Health Vulnerability Versus Multiple Vulnerability Factors Among Low-Income Group in Malaysia

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ABSTRACT

Environmentally adverse conditions, poverty, and social status can result in healthcare vulnerability. This paper aims at explaining the health-related expenditure patterns and low-income households' (B40) characteristics in Malaysia, to identify the health vulnerability factors. Descriptive analysis and k-means clustering methods were employed to obtain demographic information of the low-income group and to cluster the group with different health vulnerability factors, namely (1) medical appliances, equipment, and products, (2) outpatient services, and (3) hospital or in-patient services. Based on the cluster analysis, three groups with different health vulnerability factors were identified. Researchers studied each group's characteristics and identified that the most vulnerable group comprised those having females as the heads of household and not working (10.5%), having low or no education at all, having the lowest income of RM1027.70, and living in the rural area (59.8%). Their health expenditure was also the lowest in which the average expenditure on medication was just RM16; RM5 for outpatient services and RM1.00 for in-patient services. The other two groups with better health vulnerability were households with higher education level and working for a living. Based on the findings, the authorities should give more attention to this most vulnerable group and prioritise them for better healthcare accessibility and in policymaking.

Keywords: Cluster analysis, healthcare, poverty, social status, vulnerable

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INTRODUCTION

Vulnerability is the degree to which an individual, an organisation, or a population is unable to anticipate, cope with, recover from, and resist the impacts of disasters (World Health Organization [WHO], 2002). Besides, according to Grabovschi et al. (2013), a vulnerable portion of a population is those who is at risk of poor healthcare disparities and health quality. They found that low healthcare accessibility and quality result in higher healthcare needs but multiple vulnerability factors made the group of the population be in higher vulnerability state. On the other hand, high healthcare accessibility and quality result in lower healthcare needs, thus, fewer vulnerability factors categorise this group to be in lower vulnerability state. The consequences of vulnerability on poor health may result from the degraded neighbourhood, developmental problems, disadvantaged social status, environments, inadequate interpersonal networks and supports, and personal incapacities. Braveman and Gottlieb (2014) defined a social determinant of health as *"the conditions in which people are born, grow, live, work, and age".* The finding pointed out that socio-economic aspects, such as educational attainment and family income, as the fundamental cause of wide-ranging health outcomes.

Based on the Report of Household Income and Basic Amenities Survey 2016 released by the Department of Statistic Malaysia in 2017, Malaysian household economic status is categorised into three categories. The lowest in the hierarchy is the households with a median monthly income of the bottom 40% from the overall Malaysian population, followed by the households with a median monthly income of the middle 40% and the highest in the hierarchy is the top 20%. Thus, B40 is defined as the bottom 40% of the population earning the lowest 40% from the median monthly income (Department of Statistics Malaysia, 2017). For low-income households, such as those categorised as B40 in our country, there is a concern that this group experience multiple vulnerabilities – they are growing up or living with risks that could affect their well-being and ultimately life chances due to their financial constraints.

Children, elderly people, ill or immunocompromised people, malnourished people, and pregnant women are particularly vulnerable when a disaster strikes, and take a relatively high share of the disease burden associated with emergencies. Indeed, poverty – and its common consequences, such as destitution, homelessness, malnutrition, and poor housing – is a major contributor to vulnerability. The vulnerability can result from a social status as vulnerable groups, people, or the surrounding population. Corrupted environment or neighbourhood, lack of social networking quality or quantity, personal inability, and poor social status are among factors affecting the vulnerability (Mechanic & Tanner, 2007).

Total health expenditure is the sum of private and public health expenditures. It covers the provision of emergency aid, family planning activities, health services

(curative and preventive), and nutrition activities designated for health but does not include the provision of sanitation and water. In 2015, health expenditure as a share of GDP for Malaysia was 4 %. Health expenditure as a share of GDP of Malaysia increased from 2.7% in 2001 to 4% in 2015 growing at an average annual rate of 3.02%. In 2017, the amount of money that Malaysia spent on healthcare, as a percentage of total government expenditure is a mere 6%. This figure is deemed low/small. Thailand allocated more than double the amount, at 13%, and Singapore and Vietnam even more, at 14%. Even many low-income countries, from Afghanistan to Zambia, earmarked relatively more funds to healthcare than Malaysia.

According to Frost & Sullivan Inc. (2016), the total Malaysian healthcare spending could reach up to USD 20 billion by 2025 following the increasing chronic disease incidences, escalating healthcare costs, particularly in Selangor and Wilayah Persekutuan due to urbanisation, and a weak ringgit. Health spending is a measure of the current health expenditure or total consumption spent on healthcare goods and services (Organisation for Economic Cooperation and Development [OECD], 2017). Collective services and personal healthcare are also included in this measure and exclude investment spending. Studies on health spending are important since the financial consequences of paying for healthcare affects both poor and rich countries (Xu et al., 2007). It is well known among health economists that health spending per

capita is positively correlated to GDP per capita (Anderson et al., 2006). Based on a report by UNDP, the Malaysian Government spends 2.2% of its GDP on the public healthcare sector (Quek, 2014).

The roles of basic needs, other demographic factors, and expenditure in explaining the 'survivability' concept in Malaysia's current economic environment among Muslim B40, M40, and T20 households have been examined by Rashid et al. (2018). Different consumption behaviours and patterns among the households were observed. However, this study is associated with several limitations in which only Muslim respondents in Kelantan and Selangor were chosen. Therefore, it may affect the generalisability of the findings. To fill the gap in the survivability measurement, measuring the expenditure based on other ethnicities and in different states of Malaysia is needed.

Several studies have been reported by the Consortium of Low Income Population Research (CB40R) highlighting comprehensive health aspects, i.e. health behaviour, health financing, mental health, and physical health; and also nutrition involving all lifespan stages of the socioeconomic deprived group in Malaysia (Shahar et al., 2019). They found that the low-income population in Malaysia is facing various health challenges, particularly related to non-communicable disease (NCD) and poor mental health, nutritional, and physical function. A sustainable intervention model to tackle the issues is highly required. They

also highlighted the important issues of reducing socioeconomic status (education, income, and occupation) disparities in health requiring policy initiatives and the pathways by which these affect health. Their findings and previous research on the household expenditure on health have prompted us to continue the study by taking into account health expenditure factors among low-income households by acquiring mutually exclusive socioeconomic factors using cluster analysis so that the government can continue to provide healthcare assistance to this target group.

Therefore, this study aims to share the results of a scoping review examining the relationship between healthcare disparities and the multiplicity of vulnerability factors often clustered together. The Department of Statistics Malaysia has itemised the health spending under three groups, namely (1) medical appliances, equipment, and products, (2) hospital or in-patient services, and (3) outpatient services. The household income, as well as education levels and living location, are among the clusters used to profile the vulnerable group in focus, which is the low-income households, categorised as B40.

MATERIALS AND METHODS

Data Analyses and Statistics

The Household Income Expenditure Survey (HIES) 2016 data was obtained from Bank Data UKM, which had established an official agreement and partnership with the Department of Statistics Malaysia. According to the Report of Household Income and Basic Amenities Survey 2016, the survey was conducted by the Department of Statistics Malaysia using the personal interview approach on selected households and the sampling method used was Simple Random Sampling (SRS) method.

The variables being considered in the analysis are the household expenditure, household health item expenditure, household income, and socio-demographic characteristics of low-income households (activity status, ethnic, gender, highest education level, living location (rural and urban), and marital status). For the living location variable, the Department of Statistics Malaysia classified the location by strata; urban is an area having a population of at least 60% engaged in non-agriculture activities while the remaining are classified as rural. Briefly, in this study, the data was selected according to the head of low-income household and this research analysed health vulnerability factors among the low-income population by looking at the healthcare expenditure pattern in Malaysia without considering the states. All statistical analyses were performed using the R Project for Statistical Computing software.

Descriptive Analysis

The descriptive analysis was conducted on the entire socio-demographic factor to see the characteristics of the low-income population in this research. Each data frequency was reported in percentage for every considered factor and the measure of central tendency was measured to describe data distribution. Concerning health-related

expenditure, three items were identified and categorised into three categories; Item1 refers to medical appliances, equipment, and products, Item 2 refers to hospital or in-patient services spending, and Item 3 refers to outpatient services spending. Besides, the additional important factors in this study are the mean income, mean of total expenditure, and percentage of expenditure.

The definitions of the three additional factors are as follows:

i. Mean income: The average amount of income per household.

ii. Mean of total expenditure: The average amount of total expenditure per household.

iii. Percentage of expenditure: The percentage of difference of mean income and mean of total expenditure per mean income.

Clustering Analysis

Subsequently, to categorise the low-income population based on their health vulnerability or health multiple vulnerabilities, the multivariate analysis was carried out. Multivariate analysis can be used in data collection and evaluation to explain the relationships between different variables associated with the data being studied. There are many multivariate analyses such as cluster analysis, factor analysis, and principal component analysis. In this paper, we considered the cluster analysis that could group a set of objects in such a way that objects in the same group (called a cluster) were more similar to each other than to those in other groups.

In cluster analysis, two procedures can be used, namely hierarchical and non-hierarchical. A hierarchical procedure can be either agglomerative or divisive while non-hierarchical procedure in cluster analysis is often referred to as k-means clustering. The k-mean clustering was chosen as the clustering method since the data in this study was unlabelled, i.e. not defined as categories or groups. Therefore, the k-means clustering can group similar data and discover underlying patterns by a fixed number (k) of clusters in a data set.

To define a target number k, the k-means algorithm identifies k number of centroids, and then allocates every data point to the nearest cluster while keeping the centroids as small as possible. By using the k-means algorithm, the three clusters were established from four clusters when the agglomerative coefficient increased from 0.92% (4 clusters) to 99.08% (three clusters). This explains that the total within-cluster variation (error) is minimum and the within-cluster similarity is high. Thus, three factors were considered in the k-means clustering that are the household income, household total expenditure, and household health-related expenditure for three items, namely (1) medical appliances, equipment, products, (2) outpatient services, and (3) hospital or in-patient services. The results reported the most vulnerable group in the low-income population and the health vulnerability and multiple vulnerability factors related to the group.

Nora Muda, Anisa Mohammad Azahari, Faridatulazna Ahmad Shahabuddin, Zamira Hasanah Zamzuri, Noratiqah Mohd Arif, Mohd Aftar Abu Bakar and Nur Riza Mohd Suradi

RESULTS AND DISCUSSION

Statistical Analysis: Descriptive Analysis of Low-income Population

The descriptive analysis describes the socio-demographic characteristics of low-income population data used in this research. The distribution of the B40 group is described by a list of mean and median household income in the year 2016 in which the household mean income is RM2,848.00 monthly while the household median income is RM3,000. Thus, for the year 2016, the B40 group is categorised as a household group earning not more than RM2, 848.00 of household mean income.

Table 1 summarises the socio-demographic characteristics of the low-income population. A total of 2443 samples (30%) of HIES 2016 households were

studied in this research. It is noted that, based on the survey, all individuals in this population were the head of the household. The majority of 1865 (76.3%) were male heads of households and 578 (23.7%) were female heads of the household. On the other hand, it was be observed that 1288 (52.7%) of the low-income household population living in the urban area and another 1155 (47.3%) living in the rural area. This number does not show a very huge difference (only 5.4% different) in which we can conclude that there is still a high number of the low-income population in the urban area. Among this low-income population, the majority of them were married with a frequency of 1724 (70.6%), 273 (11.2%) were single, 92 (3.8%) were divorced, and 354 (14.5%) were widowed.

Table 1

Descriptive analysis for the low-income population

Total sample	*n* (%)	Total sample	*n* (%)
Gender		**Highest education level**	
Male	1865 (76.3)	Primary school	1261 (51.6)
Female	578 (23.7)	Secondary school	825 (33.8)
Ethnic		Tertiary	54 (2.2)
Bumiputera	1867 (76.4)	No education	303 (12.4)
Non-Bumiputera	575 (23.5)	**Activity status**	
Living location		Employer	10 (0.4)
Urban	1288 (52.7)	Government servant	79 (3.2)
Rural	1155 (47.3)	Private sector employee	1070 (43.8)
Marital status		Self-employed	832 (34.1)
Single	273 (11.2)	Housewife	125 (5.1)
Married	1724 (70.6)	Pensioner	112 (4.6)
Divorced	92 (3.8)	Others	215 (8.8)
Widowed	354 (14.5)		

Furthermore, based on the analysis, it is a concern that half of the low-income individuals (51.6%) were reported of having primary school level as their highest education while 303 (12.4%) were reported of not having any education. Additionally, the highest number of individuals worked as private-sector employees with 43.8% (1070), followed by self-employed with 34.1% (832). A small portion of the low-income population was government servants 3.2% (79) and 4.6% (112) were pensioners, 5.1% (125) housewives, and 0.4% (10) employers. Maybe due to not having adequate qualifications, individuals from the low-income population did not manage to get a job in the government sector. Concerning 10 individuals (0.4%), who are an employer, most probably they are running a market stall, homeworker, or having other jobs not declared in the survey.

Health-Related Expenditure

In this study, the health expenditure of the low-income group in Malaysia was analysed. The health expenditure for the population was categorised into three categories, namely Item 1, Item 2, and Item 3.

The details of the three items listed in Table 2 are as follows:

1. The first item (Item 1) represents the expenditure on medical appliances, equipment, and products. For example, the items in this category are healthcare or medical products (such as a condom, first aid kit, and pregnancy test kit), pharmaceutical products (prescription medicine or without prescription medicine including traditional medicine), and therapeutic appliances and equipment (dentures, hearing aid, and spectacles).

2. The second item (Item 2) represents outpatient services such as dental services, medical services, or paramedical services (the outpatient services include treatment and medicine at both government outpatient and private clinics).

3. The third item (Item 3) represents hospital services, particularly in-patient hospitalisation. This includes the expenditure spent on hospitalisation fees at both government and private hospitals including the specialist consultation fees.

Table 2

Health expenditure items

Item 1	Medical appliances, equipment, and products
Item 2	Outpatient services
Item 3	Hospital or in-patient services

Cluster Analysis

The clustering is based on several characteristics that are household income, household total expenditure, and the expenditure spent on Item 1, Item 2, and Item 3. Based on the cluster analysis, a three-cluster k-means solution with different vulnerability factors was recorded.

Table 3

Summary of living location, mean income, mean of total expenditure, and percentage of expenditure of three clusters

	Living location			Mean income (RM)	Mean of total expenditure (RM)	Percentage of expenditure (%)
	Urban (%)	Rural (%)	Total (% across the group)			
Group 1	532 (51.0)	511 (49.0)	1043 -42.7	RM2,227.00	RM1,867.00	83.8
Group 2	419 (46.9)	474 (53.1)	893 -36.6	RM1,636.00	RM1,478.60	90.4
Group 3	204 (40.2)	303 (59.8)	507 -20.8	RM1,027.70	RM1,027.10	99.9

The last column of Table 3, shows the percentage of expenditure variable, explaining the percentage of total expenditure over the income earned by the groups. As reported in Table 3, group 1 cluster is the group with the highest mean income and mean of total expenditure but the lowest percentage of expenditure with 83.8% in which 51% of that group living in the urban area and another 49% living in the rural area. As for group 2 and 3 clusters, more than 50% of households in both groups living in rural areas with 53.1% and 59.8%, respectively. Moreover, the mean income earned and the mean of total expenditure spent is higher for group 2 as compared to group 3. The most unexpected result is the percentage of expenditure for group 3, which is nearly 100% indicating the expenditure spent is as much as the income earned. Individuals in group 3 consist of 20.75% of the total individuals in this research.

In conjunction with Table 3, Table 4 shows the number of individuals with the highest education level for the three group clusters. 53.8% of the total individuals (51.7% secondary school; 2.1% tertiary) completed at least their secondary school education, 33.8% only completed their primary school education, and another 12.4% did not receive any formal education. Group 1 cluster is the group with the highest number of individuals receiving all three education levels and the lowest number of individuals not receiving any formal education. Group 3 cluster is the group without individuals receiving tertiary education and recorded the highest number of individuals without any formal education. With a total of 12.4% of individuals not receiving any formal education and another 33.8% only completed their primary school education, this number raises a concern. In developing countries like Malaysia, this should not be the case. How can a number

of individuals still miss the opportunity to get their education?

The activity status in this research describes what the individuals of the low-income population do for a living. As explained earlier, all individuals in this population were the heads of households.

Table 5 provides information concerning the activity status of male and female heads of households. The highest percentage of individuals in group 1 cluster was working for a living (89.1%), only 1.8% of them were housewives and 5.4% were pensioners.

Table 4

Highest education level for each cluster group

	Education			
	Primary school	Secondary school	Tertiary	No education
Group 1	309	624	37	73
Group 2	293	475	15	110
Group 3	223	162	0	120
Total (%)	852(33.8)	1261(51.7)	52(2.1)	303(12.4)

Table 5

Activity status for both male and female gender for all three-cluster groups

Activity status (%)	Group 1		Group 2		Group 3	
	Male	Female	Male	Female	Male	Female
Employer	1 (0.1)	1 (0.1)	5 (0.6)	1 (0.1)	2 (0.4)	0 (0.0)
Government servant	55 (5.3)	3 (0.3)	17 (1.9)	3 (0.3)	1 (0.2)	0 (0.0)
Private sector employee	451 (43.2)	77 (7.4)	350 (39.2)	61 (6.8)	99 (19.5)	32 (6.3)
Self-employed	263 (25.2)	78 (7.5)	255 (28.6)	61 (6.8)	126 (24.9)	49 (9.7)
Housewife	2 (0.2)	17 (1.6)	7 (0.8)	40 (4.5)	4 (0.8)	55 (10.8)
Pensioner	52 (5.0)	4 (0.4)	34 (3.8)	5 (0.6)	14(2.8)	3 (0.6)
Others	28(2.7)	11 (1.1)	34 (3.8)	20 (2.2)	65 (12.8)	57 (11.2)
Total sample	1043		893		505	

For group 2 cluster, 84.3% of the individual was working for a living, 5.3% of them were housewives or not working for a living, and 4.4% were pensioners. Concerning group 3 cluster, only 60.9% of the individuals were working for a living and a high percentage of 11.6% of the individual were housewives or heads of households not working for a living in which 10.8% were female. Thus, with a total of 125 (5.1% from the total heads of household) not working for a living, how did this small group of individuals make sure their survivability and their family? Did they just

wait for financial aid from the government? What had the government done to help this group of non-working individuals of the low-income population?

Figure 1 presents the expenditure by item for all three group clusters. The list of expenditure items is illustrated in Table 2. The expenditure of each item in all item groups is filtered from expenditure data sets and summed up according to expenditure spent for (1) medical appliances, equipment, and products, (2) outpatient services, and (3) hospital or in-patient services. From the total expenditure of 3 item groups, the mean for each item is calculated. For Item 1 (medical appliances, equipment, and products), group 1 cluster spent the highest for this item with a mean of RM25, while both group 2 and 3 clusters spending was not much different with the amount of RM17 and RM16, respectively. Concerning Item 2 (outpatient services), group 1 and 2 clusters spent

nearly the same amount of RM8 and RM 7, a difference of just RM1, while group 3 cluster spent only RM5 for this item. Lastly, for Item 3 (hospital services or in-patient), the group 2 cluster recorded the highest spending on this item while group 1 and 3 clusters spent RM2 and RM1, respectively.

Why did group 1 and 3 spend less on Item 3? If we compare the education level and working sector, individuals in group 1 cluster were most likely able to get a healthy meal and having awareness concerning the importance of stay healthy, hence spending less on the hospital or in-patient services. While the low spending on Item 3 by group 3 cluster may be due to earning low income and can only afford to go to the government hospital since the registration fee is just RM1. It can be seen that, throughout this paper, the overall B40 population in Malaysia still has a low education level as half of the individuals from this population
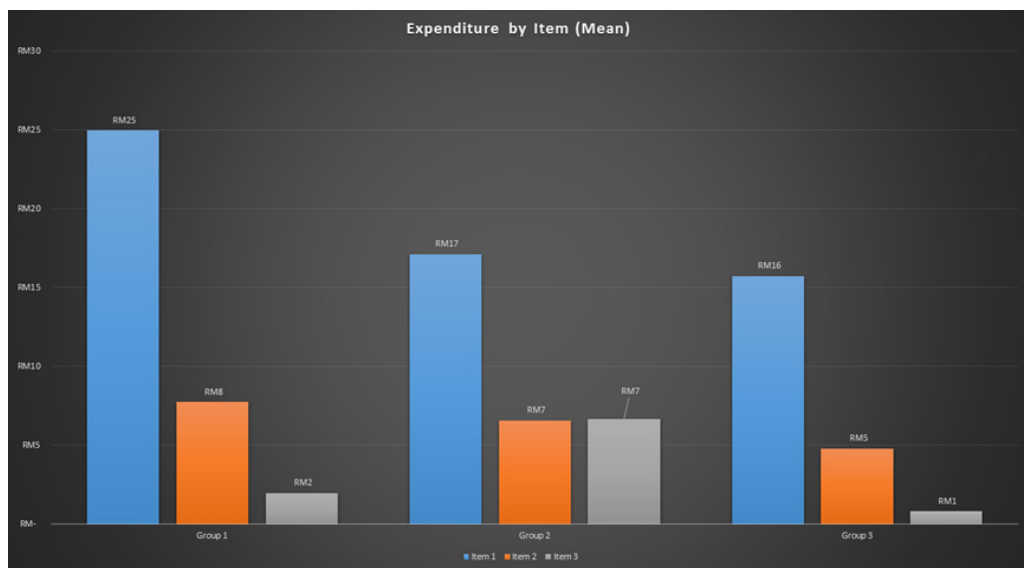

Figure 1. Graph of expenditure by item for each group cluster

only completed primary school education, and 12.4% of this population did not even have the opportunity to get a formal education. Hence, the low education levels of the low-income population may result in low quality of life, thus, put this group in the same level of life over generations. Furthermore, throughout this research, we have established a three-cluster k-means solution with different health vulnerabilities and other multiple vulnerability factors. We have determined the group 1 cluster as the less vulnerable group, group 2 cluster as the intermediate, and group 3 cluster as the highly vulnerable group.

Based on the cluster analysis, it is found that, despite having the lowest income of RM1027.70 as reported in Table 3, the group 3 cluster had the highest percentage of expenditure to the ratio of their mean income of 99.9%. This means with a mean of just RM0.60 excess of the income, they were not making any saving or the rising cost of living stopped them from having any extra money. Moreover, 120 from a total of 505 individuals in group 3 cluster did not receive any formal education and there was no individual from this group even further their study to the tertiary level. Having the highest percentage of heads of households not working for a living (11.6%) with the majority of them were female (10.8%), the group 3 cluster is the group that the government or private organisations should be focusing on. Furthermore, among the three group clusters, the group 3 cluster spent the lowest on their health expenditure item. Are the items not affordable too? Were they not receiving enough awareness concerning health issues? These findings have been supported by several actions and reports by the Malaysian government as reported by Fong (2019), Jalil (2019), and Lum (2019). Lum (2019) reported that the healthcare expenditure would continue to rise due to the ageing population, double burden of non-communicable and infectious diseases, increasing patient demands, new technologies, and unrestrained role of middlemen in healthcare. While Fong (2019) reported that the government had launched the operational test phase of health protection plan Peduli Kesihatan scheme for B40 (PeKa B40) in which the scheme would be focusing on health screening for those aged 50 and above of the B40 group receiving Bantuan Sara Hidup (BSH), including their spouses. The benefits include health screening, payment-incentive of RM1,000 upon completion of cancer treatment, purchasing of medical devices up to a maximum of RM20,000, and transport allowance of up to RM500 for Peninsular Malaysia and RM1,000 for Sabah and Sarawak.

Jalil (2019) reported that the government had increased 6.6% allocation in healthcare to RM30.6 billion from 2018's RM28.7 billion as outlined in Budget 2020 and extended to cover 45 illnesses from the existing three for the low-income groups, particularly B40 group, and upgrading the healthcare system such as mySalam's scheme.

Nora Muda, Anisa Mohammad Azahari, Faridatulazna Ahmad Shahabuddin, Zamira Hasanah Zamzuri,
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CONCLUSIONS

This paper aims at explaining the health-related expenditure patterns and the characteristics of low-income household (B40) in Malaysia, to identify the health vulnerability factors through the k-means clustering algorithm on the three expenditure variables, namely (1) medical appliances, equipment, and products, (2) outpatient services, and (3) hospital or in-patient services; three distinct clusters are identified. Consistently in all three clusters, the highest amount of money was spent on medical products, followed by the outpatient and then the inpatient services. Group 3 cluster was identified as the most vulnerable group in which the mean value of expenditure spent was the lowest among all three variables, i.e. 99.9% (RM1027.70) spending of the income. Their health expenditure was also the lowest in which the average expenditure on medication, outpatient, and in-patient services were only RM16, RM5, and RM1, respectively. The group 3 cluster household's characteristics were the most vulnerable with the majority of them having low or no education at all, lived in rural areas, no savings, and mostly were housewives and self-employed. Group 2 cluster is the intermediate group while group 1 cluster was the least vulnerable based on the health expenditure patterns and household characteristics.

Emphasising group 3 cluster identified as the most vulnerable group, it was observed that this group is also vulnerable in other factors, for example, education and income. It was also observed that as the vulnerability factors improved, health vulnerability is also improved. These vulnerability factors are identified as activity status, education, and head of the household gender. Further analysis is required to verify the relationship between these factors and health vulnerability and to be reported in the future since all of the households are categorised as low-income earners in Malaysia. It is an alarming situation that the health vulnerability condition does exist in this country. The authorities should give more attention to these groups, particularly the most vulnerable ones, and prioritise them for better healthcare accessibility and policymaking. Perhaps, this study can contribute as an eye-opener in the economic and social status of Malaysian households to help policymakers in planning the future of our nation.

ACKNOWLEDGEMENTS

REFERENCES

Anderson, G. F., Frogner, B. K., Johns, R. A., & Reinhardt, U. E. (2006). Health care spending and use of information technology in OECD countries: The United States is an outlier in both its health spending and its use of health information technology. *Health Affairs, 25*(3), 819-831.

Braveman, P., & Gottlieb, L. (2014). The social determinants of health: It's time to consider the causes of the causes. *Public Health Report, 129*(2), 19-31.

Department of Statistics Malaysia. (2017). *Household income and basic amenities survey report 2016.* Retrieved January 12, 2019, from https://www.dosm.gov.my/v1/

Fong, L. F. (2019, May 2). Steady hands for nation's healthcare. *The Star Online.* Retrieved May 15, 2019, from https://www.thestar.com.my/news/nation/2019/05/02/steady-hands-for-nations-healthcare

Frost & Sullivan Inc. (2016, January 27). *Malaysia – The 20 by 2020 inevitability.* Retrieved May 15, 2019, from https://ww2.frost.com/news/press-releases/frost-sullivan-malaysia-20-2020

Grabovschi, C., Loignon, C., & Fortin, M. (2013). Mapping the concept of vulnerability related to health care disparities: A scoping review. *BMC Health Services Research, 13*(94), 1-11.

Jalil, A. (2019, October 14). Healthcare should be more than just for B40. *The Malaysian Reserve.* Retrieved December 6, 2019, from https://themalaysianreserve.com/2019/10/14/healthcare-should-be-more-than-just-for-b40/

Lum, M. (2019, January 9). An outlook on the Malaysian healthcare scene for 2019. *The Star Online.* Retrieved December 6, 2019, from https://www.thestar.com.my/lifestyle/health/2019/01/09/malaysian-healthcare-scene-2019

Mechanic, D., & Tanner, J. (2007). Vulnerable people, groups, and population: Societal view. *Health Affair, 26*(5), 1220-1230.

Rashid N. K. A., Sulaiman N. F. C., & Rahizal N. A. (2018). Survivability through basic needs consumption among Muslim households B40, M40 and T20 income groups. *Pertanika Journal of Social Sciences & Humanities, 26*(2), 985-998.

Organisation for Economic Cooperation and Development. (2017). *Health expenditure.* Retrieved December 6, 2019, from http://www.oecd.org/els/health-systems/health-expenditure.htm

Shahar, S., Lau, H., Puteh, S. E. W., Amara, S., & Norizan, A. R. (2019). Health, access and nutritional issues among low-income population in Malaysia: Introductory note. *BMC Public Health, 19*(552), 1-5. doi:10.1186/s12889-019-6852-8

Quek, D. (2014). *The Malaysian health care system: A review.* Retrieved December 6, 2019, from https://www.researchgate.net/publication/237409933_The_Malaysian_Health_Care_System_A_Review

World Health Organization. (2002). *Environmental health in emergencies and disasters: A practical guide.* Retrieved December 6, 2019, from http://www.who.int/iris/handle/10665/42561

Xu, K., Evans, D. B., Carrin, G., Aguilar-Rivera, A. M., Musgrove, P., & Evans, T. (2007). Protecting households from catastrophic health spending: Moving away from out-of-pocket health care payments to prepayment mechanisms is the key to reducing financial catastrophe. *Health Affairs, 26*(4), 972-983.