RESEARCH ARTICLE

Editorial Process: Submission:10/16/2024 Acceptance:06/03/2025

Catastrophic Health Expenditure and its Associated Factors among Adult Cancer Patients in a Teaching Hospital in East Coast of Malaysia

Muhd Abdul Hafiz Kamarul Zaman¹, Surianti Sukeri^{1*}, Norazlina Mat Nawi², Suhailah Badaruddin², Mohd Arif Saifuddin Sulong², Aienuddin Husairi Hussain², Mohd Shafizol Mohamad Zuki², Azlan Husin³

Abstract

Objective: To determine the proportion of Catastrophic Health Expenditure (CHE) and its associated factors among adult cancer patients in a teaching hospital in the East Coast of Malaysia. **Methodology:** A cross-sectional study was conducted at a teaching hospital involving 209 randomly-selected adult cancer patients who were diagnosed for at least one year. Guided interviews were conducted using a questionnaire. The Budget Share method i.e. out-of-pocket (OOP) health expenses exceeding 10% of household income was used to define CHE. To prevent overestimation of CHE, non-medical spending were excluded. **Results:** The study revealed that 15.3% of patients experienced CHE. Significant factors associated with CHE were ethnicity, education level, ownership of guarantee letter (GL), and employment status. Non-Malay patients had 6.63 times the odds of experiencing CHE compared to Malay patients (p-value=0.013, 95% CI: 1.49, 29.57). Patients with primary school qualification had 9.56 times the odds of experiencing CHE compared to those with tertiary education (p-value=0.005, 95% CI: 2.01,45.57). Patients without GL were 4.81 times more likely to experience CHE than those with GL (p-value=0.008, 95% CI: 1.51, 15.34). Households where the head was unemployed had 6.55 times the odds of experiencing CHE compared to those with employed heads (p-value=0.014, 95% CI: 1.46,29.35). **Conclusion:** The proportion of CHE is low, nevertheless the burden of non-medical spending and indirect costs, remains concerning. Financial aid may be considered on vulnerable groups such as non-Malay patients, those with lower education levels, individuals without GL, and unemployed head of households.

Keywords: Catastrophic illness- out-of-pocket health expenditures- universal health coverage- cancers- Malaysia

Asian Pac J Cancer Prev, 26 (6), 2035-2042

Introduction

The World Health Organization (WHO) defines outof-pocket (OOP) health expenditures as payments made by individuals and households directly to healthcare providers at the time of service which are not reimbursed by health insurance or other financial mechanisms [1]. High levels of OOP expenditures exceeding a certain threshold can indicate limited financial protection in a health system, potentially leading to financial hardship or Catastrophic Health Expenditure (CHE) [2]. The CHE is a significant obstacle to achieving universal health coverage (UHC), as it can lead to financial hardship and poverty, ultimately undermining the effectiveness of healthcare systems. The significance of CHE is underscored by its designation as the indicator used to measure Target 3.8.2 of the Sustainable Development Goals towards achieving UHC by 2030. This target specifically calls for ensuring universal health service coverage without exposing households and individuals to financial risks [3]. The CHE reflects the population-level burden of excessive OOP payments and facilitates the identification of disadvantaged groups affected by such financial hardship. This information provides decision-makers with an invaluable evidence base to develop equity-oriented health policies, which essential to strengthen financial protection and resulted in achieving UHC [4]. The global prevalence of CHE has experienced a substantial increase from 2000 to 2019. According to recent reports, the prevalence of CHE has increased from 9.6% in 2000 to 13.5% in 2019, which translates to over 1.04 million individuals worldwide who faced financial hardship due to healthcare costs [1, 5].

Cancer treatment significantly influences the likelihood

¹Department of Community Medicine, School of Medical Sciences, University Sains Malaysia, Malaysia. ²Department of Nuclear Medicine, Radiotherapy & Oncology, HUSM, Kubang Kerian, Kelantan, Malaysia. ³Department of Medicine, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia. *For Correspondence: surianti@usm.my

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of facing CHE. Treatments such as chemotherapy, surgery, radiation therapy, can all lead to high OOP and other direct non-medical expenses, which can result in financial hardship for patients and their families. A study on OOP among breast cancer women receiving outpatient treatment in a tertiary teaching hospital in Kuala Lumpur reported the OOP expenses for these women were MYR 1.04 million annually comprising multiple modalities of treatment [6]. In another study on the direct and indirect cost among cancer patients in Hospital Kuala Lumpur reported the mean total cost for cancer patients was MYR7955.39 annually [7].

Several studies have identified various factors associated with CHE in adult cancer patients, which can be categorized into sociodemographic, disease and treatment-related, and household factors. Lower levels of education and unemployment have been consistently associated with an increased likelihood of CHE [8, 9]. Additionally, the introduction of multiple treatment modalities has been shown to heighten the risk of CHE, although the cancer site itself was not found to be a significant factor in numerous studies [10, 11]. Household factors also play a crucial role, with research indicating that female heads of households and unemployment significantly elevate the risk of CHE [12, 13]. Conversely, the possession of a Guarantee letter (GL) and high income group have been demonstrated as protective factors against CHE [14, 15].

The rising prevalence of cancer poses a significant health challenge and contribute to the financial instability of households thus exposed the patients to CHE. However, there is a notable lack of research on the financial impact of cancer in the East Coast of Malaysia, as most studies were focused in the Klang Valley region. Besides, presence of methodological inconsistencies, mainly the inclusion of direct non-medical costs in OOP calculations, have led to an overestimation of CHE in some studies. Addressing these methodological gaps and expanding research to include diverse geographical contexts is crucial for accurately assessing the financial burden on cancer patients and guiding targeted interventions. A comprehensive understanding of CHE across different demographics and regions is essential for policymakers to develop effective health financing strategies that address the financial needs of cancer patients. This study aims to determine the proportion of CHE and its associated factors among adult cancer patients in a teaching hospital in East Coast of Malaysia.

Materials and Methods

A cross-sectional study was carried out from December 2023 to April 2024 at a teaching hospital that is the main referral centre for cancer patients in the east coast region of Malaysia. The sample size was 232 calculated based on two-proportion formula using the PS software. A systematic random sampling method was applied to select patients from the oncology and haematology clinics and wards based on their clinic attendance and ward admission. The inclusion criteria were Malaysian nationality and patient who was diagnosed with any type of cancer for at least one year. While the exclusion criteria were patients unable to recall health and nonmedical expenditures or loss of income, and patients who defaulted medical treatment for the past one year. Prior to conducting the study, ethical approval was acquired from the Human Research and Ethics Committee, Universiti Sains Malaysia.

The research tool was a proforma developed in the Malay language and consisted of four domains, namely patient's sociodemographic details, disease information, household details, and expenditures and income. Questions on expenditures were divided into direct medical and nonmedical OOP costs, and indirect costs. Direct medical and non-medical OOP costs were based on the definitions in the Classification of Individual Consumption according to Purpose (COICOP) [16]. Indirect cost refers to the loss of monthly or daily wage of patients or family members due to cancer [7]. Information on income relates to monthly household income including financial aid received. Financial aid was defined as any form of monetary assistance received from family members, friends, government agencies, or non-governmental organisations which included direct financial support, cost-sharing arrangements, subsidies, and welfare benefits intended to alleviate the financial burden of healthcare expenses [22].

Data were collected through a face-to-face interview to ensure full completion of the proforma. For accuracy of data collection, patients were explained that OOP expenses for direct medical costs refer to expenses directly related to the treatment of illness or the maintenance of health. This includes costs for medicines, medical consultations, hospital stays, surgeries, diagnostic services, rehabilitation, physiotherapy, and medical devices that were not reimbursed or covered under the GL of their employers or insurance providers. A GL is a formal document issued by employers or insurance company, to a healthcare provider, ensuring that the cost of medical treatment (including cancer therapy) for a patient will be covered(14). Respondents were also asked to recall non-medical costs on OOP expenses associated with the process of obtaining healthcare such as transport, accommodation, food. In addition, hospital records were reviewed, to cross-validate information on treatment modalities, frequency of visits, and related healthcare expenses. Where available, supporting documents such as quotations and billing statements were requested as evidence to substantiate the reported OOP expenses. All expenditure and income were reported in Malaysian Ringgit currency (RM 1.00 = USD 0.23).

Data analysis was performed using SPSS version 28. The Budget Share method i.e. out-of-pocket (OOP) health expenses exceeding 10% of household income was used to calculate CHE. To prevent overestimation of CHE, direct non-medical costs were excluded in the calculation. Categorization of poverty-level income was based on household with monthly income below the poverty line index (PLI) at RM 2589.00 (USD 595.47) [17]. Descriptive statistics was used to summarise the socio-demographic characteristics of subjects, disease information, household details, expenditure and income. Univariate analysis was conducted using simple logistic regression and multivariate analysis was performed using multiple logistic regression.

Results

Total participants were 209, recording a 90.1% response rate. Thirty two individuals (15.3%) experienced CHE. Sociodemographic analysis revealed that those with CHE were predominantly female (78.1%), Malays (78.1%), married (62.5%), aged 60 years and above (50.0%), had a secondary education level (62.5%), unemployed (84.4%), lacked financial aid (62.5%), and were without medical insurance (84.4%). Regarding disease and treatment, the highest incidence of CHE was among breast cancer patients (34.4%), with most individuals undergoing combination therapies (46.9%). Household factors associated with higher CHE occurrence included male-led households (75.0%), unemployed heads of households (62.5%), presence of elderly members (56.3%), smaller household sizes (37.5%), poverty-level income (56.3%), and lack of a GL (75.0%). The general sociodemographic characteristics of the respondents are shown in Table 1.

The median monthly household income, monthly direct medical expenditure, monthly direct non-medical expenditures were RM 4000.00 (IQR RM 5491.00), RM 16.70 (IQR RM 141.83), and RM 88.7 (IQR RM 885.00). Only 22 participants reported for annual loss of income with the median of RM 4300.00 (IQR RM 6855.00). The minimum, maximum, mean and standard deviation for income, expenditures and income loss were shown in Table 2.

Based on Table 3, the univariate analysis showed significant factors associated with the CHE were ethnicity (p < 0.001), level of secondary education (p < 0.001), level of primary education (p-value= 0.003), absence of formal education (p<0.001), and unemployed status (p < 0.001). Additionally, household income below the poverty line (p-value= 0.007), unemployed head of household (p < 0.001), and GL status (p = 0.001) were also significant predictors of CHE. The multiple logistic regression analysis discovered four significant factors associated with CHE which were non-Malays ethnicity (AOR 6.63; 95% CI: 1.49, 29.57), patients education background of primary education or below (AOR 9.56; 95% CI: 2.01,45.57), absence of GL (AOR 4.81; 95% CI: 1.51,15.34), and unemployed head of household (AOR 6.55;95% CI: 1.46,29.35). The model's fitness was good as the Hosmer and Lemeshow goodness of fit test was not significant (p=0.835), the classification table had an accuracy rate of 89.0% and The Receiver Operating Characteristics (ROC) curve was 87.6%.

Discussion

This study provides significant insights into the parameters linked to CHE among adult cancer patients at a teaching hospital in the East Coast of Malaysia. The median gross household income among participants in this study was RM 4,000.00 (USD 900.00), which is lower than the national median of RM 6,338.00 (USD 1457.74) [18]. The average monthly health expenditure reported

Variables	n (%)	CHE,	n (%)
		Yes (n=32)	No (n=177)
Gender			
Male	49 (23.4)	7 (21.9)	42 (23.7)
Female	160 (76.6)	25 (78.1)	135 (76.3)
Ethnicity			
Malay	197 (94.3)	25 (78.1)	172 (97.2)
Non-Malay	12 (5.7)	7 (21.9)	5 (2.8)
Age (years)			
18-39	25 (12.0)	4 (12.5)	21 (11.9)
40-59	103 (49.3)	12 (37.5)	91 (51.4)
≥ 60	81 (38.8)	16 (50.0)	65 (36.7)
Marital status			
Married	155 (74.2)	20 (62.5)	135 (76.3)
Divorced	29 (13.9)	7 (21.9)	22 (12.4)
Single	25 (12.0)	5 (15.6)	20 (11.3)
Education level			
Tertiary	98 (46.9)	3 (9.4)	95 (53.7)
Secondary	87 (41.6)	20 (62.5)	67 (37.9)
Primary and below	24 (11.5)	9 (28.1)	15 (8.5)
Patient's employment st	atus		
Employed	64 (30.6)	2 (6.3)	62 (35.0)
Pensioner	37 (17.7)	1 (3.1)	36 (20.3)
Self employed	8(3.8)	2 (6.3)	6 (3.4)
Unemployed	100 (47.8)	27 (84.4)	73 (41.2)
Financial aids			
Yes	62 (29.7)	12 (37.5)	50 (28.2)
No	147 (70.3)	20 (62.5)	127 (71.8)
Medical insurance			
Yes	38 (18.2)	5 (15.6)	33 (18.6)
No	171 (81.8)	27 (84.4)	144 (81.4)
Treatment for 1 year			
Follow-up	26 (12.4)	1 (3.1)	25 (14.1)
Radiotherapy	19 (9.1)	3 (9.4)	16 (9.0)
Chemotherapy	64 (30.6)	10 (31.3)	54 (30.5)
Targeted therapy	22(10.5)	3 (9.4)	19 (10.7)
Mixed of treatment	78 (37.3)	15 (46.9)	63 (35.6)
Types of cancer			
Breast	107(51.2)	11 (34.4)	96 (54.2)
Gastrointestinal tract	36 (17.2)	8 (25.0)	28 (15.8)
Gynaecology	16 (7.7)	1 (3.1)	15 (8.5)
Head and neck	15 (7.2)	4 (12.5)	11 (6.2)
Others	35 (16.7)	8 (25.0)	27 (15.3)
Household leader gende	er		
Male	170 (81.3)	24 (75.0)	146 (82.5)
Female	39 (18.7)	8 (25.0)	31 (17.5)
Household leader emplo	yment status		
Employed	60 (28.7)	3 (9.4)	57 (32.2)
Self employed	44 (21.1)	5 (15.6)	39 (22.0)
Pensioner	49 (23.4)	4 (12.5)	45 (25.4)
Unemployed	56 (26.8)	20 (62.5)	36 (20.3)

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Table 1. Continued

Variables	n (%)	CHE, n (%)		
		Yes (n=32)	No (n=177)	
Presence of elderly				
Yes	91 (43.5)	18 (56.3)	73 (41.2)	
No	118 (56.5)	14 (43.8)	104 (58.8)	
Household size				
1-2 (small)	46 (22.0)	12 (37.5)	34 (19.2)	
3-5 (medium)	107 (51.2)	10 (31.3)	97 (54.8)	
≥6 (large)	56 (26.8)	10 (31.3)	46 (26.0)	
Poverty income				
Yes	73 (34.9)	18 (56.3)	55 (31.1)	
No	136 (65.1)	14 (43.8)	122 (68.9)	
GL status				
Yes	137 (65.6)	8 (25.0)	129 (72.9)	
No	72 (34.4)	24 (75.0)	48 (27.1)	

was RM 178.80 (USD 40.94), exceeding the national average of RM 141.00 (USD 32.43) [19]. Furthermore, 34.9% of participants had household incomes below the poverty line, a proportion notably higher than the national figure of 6.2% [17].

The proportion of CHE in this study is lower compared to previous studies conducted among adult cancer patients at the National Cancer Institute (26.2%) and three tertiary hospitals in the Klang Valley (54.4%) [17]. This study also has a lower proportion compared to other studies that focused on different types of cancer in Malaysia, ranging from 47.8% to 86.5 [12, 15, 20]. The prevalence of CHE among cancer patients in other countries was also reported to be higher than this study. In South Korea, the proportion was 39.8% among its cancer patients [9]. While a study among cancer patients across eight Southeast Asian countries revealed that 48% of individuals experienced CHE [13]. The proportion of CHE in this study was also lower than other non-cancer diseases in Malaysia. Multiple studies involving households with preterm babies admitted to two hospitals in Kedah, households with paediatrics rotavirus infection and study among cardiac disease patients at the National Heart Institute found CHE proportions of 38%, 33% and 16% respectively [21-23].

The variations on the proportion CHE between studies are influenced by multiple factors. One significant factor is the misconception of OOP expenses. Most studies included direct non-medical expenses in their estimation of OOP and CHE [15]. These spending do not represent the actual OOP as defined by the World Bank and the WHO. Including these expenses increased the OOP which

resulted in higher proportion of CHE. Moreover, the global variability in CHE can be attributed by different thresholds and calculation methods using different denominators in the calculation formulas. A comparative study examining CHE across fourteen European nations found that the percentage of CHE was significantly higher when employing the Budget Share method with a 10% threshold compared to other calculation methods [24]. Additionally, variations in the proportion of CHE may also be due to differences in health financing systems across countries. A study covering 133 countries using household survey data from 1984 to 2015 found that the variation in CHE ranged widely, from less than 1% to 40%. The presence of social security funds, financial assistance from governmental agencies, and support from non-profit institutions were negatively correlated with the incidence of CHE [5].

The study discovered factors such as non-Malay ethnicity, lack of formal education in patients, unemployed head of household, and absence of government GL, were predictors of CHE. Non-Malays patients were seven times more likely to suffer from CHE. This finding is similar to several other studies within Malaysia and globally. Study among adult cancer patients in the National Cancer Institute revealed that Indians had the highest level of CHE compared to other ethnicities [25]. Other research in China across four years found that individuals of ethnicities other than the Han ethnicity were associated with 24% increase in risk of CHE [26]. The Chinese and Indian individuals allocated a larger proportion of their income towards healthcare expenses. According to the Household Income and Expenditures Surveys (HIES) 2022 data, Indians allocated 3.1% of their monthly spending towards health, while the Chinese, 3.0%. In comparison, Bumiputera (native citizens) allocated 2.6% of their monthly expenditure towards health [19]. Increased spending on healthcare increases their susceptibility to CHE. One study postulated that the high CHE among non-Malay ethnicities was due to the low ownership of GL. The use of GL was dominated by government employees who were mostly Malays. The non-Malays may not be interested to become government employees due to their penchant in entrepreneurship and preference towards the private sector. Absence of GL and insufficient financial aid may expose these groups to financial distress when facing significant medical expenses [14].

Individuals with lower education levels were at a significantly higher risk—over six times more likely of experiencing CHE. This finding is corroborated by previous studies conducted in different populations and regions. For example, a study in Kurdistan among

Table 2. Monthly Household Income, Direct Medical and Non-Medical Expenditures

	Min	Max	Mean	SD^1	Median	IQR ²
Monthly household income (RM) (n=209)		28000	5244.6	4584	4000	5491
OOP/Monthly direct medical expenditures (RM) (n=209)		4383.3	178.8	509.8	16.7	141.83
Monthly direct non-medical expenditures (RM) (=209)		885	121.9	123.5	88.7	885
Annual loss of income (RM) (n=22)	375	24000	7647.5	9936.6	4300	6855

¹, Standard Deviation; ², Interquartile Range; * RM 1.00, USD 0.23

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in the Last Coast Malay	31a (11 207)					
Variables	Crude Coefficient Regression (b)	Crude OR (95% CI)	p- value	Adjusted coefficient regression (B)	Adjusted OR (95% CI)	p-value
Gender		1	7			7
Male		1				
Female	0.105	1.11 (0.45,2.75)	0.82			
Ethnicity						
Malays		1			1	
Non-Malays	2.265	9.63 (2.83,32.69)	< 0.001	1.891	6.63 (1.49,29.57)	0.013
18-39		1				
40-59	-0.368	0.69 (0.20,2.36)	0.557			
≥ 60	0.256	1.29 (0.39,4.30)	0.676			
Marital status						
Married		1				
Divorced	0.764	2.15 (0.81,5.67)	0.123			
Single	0.523	1.69 (0.57, 5.00)	0.345			
Education level						
Primary and below		1			1	
Secondary	2.246	9.45 (2.70,33.10)	< 0.001	1.022	2.78 (0.66,11,78)	0.165
Tertiary	2.944	19.00 (4.61,78.26)	< 0.001	2.258	9.56 (2.01,45.57)	0.005
Patient's employment sta	tus					
Employed		1				
Self employed	2.335	10.33 (1.23,87.09)	0.032			
Pensioner	-0.15	0.86 (0.75,9.83)	0.904			
Unemployed	2.439	11.47 (2.62,50.15)	0.001			
Financial aids						
Yes		1				
No	-0.421	0.66 (0.30,1.44)	0.294			
Medical insurance						
Yes		1				
No	0.213	1.24 (0.44,3.45)	0.684			
Treatment for 1 year						
Follow-up		1				
Radiotherapy	1.545	4.69 (0.45,49.08)	0.197			
Chemotherapy	1.532	4.63 (0.56,38.17)	0.155			
Targeted therapy	1.373	3.95 (0.38,41.00)	0.25			
Mixed of treatment	1.784	5.95 (0.75,47.48)	0.92			
Type of cancer						
Breast		1				
Gastrointestinal tract	0.914	2.49 (0.91,6.80)	0.074			
Gynaecology	-0.542	0.58 (0.07,4.84)	0.616			
Head and neck	1.155	3.17 (0.86,11.68)	0.082			
Others	0.95	2.59 (0.95,7.07)	0.064			
Head of household gende	er					
Male		1				
Female	0.444	1.56 (0.64,3.80)	0.328			
Household leader employ	ment status	· · /				
Employed		1			1	
Self employed	0.89	2.44 (0.55,10.79)	0.241	0.181	1.20 (0.21,6.98)	0.841
Pensioner	0.524	1.69 (0.36,7.93)	0.507	1.502	4.49 (0.73,27.46)	0.104
Unemployed	2.357	10.56 (2.93,38.09)	< 0.001	1.879	6.55 (1.46,29.35)	0.014

Table3. Factors associated with catastrophic health expenditures among adult cancer patients in a teaching hospital in the East Coast Malaysia (n=209)

Catastrophic Health Expenditure and Its Associated Factors among Adult Cancer Patients

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Variables	Crude Coefficient	Crude OR	p value	Adjusted coefficient	Adjusted OR	p-value
D C 11 1 1		()5/0 CI)	value	Tegression (D)	()5/0(CI)	
Presence of elderly ho	busehold members					
No		1				
Yes	0.605	1.83 (0.85,3.92)	0.118			
Household size						
1-2 (small)		1				
3-5 (medium)	-0.777	0.46 (0.15,1.41)	0.174			
\geq 6 (large)	0.294	1.34 (0.41,4.39)	0.627			
Poverty income						
No		1				
Yes	1.048	2.85 (1.32,6.14)	0.007			
GL status						
Yes		1			1	
No	2.087	8.06 (3.39,19.17)	< 0.001	1.571	4.81 (1.51,15.34)	0.008

Notes: Constant -4.787; Backward LR method applied; No multicollinearity and no interaction; Hosmer and Lemeshow goodness of fit test, p-value= 0.835; the classification table : 89.0% correctly classified; Area under Receiver Operating Characteristics (ROC) curve: 0.876

households with dialysis, kidney transplants, and multiple sclerosis patients demonstrated that higher levels of education, specifically secondary and tertiary education, served as protective factors. These educational levels were shown to reduce the risk of experiencing CHE by up to 60% [27]. Such scenario can be attributed to several interrelated factors. Firstly, individuals with lower educational attainment often had limited access to high-paying jobs, resulting in lower overall income and financial instability. Secondly, lower education levels are frequently associated with reduced health literacy. According to the NHMS 2019, the limited health literacy category was prevalent among those with a low level of education, accounting for 64.8% of the population [28]. Having low literacy will impair the individual's ability to understand health information and make informed decisions about their health which leads to delayed healthcare seeking, underutilisation of preventive services, and poor management of chronic conditions, all of which can escalate healthcare costs. Research conducted among oral cancer patients in Pakistan indicated that delayed health-seeking behaviour has a detrimental impact, resulting in significantly higher healthcare costs [29].

The study found patients whose head of households were unemployed, had seven times the risk of suffering from CHE. This finding is corroborated by various global studies. For instance, a study conducted in Nigeria using the General Household Survey 2015-2016 revealed that unemployment increases the risk of CHE threefold compared to employed individuals [30]. Similarly, research conducted in Vietnam, found that employment reduces the risk of CHE by 30% [31]. Typically, employed heads of households possess greater financial resources to manage healthcare expenses, a financial capacity that stems from multiple factors. First, having a job usually ensures a consistent and dependable stream of money, allowing people to set aside cash for both regular and unforeseen medical costs. Additionally, several job opportunities include benefits such as employer-provided

health insurance, which may significantly decrease the amount of OOP on health. Moreover, working persons often have enhanced availability of financial resources and credit options, enabling them to handle substantial medical expenses more. Furthermore, a cancer diagnosis exacerbates this situation by increasing the likelihood of adverse employment outcomes, such as job loss and financial difficulties, which can lead to severe financial distress and even bankruptcy [32].

This study also demonstrated that having GL is essential for the prevention of CHE. This policy ensures that eligible individuals receive extensive medical support, thereby reducing the financial burden associated with healthcare needs. Due to its comprehensive coverage, this scheme effectively mitigates the impact of CHE even for low-income households. The use of GL is not only confined among government employees, pensioners and their dependents. Similar GL benefits are also entitled to public school and university students and the disabled. Nevertheless, there is contradictory finding on the use of GL to protect against CHE. A study in Nakhon Sawan, Thailand, revealed that those enrolled in the Civil Servant Medical Benefit Scheme had a much greater likelihood of encountering CHE up to four times. The heightened risk is ascribed to the scheme's restricted scope, which does not include medications, medical equipment, and charges for accommodation and meals at public hospitals [33].

As a conclusion, when a proper definition of OOP expenses was imputed in the calculation of CHE, the proportion of CHE is indeed lower. The findings suggest that although the proportion of CHE was lower than other studies, the burden of non-medical spending and indirect costs, remains concerning. The study also identifies ethnicity, patient's education, employment status of the household head, and possession of GL as significant risk factors for CHE. Emphasis should be placed on implementing targeted interventions to alleviate the financial burdens on cancer patients, with particular attention to education, employment, and financial support mechanisms.

Limitation

The data collection relied on self-reported values on income and household expenditures, which may introduce recall bias and potentially leading to overestimation or underestimation. Furthermore, variations in healthcare fees, such as those pertaining to medicine and medical equipment, may lead to fluctuations in the expenses borne by individuals. The research was conducted at a single cancer-treating hospital located in the east coast of Malaysia, thereby limiting its ability to generalise findings to all adult cancer patients in other regions. In addition, patient management, treatment policy and charges in a teaching hospital that operates under the Ministry of Higher Education may vary compared to those in Ministry of Health government hospitals.

Author Contribution Statement

Conceptualization, Data collection, Formal analysis, methodology: writing-original draft preparation, writingreview and editing.

Acknowledgements

General

We would like to express our appreciation to collaborators from Department of Community Medicine and Department of Nuclear Medicine, Radiotherapy and Oncology, School of Medical Sciences, Universiti Sains Malaysia who facilitate the data collection process. Besides, we would like to express our gratitude to Department of Community Medicine, Universiti Sains Malaysia for the invaluable support throughout the study.

Approval

This study is a part of student master's thesis in the Universiti Sains Malaysia, Malaysia.

Ethical Declaration

Ethical approval was acquired from the Human Research and Ethics Committee (HREC), Universiti Sains Malaysia (study protocol code: USM/JEPeM/ KK/23110864).

Conflict of Interest

There was no conflict of interest.

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