of household have a positive and significant effect at  $p\text{-value} < 0.05$ . On the contrary, household size, insurance ownership, type of health facility visited, and interaction variable of the head of the household with an education equivalent to elementary school and having chronic disease have a negative effect. The bigger the

household will decrease the probability experiencing 40% CHE by 78%. Having health insurance will decrease the probability experiencing 40% CHE by 33.5%. Household who visited public health care, practice doctors, practice nurses, and traditional medicine have lower probability experiencing 25% CHE by 15%-40%.

### OLS Regression Results

OLS regression in this study is used to see the impact of CHE at various thresholds on the household economy. Household food expenditure is used as a proxy for household economic conditions; this is because food expenditure is a primary need that must be met. If health expenditure affects food expenditure in the household, it can be said to be catastrophic health expenditure.

Results of regression OLS shows, presented in Table 4, the value of  $R^2$  of 0.0006. This shows that the independent variable is able to explain the dependent variable by 0.06 percent and the rest is explained outside the model. According to Woolridge (2013), in the social sciences is not uncommon coefficient of determination ( $R^2$ ) is low, especially for the study with the data cross section. This is due to the difficulty in predicting heterogeneous individual behavior.

Table 4. OLS Regression Results Impact of CHE on Household Food Expenditure

Independent Variable	Household Food Expenditures (Foodexp)
Constant	343,009 *** (1,957)
CHE_10	-21,730 *** (3,761)
CHE_25	-1,942 (4,885)
CHE_40	-76,981 *** (5,878)
<b>Observation</b>	<b>148,661</b>
<b>R-squared</b>	<b>0.0006</b>
<b>Prob&gt; F</b>	<b>0.0000</b>

Robust standard errors in parentheses (\*\*\*)  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ )

Based on the OLS regression results, the CHE variable with a threshold of 10 percent and 40 percent significantly affects household food expenditure with a significance level of 1 percent. Households that experienced 10 percent CHE had a lower food expenditure of IDR 21,730 compared to households that did not experience 10 percent CHE, assuming other variables were constant. Households that experienced CHE 40 percent increased by IDR 1,000

had lower food expenditure by IDR 76,981 compared to households that did not experience CHE 40 percent, assuming other variables were constant. Meanwhile, the CHE variable with a threshold of 25 percent has no effect on household food expenditure.

### Discussion

From all of independent variables in this study, eight variables have an effect on the probability of

households experiencing CHE. These variables are in line with the main hypothesis in this study. They are the occupational status of the head of the household, sex of the head of the household, education level of the head of the household, age, types of disease suffered, health insurance ownership, household size, residence location. Meanwhile, 3 others have no effect on the probability of households experiencing CHE. The three variables are education level of the head of the family, the type of illness suffered by the household, and the interaction variable between the type of illness suffered by the ownership of insurance did not affect the occurrence of CHE.

The variable of the occupational status of the head of the household is the determinant of CHE with a threshold of 10 percent and 25 percent. This variable is negatively related to the probability of experiencing CHE 10 percent and 25 percent. The head of the household who has a job will reduce the probability of experiencing CHE, assuming other variables are constant (*ceteris paribus*). This study is in line with research conducted by Abolhallaje et al.(2013) also stated that the occupational status of the head of the household is one of the determinants of CHE in Iran. In other studies, it is concluded that households with a head of households who do not have a job will increase the probability of experiencing CHE (Amaya-Lara, 2016; Aregbeshola & Khan, 2018; Choi et al., 2016). The variable of the occupational status of the head of the household is the determinant of CHE related to the source of financing in the household. The head of the household who has a job has a source of income which can then be spent on household needs, including on health expenses.

The age variable is also the determinant of CHE at the thresholds of 10 percent, 25 percent, and 40 percent. The results in this study found that age has a positive relationship with the probability of experiencing CHE, assuming other variables are constant. This finding is in line with Grossman's (1972) theory which states that a person's health condition is considered an investment, which when discussing investment cannot be separated from the depreciation rate. Depreciation rate depends on age; individuals who are sick or old will have a higher gross investment than healthy people or young people. When the gross investment is getting bigger, it will require higher costs, which will increase the probability of experiencing CHE. The results of this study are in line with previous research which states that increasing age will increase the probability of experiencing CHE (Abolhallaje et al., 2013; Aregbeshola & Khan, 2018; Brinda,Rodríguez Andrés, & Enemark, 2014; Lee & Yoon, 2019; Zhou et

al., 2016).

The household size variable is a determinant of CHE across all thresholds. This study found that the household size has a negative relationship with the probability of experiencing CHE, assuming the other variables are constant. This finding is in line with the research in China which states that the larger the household size, the lower the probability of experiencing CHE (Wang,Li, & Chen, 2015; Zhou et al., 2016). It is due to several sources of income in the family which will further reduce the probability of experiencing CHE. Each family member who works will reduce the probability of CHE occurring in the family. Meanwhile, in smaller households, when there is a family member who is sick, it will reduce income which in turn can increase the probability of experiencing CHE. The results of this study are inconsistent with studies conducted in Nigeria and Tanzania. Aregbeshola & Khan (2018) and Brinda et al., (2014) found that the larger the household size, the greater the probability of experiencing CHE. Both studies found that household size, such as having more than five members, was not associated with catastrophic health expenditure.

The variable of residence location is a determinant of CHE at the 10 percent threshold. This study found that households who live in urban areas have a lower probability of experiencing CHE than households in rural areas, assuming other variables are constant. In other words, households in rural areas are likely to experience a higher CHE. The result is in line with the previous studies conducted in Colombia and China (Amaya-Lara, 2016; Li et al., 2013; Wang et al., 2015). Li et al. (2013) also stated that this difference is due to differences in health costs between urban and rural areas, the income of rural residents is generally lower than in urban areas, and urban hospitals are equipped with adequate technology so that villagers are willing to go to the hospital in urban although the price is higher. The result in this study is on the contrary with the research conducted by Aregbeshola & Khan(2018); You & Kobayashi(2011) stating that households living in urban areas have a higher probability of experiencing CHE than rural areas.

The variable of insurance ownership is a determinant of CHE at all thresholds. This study found that households with members who have health insurance have a lower probability of experiencing CHE than those who do not have health insurance, assuming other variables are constant. In other words, households with members who do not have health insurance will have a higher probability of experiencing CHE. The findings in this study are in

line with research conducted in Iran, South Korea, and China (Abolhallaje et al., 2013; Lee & Yoon, 2019; Li et al., 2013; Wang et al., 2015). Household members who have health insurance will have protection when they are sick, thus reducing the probability of experiencing CHE.

The health facility variable visited is also a determinant of CHE across all thresholds. This study found that household members who went to public health center, doctor's practice, nursing practice, and traditional medicine had a lower probability of experiencing CHE. Regarding household members who seek treatment at the health center have a lower probability of experiencing CHE. According to the results of research conducted in India, e.g., Sinha et al.(2016) also stated that individuals who seek treatment at public health facilities have a lower probability of experiencing CHE than individuals who seek treatment at private health facilities. Regarding household members who seek treatment in traditional medicine have a lower probability of experiencing CHE. It is in contrast to the results of a study conducted in Tanzania. Brinda et al.(2014)stated that individuals who seek treatment in traditional medicine have a higher probability of experiencing CHE.

The interaction variable between the types of disease by the level of education of the head of the family is a determinant of CHE at the 10 percent and 40 percent thresholds. In this variable, the category that has a significant effect is the head of the family who has chronic disease with the highest education level equivalent to elementary school. Household heads that have chronic diseases with the highest education level equivalent to elementary school have a higher probability of experiencing CHE. The results of this study are different from research conducted by You & Kobayashi(2011) in China which states that households with heads of families who have chronic disease and high or secondary education levels are more likely to experience CHE than those with chronic disease and have low education.

The variable of the sex of the head of the household is a determinant of CHE at the 40 percent threshold. This study found that households with male heads of families have a higher probability of experiencing CHE than households with female heads of household, assuming other variables are constant. The results of this study are consistent with research conducted by Lee & Yoon(2019) in Korea and Sinha et al. (2016)in India. The effect of sex and CHE is related to access to health services. Vlassoff (1994) states that women in low-income countries need health services higher than men but have lower

access to health. Schuler (2002) supports these findings by stating that women in Bangladesh have poor access to health, because women are economically dependent on their husbands or male family heads. This finding is different from the results of studies in Tanzania and Korea which found that households experienced higher CHE when they had a female head of household (Brinda et al., 2014; Choi et al., 2015).

The variable of the level of education of the head of the household statistically has no effect on the probability of experiencing CHE. This finding contradicts the argument by Grossman (1972), as education increases, it will demand more health stocks, but reduce the use of medical care. An educated person will have an incentive to offset the increase in health stocks caused by the increase in his education by reducing the use of medical services. In other words, increasing education will increase the probability of experiencing CHE being used as a preventive compared to CHE for the use of medical services. The result of this study is in line with the research conducted in China, Cambodia, and India which found no statistical influence between the education level of the head of the household and the probability of experiencing CHE (Jacobs,De Groot, & Fernandes Antunes, 2016; Sinha et al., 2016; Zhou et al., 2016).

The type of disease suffered statistically has no effect on the probability of experiencing CHE. This finding contradicts the research conducted in Tanzania and China which found that households with members who have chronic disease have an increased probability of experiencing CHE (Brinda et al., 2014; Wang et al., 2015; You & Kobayashi, 2011). Meanwhile, research by Zhou et al.(2016) in China found that the type of disease had no effect on the probability of experiencing CHE.

The interaction variable between the types of illness suffered by the insurance ownership statistically has no effect on the probability of experiencing CHE. Wang et al., (2015) stated that households that have members with chronic diseases increase the probability of experiencing CHE, but insurance ownership has no effect on the probability of experiencing CHE. This is because the social health insurance program has not been able to reduce the risk of CHE. The weak performance of social health insurance in financial protection is due to the high prevalence of chronic disease in the population and the pattern of health spending related to policy design.

### **Discussion on OLS Regression Results**

Based on the OLS estimation results, it can be seen that CHE has an influence on household food expenditure. The 10 percent CHE and 40 percent CHE have an effect on reducing food expenditure in the household. Although these two variables have the same effect, they both have different magnitudes. The 40 percent CHE has a greater effect on reducing household food expenditure than 10 percent CHE. This condition is related to financing and financial protection in the household.

World Health Organization (2019) stated that the use of thresholds in the calculation of CHE will generally focus on rich household groups. Rich what is meant here is that the household is indeed capable or the household looks rich from borrowing money or selling assets to meet their needs? This is why CHE 40 percent has a greater influence on household food expenditure. In general, every household has basic needs that must be met in order to survive. These needs are needs related to clothing, food and shelter. This basic need absorbs most of the expenditure or income of poor household groups. As a result, poor households are only able to allocate less health expenditures than rich households. This is why 10 percent CHE has less effect on food expenditure.

This finding is in line with previous research conducted by Kim & Yang (2011) in South Korea. Kim & Yang (2011) define CHE as OOP for health expenditure exceed 10% and 20% from annual income. The study states that expenditure on consumption is lower in households experiencing CHE. Households that experienced CHE had lower expenditures on food, clothing, education, housing and electricity than households that did not experience CHE. Similar findings in Vietnam states that households experiencing shocks as a result of health spending, spend less expenditure on food (Wagstaff, 2007). This is because households experiencing CHE face difficulties in managing available resources to offset health expenditures. As a result, these households have to reduce their consumption of other goods (Abegunde & Stanciole, 2008; Wagstaff, 2008).

### **5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS**

The occurrence of CHE in the household is affected by the variables of occupational status of the head of the family, the sex of the head of the family, the age, the size of the household, the location of residence, the ownership of insurance, the type of health facilities visited, and the interaction variable between the type of illness suffered by the education

level of the head of the family. However, it is not affected by the variable of the education level of the head of the family, the type of illness suffered by the household, and the interaction variable between the types of illness suffered by the ownership of insurance. The OLS regression results found that households who experienced CHE with a threshold of 10 percent and 40 percent made a reduction in their basic needs (food expenditure).

The importance of health has its implication. Someone who is sick will have an impact on high OOP for health expenditure and lost productive time. Naturally, it will cause economic shocks in the household. This finding also implies the importance of financial risk protection in the household. Having health insurance will decrease the probability of households experiencing economic shocks and CHE.

Based on the estimation of this study, it was found that 10 percent and 40 percent of household groups experienced CHE influence their basic expenditure component (food expenditure). Therefore, the researchers suggest that the government should increase the efficiency of spending in the health sector. The provision of Law no. 36 of 2009 article 171 makes the allocation of spending in the health sector absolutely fulfilled (mandatory spending). The article states that the government allocates a minimum health expenditure budget of 5 percent of the state budget, while the provincial and district / city governments allocate a minimum health budget of 10 percent of the state budget. The more efficient the allocation of expenditures in the health sector is expected to increase access to better health. So that poor households or those experiencing CHE can take advantage of access to health without disturbing the allocation of expenditures for their basic needs.

Referring to the findings related to the variable of residence location, it can be seen that it is a determining factor in CHE 10%. It is expected that the government can increase the delivery of the health system. This aims to reduce the disparity in health access between urban and rural areas. The main components in the health delivery system are resources (educated and experienced medical personnel and complete equipment in health services) and the organizational system (the karma of medical personnel and the waiting time of the health service process). The variable of insurance ownership in this study was found to be a determinant of CHE at all thresholds. The government is expected to create insurance and social security programs that can cover all levels of

society. This aims to provide protection for the community against financial risks due to health costs. The existence of the BPJS as a social security program that is promoted by the government, in its implementation, still faces various obstacles. It is expected that the government can improve the system and regulations at the BPJS in order to protect the public from the possibility of experiencing CHE.

The main limitation of this study is on the data collection. This study only analyzes the factors that determine CHE in Indonesia in 2007 and 2014. Consequently, this study can't describe the whole pattern of CHE in Indonesia.

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