ORIGINAL ARTICLE

Factors Contributing to Non-Communicable Diseases in a Selected Low Socio-Economic Status Community in Kedah, Malaysia

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ABSTRACT

Introduction: Non-communicable diseases (NCDs) are evolving as the leading cause of death worldwide, including in Malaysia. Changes in a socio-economic status have increased at-risk populations with NCDs. The objective of this study is to describe the prevalence of self-reported NCDs and its contributing factors in a selected low socio-economic status community in Kedah, Malaysia. **Methods:** A cross-sectional study with a self-administered questionnaire was done among convenience samples of 139 adults (age more than 18 years old) living in a selected low socio-economic status community in Kedah. **Results:** Among 139 respondents with a mean (SD) age 48.5 (13.1), there were 40.3% of respondents reported to have chronic illnesses with a prevalence of hypertension (25.9%), diabetes mellitus (21.6%), hypercholesterolemia (7.2%), chronic respiratory diseases (5.0%), heart disease (2.9%) and stroke (1.4%). The significant contributing factors of NCDs by multiple logistic regression were age, marital and working status. A person with an increase in 1 year of age has 1.05 times the odds to have NCDs (95% CI: 1.01 to 1.09, p-value=0.007). A divorcee has 3.55 times the odds compared to a married person to have NCDs (95% CI: 1.28 to 9.80, p-value=0.015). The non-working individual has 2.27 times the odds compared to working individuals to have NCDs (95% CI: 1.03 to 5.01, p-value=0.042). **Conclusion:** The prevalence of NCDs is high in this selected low socio-economic status community. The contributing factors are age, marital and working status.

Keywords: Contributing factors, Low socioeconomic status, Non-communicable diseases

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INTRODUCTION

Non-communicable disease (NCD) threatens the health and life of a million people in the world. Approximately 79% of all death contributed by NCD happened in developing countries (1). In Malaysia, NCD contributed 73% of total deaths and 35% of death occur in the working population (2). National Health and Morbidity Surveys (NHMS) revealed an uptrend for all NCD risk factors. For the year 2019, NHMS had shown that for adult aged 18 years and beyond, the prevalence of overall high blood cholesterol was 38.1%, either overweight or obesity (50.1%), high blood pressure (30.0%) and high blood sugar(18.3%) (3).

Malaysia now has an increased at-risk population. Extra alarmingly, the children are also exposed to the risk of NCD by exposure to unhealthy diets, excessive alcohol consumption, smoking, lacks of exercise as well as a stressful lifestyle (4). Malaysia's healthcare delivery is having the pressure to provide quality management to all NCDs patients with their various complications. A high proportion of Malaysians with undiagnosed NCDs leads to late diagnosis and contributes to the development of complications which is hard and expensive to manage (3). This will add to the cumulative burden of NCDs in Malaysia.

The association between the socio-economic status of individuals and the population and their health is well established (5). Functional limitations and morbidity before age 75 are both absolutely and relatively concentrated in the lower socio-economic status (6). People in lower socio-economic groups had a higher level of having cardiovascular risk factors and they are more possible to become obese, be a smoker, and more exposed to other behavioral risk factors (7). More efforts

targeting modifiable behavioral risk factors among the underprivileged groups can play a significant role in promoting healthier lifestyles, giving individuals better choices, and decreasing health inequalities.

Kedah is situated at the northern tip of Peninsular Malaysia, which covers a total area of over 9,500 km2 and a population of 1,890,098. Kedah is bordering with Perlis to the north and also shares an international boundary with Thailand. It borders the states of Perak to the south and Penang to the southwest. Kedah is one of the less advanced and poorer states in Malaysia because of the low industrial development base. This leads to low gross monthly family income that is 40 percent fewer than the Malaysian mean level (8). PPR (Projek Perumahan Rakyat or 'Citizen's Housing Project') is a public housing project located in Paya Nahu, Kedah. Only those who had been identified as having low socioeconomic status or being poor, based on qualifications can inhabit this housing area (9).

Drastic urban development changes from 3.1% in the year 2000 to 24.1% in the year 2013 has brought social afflictions to this community (10). Urbanization also related to NCDs in many ways. There is a shift from strenuous work in agronomy to work that needs fewer energy expenditures. Urban people relied on motorized transport and having sedentary recreation. These result in lower physical activities. The accessibility of high-calorie processed food is greater in urban areas compared to the countryside. These are the significant risk factor for NCDs (11). The effect of urbanization on the NCDs prevalence and its contributing factors in the Paya Nahu community was not known. In addition to the low socio-economic status of this community, they are more susceptible to develop NCDs. Therefore, this study's objective is to determine the prevalence and contributing factors of non-communicable diseases in a selected low socio-economic status community in Kedah, Malaysia.

MATERIALS AND METHODS

Research Methodology
This was a cross-sectional study steered during a health promotion activity in Paya Nahu Kedah on 20th April 2019. The reference population was the low socio-economic status of people in Sungai Petani, Kedah. The source population was people living in Paya Nahu Flats. The sampling frame was the list of people living in Paya Nahu flats. Convenience sampling was used whereby the people who were attending the health promotion activities and fulfilled the study criteria would be selected. There was considerable similarity between the result obtained from nationally representative population-based samples and convenience samples (12).

The inclusion criteria were those aged 18 years old and older, and a Malaysian citizen. Must be a resident in Paya Nahu flats. The exclusion criteria were those who were incapable to understand either Bahasa Melayu or English.

Single proportion formula was used to calculate the sample size. With the prevalence of hypertension p= 0.375 (4) and precision= 0.1, z =1.96 (95% confidence interval). After considering a 30% drop out rate, the total subjects needed were 117.

Research Tools
A proforma consists of socio-demographic characteristic questions and a question "Do you have any chronic illness?". If yes, the participants are required to tick whether they have Diabetes Mellitus, Hypertension, Heart Disease, Stroke, Chronic Respiratory Diseases, or other diseases. For other diseases, they are required to specify the disease(s) by writing it in the provided column. For this survey, the "chronic illness" was defined as self-reported of being diagnosed to have the illness by a medical assistant or a doctor.

Data Collection
The announcement of health promotion activity that would be carried out in the community of Paya Nahu was made two months beforehand. The research team and the community leaders conducted a health promotion activity at one of the 15 blocks (total of 3400 residents) in Paya Nahu flats. Health promotion activities consist of health talks, health screening (Body Mass Index, blood pressure, dental check-up and random capillary blood glucose) and exercise. On the day of health promotion activity, participants were required to register and attend all the activities. One of the activities was to answer the survey questions. Written consent was obtained from those who volunteered to answer the survey questions. Participants who were unable to read were interviewed face to face. Participants were given a token of appreciation and a lunch coupon after completing the survey.

Analysis of statistical
SPSS software version 24 (13) was used to analyze the data. Descriptive statistics were used to analyze the demographic characteristics and prevalence of non-communicable diseases. Two binary outcome variables were defined for the prevalence of chronic illness. These were the 'absence' of chronic illness (coded as '0') or 'presence' of chronic illness (coded as '1'). The chronic illnesses were diabetes mellitus, hypertension, heart disease, stroke, hyperlipidemia, chronic respiratory diseases or other diseases. Contributing factors were determined by multiple logistic regression, where the outcome variable was non-communicable disease status (YES/NO) and the independent variables were the socio-demography characteristic (age, gender, race, smoking status, marital status, number of children, education level, working status and income level). Univariate

analysis (Simple logistic regression) was conducted for each independent variable. Normality was checked for the age variable and it was normally distributed. No missing data as the authors will check the completeness of the form before giving the token of appreciation to each participant. The significant level was set at P-value <0.05 and the confidence interval was set at 95%.

RESULTS

Socio-demography of respondents
Four hundred people (11.8% of total residents) attended the health promotion activity. A total of 139 residents took part in this study. Their mean (SD) age was 48.5 (13.1) years old. The majority of them were females (90.6%) and Malays (92,1%). More than half were married (71.2%), had a medium education level (67.6%), and not working or housewives (58.3%). According to the Department of Statistic Malaysia, the B40 group in the household with a monthly earning of RM4850 (14). As all the participants' household earnings were below RM3000, the author had regrouped the household income as either below or above RM1000 for ease of further analysis. 86.3% of the respondents had an income of less than RM1000/month. As the majority of the respondents were females, the prevalence of smoking was low (8.6%) but 53.8% of male respondents were smokers. The characteristics were shown in Table I.

Prevalence of non-communicable diseases
There were 40.3% of respondents reported having chronic illnesses with a prevalence of hypertension (25.9%), diabetes mellitus (21.6%), hypercholesterolemia (7.2%), chronic respiratory diseases (5.0%), heart disease (2.9%) and stroke (1.4%). The results were shown in Table II.

Table I: Socio-demography characteristic of the respondents (n=139)

Variables	Frequency (%)	Mean (SD)
Age (years)		48.5(13.1)
Gender		
Male	13(9.4)	
Female	126(90.6)	
Race		
Malay	128(92.1)	
Non-Malay	11(7.9)	
Marital status		
Married	99(71.2)	
Single	10(7.2)	
Divorcee	30(21.6)	
Education level		
High	5(3.6)	
Medium	94(67.6)	
Low	40(28.8)	
Working status		
Working	58(41.7)	
Not working	81(58.3)	
Income		
≥1000	19(13.7)	
<1000	120(86.3)	
Smoking status		
No	127(91.4)	
Yes	12(8.6)	

Table II: Prevalence of Non-communicable Diseases (NCDs) in a selected low socio-economic status community in Kedah Malaysia (n=139)

Variables	Frequency (%)
Prevalence of NCDs	56(40.3)*
Hypertension	36(25.9)
Diabetes Mellitus	30(21.6)
Hypercholesterolemia	10(7.2)
Chronic respiratory diseases	7(5.0)
Heart Disease	4(2.9)
Stroke	2(1.4)

*A person can more than one NCDs

Contributing factors
The significant contributing factors of NCDs by multiple logistic regression were age, marital, and working status. A person with an increase in one year of age has 1.05 times the odds to have NCDs (95% CI: 1.01 to 1.09, p-value=0.007). A divorcee has 3.55 times the odds compared to a married person to have NCDs (95% CI: 1.28 to 9.80, p-value=0.015). A non-working individual has 2.27 times the odds compared to working individuals to have NCDs (95% CI: 1.03 to 5.01, p-value=0.042). The results were shown in Table III.

DISCUSSION

The prevalence of non-communicable diseases in this current study was 40.3%. It showed that 4 in 10 individuals in this community have at least one chronic disease. This finding was contradicted with the study

Table III: Factors Contributing to Non-communicable Diseases (NCDs) among selected low socio-economic status community in Kedah, Malaysia by Multiple Logistic Regression (n=139)

Variables	(b)[a]	Adjusted OR[b] (95% CI)[c]	Wald statistic	P value[d]
Age	0.048	1.05 (1.01,1.09)	7.303	0.007
Marital status				
Married		1		
Single	0.433	1.54 (0.31,7.68)	0.279	0.134
Divorcee	1.266	3.55 (1.28,9.80)	5.946	0.015
Working status				
Working		1		
Not working	0.821	2.27 (1.03,5.01)	4.153	0.042

Constant= - 3.448
a b regression coefficient
b badjusted odds ratio
c 95% confident interval
d p value MLR <0.05 significant Interaction checked and not found
Hosmer-Lemeshow test (p=0.097) Classification table (71.9%)
Area under ROC curve =78%

from India where they found less prevalence for all NCDs when the diagnosis was based on self-claim in a low socio-economic status community and urban poor (13.8%) in Southern India (10,11). They concluded that the poor have significant problems of reaching to healthcare to get an NCD diagnosis. This leads to the under-reporting of diseases among the poor. The current study will show the prevalence of more than 40% if this concept is applied.

Among all NCDs, hypertension had the highest prevalence in this community with 25.9%. It was higher than the overall prevalence of known hypertension in Malaysia (13.1%,) urban areas (13.2%), Kedah state in 2015 (14.3%), and Southern India (10.0%) (2,10). Paya Nahu community had a lower prevalence of hypertension compared to an urban poor population in Ghana (28.3%), Singapore (26.6%), Thailand (32.8%), and Indonesia (47.8%). (16–19) Over the past 10 years, the prevalence of hypertension had increased in economically developing countries to approximately 30% (19).

The second highest prevalence of NCD was Diabetes Mellitus (21.6%). It was also higher than the prevalence of diabetes mellitus patients in Malaysia (8.3%), urban areas (8.7%), and Kedah state in 2015 (9.3%) (2). Due to rapid rates of urbanization and industrialization, WHO estimates 150 million people will have diabetes by 2025 (20).

Our study demonstrated that the Paya Nahu community had a prevalence of 7.2% for hypercholesterolemia. It was lower than the prevalence of individuals with known hypercholesterolemia in Malaysia that was 13.5% (3). WHO Global Health Observatory Data 2008 projected that the worldwide prevalence of hypercholesterolemia among adults was also higher (39%) with southeast Asia reporting a prevalence of 29% (21). In this current study, the prevalence of hypercholesterolemia in the Paya Nahu community was determined based on self-reported cases. Thus, the lower prevalence of hypercholesterolemia in this community might be due to underreporting by the residences. Based on the Korean study, the validity and reliability of the self-reported data on hypercholesterolemia among older adults are relatively poor as compared to measured data obtained through the objective measurement of cholesterol level in the blood (22). In other studies based on the Portuguese National Health Examination Survey, socio-economic status and younger age are among the factors identified to contribute to the lower sensitivity of self-reporting of hypercholesterolemia in the population (23). Low socioeconomic status and the high proportion of young residence probably contribute to the low awareness level about the disease, hence lead to underreporting of hypercholesterolemia in the Paya Nahu community. This is supported by established evidence that the lower level of awareness of hypercholesterolemia in Malaysia

is observed more frequently among those who are living in a rural area, unemployed, and receive no formal education (24).

This community had a prevalence of 5.0% for chronic lung disease which is slightly similar to the model projection by the Global Burden of Disease Study (25). According to the data published by WHO in 2017, there were 3.64% of total deaths in Malaysia due to lung disease (26). It was reported that 80% of the total burden in developing countries is accounted for chronic disease including chronic lung disease (27). Chronic lung disease such as chronic obstructive lung disease is currently ubiquitous around the world which is mostly due to tobacco smoking (28). In a previous study conducted among 1218 individuals in Malaysia, it was found that instead of smoking, the usage of biomass fuel and exposure to dust jobs may also increase the risk of having chronic lung disease (29).

The National Health and Morbidity Survey (NHMS) shows that cardiovascular disease (CVD) is an essential cause of morbidity and mortality in Malaysia (30). Hypertension, hypercholesterolemia, diabetes mellitus, obesity, and smoking were the associated risk factors for CVD that have been on in increasing trend (31). In this study, there is a low prevalence of heart disease but high in hypertension, diabetes mellitus, and hypercholesterolemia, making them at higher risk of getting a heart disease. Meanwhile, the National Register of Cardiovascular Diseases - Acute Coronary Syndrome (NCVD-ACS) has reported that Malaysians suffer from heart disease at a younger age compared to the neighboring countries (32). This indicates a need for implementation on increasing public awareness of CVD and educating on the importance of knowing their CVD risk especially those with chronic illness and young age. Stroke is a worldwide health problem that contributes to the main cause of morbidity and mortality for both developing and developed countries. It is a serious problem in Asia (60% of the world population) and most of the countries are "developing" economies (33). In Malaysia, stroke is listed as the third most important cause of mortality for males, after ischaemic heart disease and pneumonia, while it was ranked second in the year 2009 for females after ischaemic heart disease (34). There was 67 per 100,000 persons overall age-standardized stroke incidence in the South West District of Penang Island, 23.7% were recurrent strokes and 53.1% were males. These were the finding from the first stroke incidence study in Malaysia (35). In the current study, only 1.4% of respondents reported having a stroke. Stroke patients in Malaysia were generally younger where the mean age of its beginning was between 54.5 and 62.6 years old (36). Male sex, genetics and increasing age are non-modifiable risk factors for stroke. Hypertension continues as the most frequent medical risk factor for stroke, whereas inactivity current and smoking are the most prevalent among modifiable risk factors (33).

Out of the nine contributing factors tested in this study, three factors were significantly associated with the prevalence of NCDs. The first contributing factor was age. Age is a non-modifiable risk factor for NCDs. The aging of populations, mainly due to increasing child survival and falling fertility rates, is the underlying determinant of non-communicable disease epidemics (37). A study by Patrick Heuveline, Davidson R Gwatkin, Michel Guillot on the burden of disease among the worldwide poor found that greater prevalence of non-communicable diseases amongst the poor than amongst the rich across all ages (38). In this current study, the mean age of the respondent was 48.5 years old. This was the age where non-communicable diseases started to occur in an individual.

The second contributing factor is marital status. Divorcees have a higher chance to have NCDs. In India, NCD prevalence reduces significantly among never married but rises very sharply among widowed (11). The increase of NCD in this group is explained by the stigma attached to divorce and widowhood, lack of community and family support.

The third contributing factor is the working status. Non-working individuals are having a higher chance to get NCDs. This might relate to a lack of money to buy healthy food and to lead a healthy lifestyle. A study found that a reversal of socio-economic slope with people living below the poverty line at a significantly more chance of reporting chronic conditions than rich people (15). As the majority of respondents in this current study living below the poverty line, this explained the high prevalence of NCDs in this community.

NCDs are strongly related to poverty and the level of development in an area or country. Poor people have the utmost vulnerability and least resilience and capacity to deal with NCDs (39).Urbanization also contributes to the rising of NCDs. Frequently these new urbanites are the underprivileged looking for a better life. Lifestyle changes that accompany this move put people at a bigger risk for NCDs because of reduced physical activity, more eating of energy-rich foods and little access to an active lifestyle (40).

There are several recommendations to reduce the prevalence of NCDs among this population. The first is to improve service provision in government health facilities. By this method, the treatment for chronic conditions for the urban poor will be improved. The second recommendation is to improve the socioeconomic status of this population. Increasing socioeconomic status will make this community less vulnerable to the development of NCDs.

The third recommendation is to use a life course approach as suggested by WHO. This approach will target children, youth and future generations with a focus on vulnerable groups. The life-course interventions focus on a healthy start to life. The specific interventions focus on the needs of people at a critical point in their lifetime. This will increase the effectiveness of the intervention. Hopefully, by these important steps, the NCD prevalence can be reduced in this population. Further study should be conducted to test hypotheses that may explain the effective intervention for this population.

CONCLUSION

The prevalence of NCDs is high in this population. The present data have shown that increasing age, divorcees, and the non-working individual will be riskier to NCD. The lack of financial support among non-working individuals and lack of significant social support among divorcees may lead to the increasing disease among these populations. These findings indicate a need for health promotion and health action for early diagnosis in these high-risk populations which should not be neglected if the government wants to reduce the NCDs related burden.

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REFERENCES

1. Puska P, Nissinen A, Shao R, Sarraf-Zadegan N. The Protocol for the WHO study on the effectiveness of community-based programmes for NCD prevention and control (COMPASS) Noncommunicable Diseases and Mental Health World Health Organization. 2003;1–71.
2. Institute for Public Health. National Health and Morbidity Survey 2015. Volume II: Non-Communicable Diseases, Risk Factors and Other Health Problems. 2015;
3. Institute for Public Health. National Health and Morbidity Survey 2019 Non-communicable diseases, healthcare demand and health literacy. Vol. 035. 2019.
4. Institut for Public Health. National Health and Morbidity Survey 2015 (NHMS 2015). 2015;
5. Lynch J, Kaplan G. Socioeconomic position [Internet]. 2000 [cited 2020 Jun 7]. Available from: https://books.google.com/books?hl=en&lr=&id=i0qWxy5X1gC&oi=fnd&pg=PA13&dq=Socioeconomic+position:+Social+epidemiology.+New+York&ots=NJY36eqqb7&sig=6dgwm171Ywg0sC8FFeOvXOhyei8

6. House JS, Kessler RC, Regula Herzog A. Age, Socioeconomic Status, and Health [Internet]. Vol. 68, The Milbank Quarterly. 1990 [cited 2020 Jun 7]. Available from: https://www.jstor.org/stable/3350111

7. Yu Z, Nissinen A, Vartiainen E, Song G, Guo Z, Zheng G, et al. Associations between socioeconomic status and cardiovascular risk factors in an urban population in China. Bull World Health Organ [Internet]. 2000 [cited 2020 Jun 7];78(11):1296–305. Available from: https://www.scielosp.org/article/bwho/2000.v78n11/1296-1305/en/

8. Liu A. Tourism in Rural Areas. Tour Manag [Internet]. 2006 [cited 2020 Jun 7];27:878–89. Available from: https://www.sciencedirect.com/science/article/pii/S0261517705000567

9. Omar N, Hajar S, Ah AB. Poor Children in Malaysia: Their Index of Objective Well-being [Internet]. Vol. 17, Southeast Asia: A Multidisciplinary Journal. 2017 [cited 2020 Jun 7]. Available from: http://fass.ubd.edu.bn/SEA/vol17/SEA-v17-Noralina.pdf

10. Noor MM, Mansor NS. Ethnicity, development, crimes and conflict in a multi-ethnic urban setting in Malaysia: Trans-border sociological and GIS analyses of urban society. In: WIT Transactions on Ecology and the Environment [Internet]. 2017 [cited 2020 Jun 7]. p. 359–67. Available from: www.witpress.com,

11. Yadav P, Kulkarni V, Gaiha R. Growing Burden of Non-Communicable Diseases in India. Popul Cent Work Pap [Internet]. 2018 [cited 2020 Jun 8]; Available from: https://repository.upenn.edu/psc_publications

12. Mullinix KJ, Leeper TJ, Druckman JN, Freese J. The Generalizability of Survey Experiments. J Exp Polit Sci. 2015;2(2):109–38.

13. IBM Corporation. SPSS for Windows. IBM Corp Armork, NY; 2016.

14. Department of Statistics Malaysia Official Portal [Internet]. [cited 2020 Aug 12]. Available from: https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=120&bul_id=TU00TmRhQ1N5TUxHVWN0T2VjbXJYZz09&menu_id=amVoWU54UTl0a21NWmdhMjFMMWcyZz09

15. Bhojani U, Beerenahalli TS, Devadasan R, Munegowda CM, Devadasan N, Criel B, et al. No longer diseases of the wealthy: prevalence and health-seeking for self-reported chronic conditions among urban poor in Southern India. BMC Health Serv Res. 2013;13:306.

16. Aekplakorn W, Abbott-Klafter, Jesse, c; Khonputsa, Panrasri; Tatsanavivat, Pyatat; Chongsuvivatwong, Virasakdi; Chariyalertsak, Suwat; Sangwatanaroj, Somkiat; Tiptaradol, Siriwat; Lim SS. Prevalence and management of prehypertension and hypertension by geographic regions of Thailand: the Third National Health Examination Survey, 2004. J Hypertens [Internet]. 2008 [cited 2020 Jun 7];26(2):191–8. Available from: https://journals.lww.com/jhypertension/Fulltext/2008/02000/Worldwide_prevalence_of_hypertension___a.9.aspx

17. Awuah RB, Anarfi JK, Agyemang C, Ogedegbe G, De-Graft Aikins A. Prevalence, awareness, treatment and control of hypertension in urban poor communities in Accra, Ghana. J Hypertens. 2014;32(6):1203–10.

18. Hussain MA, Al Mamun A, Reid C, Huxley RR. Prevalence, awareness, treatment and control of hypertension in Indonesian adults aged ≥40 years: Findings from the Indonesia Family Life Survey (IFLS). PLoS One. 2016;11(8):1–16.

19. Kearney PM, Whelton M, Reynolds K, Whelton PK, He J. Worldwide prevalence of hypertension: A systematic review [Internet]. Vol. 22, Journal of Hypertension. 2004 [cited 2020 Jun 7].p.119. Available from: https://journals.lww.com/jhypertension/Abstract/2004/01000/Worldwide_prevalence_of_hypertension___a.3.aspx

20. Cockram C. The epidemiology of diabetes mellitus in the Asia-Pacific region [Internet]. Hong Kong Medical Journal. 2000 [cited 2020 Jun 7]. Available from: https://www.hkmj.org/system/files/hkm0003p43.pdf

21. World Health Organization. WHO | Raised cholesterol. WHO. World Health Organization; 2015.

22. Chun H, Kim IH, Min KD. Accuracy of Self-reported Hypertension, Diabetes, and Hypercholesterolemia: Analysis of a Representative Sample of Korean Older Adults. Osong Public Heal Res Perspect [Internet]. 2016 [cited 2020 Jun 7];7(2):108–15. Available from: https://www.sciencedirect.com/science/article/pii/S2210909915300709

23. Kislaya I, Tolonen H, Rodrigues AP, Barreto M, Gil AP, Gaio V, et al. Differential self-report error by socioeconomic status in hypertension and hypercholesterolemia: INSEF 2015 study. Eur J Public Health [Internet]. 2019 [cited 2020 Jun 7];29(2):273–8. Available from: https://academic.oup.com/eurpub/article-abstract/29/2/273/5151187

24. Mat Rifin H, Robert Lourdes TG, Abdul Majid NL, Abd Hamid HA, Rodzlan Hasani WS, Ling MY, et al. Hypercholesterolemia Prevalence, Awareness, Treatment and Control among Adults in Malaysia: The 2015 National Health and Morbidity Survey, Malaysia. Glob J Health Sci [Internet]. 2018 [cited 2020 Jun 7];10(7):11. Available from: http://www.journaljammr.com/index.php/JAMMR/article/view/13704

25. Tan WC, Seale JP, Charaoenratanakul S, De Guia T, Ip M, Mahayiddin A, et al. COPD prevalence in 12 Asia-Pacific countries and regions: Projections based on the COPD prevalence estimation model. Respirology. 2003 Jun;8(2):192–8.

26. World Health Organization. World Health Statistics - Monitoring Health For The SDGs [Internet]. World Health Organization. 2016 [cited 2020 Jun 7]. p. 1.121. Available from: https://scholar.google.com/

scholar?hl=en&as_sdt=0%2C5&q=World+Health+Statistics+2017%3A+Monitoring+health+for+the+SDGs&btnG=

27. Abegunde DO, Mathers CD, Adam T, Ortegon M, Strong K. The burden and costs of chronic diseases in low-income and middle-income countries. Vol. 370, Lancet. 2007. p. 1929–38.

28. Rabe KF, Watz H. Chronic obstructive pulmonary disease. Vol. 389, The Lancet. Lancet Publishing Group; 2017. p. 1931–40.

29. Loh LC, Rashid A, Sholehah S, Gnatiuc L, Patel JH, Burney P. Low prevalence of obstructive lung disease in a suburban population of Malaysia: A BOLD collaborative study. Respirology. 2016 Aug 1;21(6):1055–61.

30. Chan YY, Teh CH, Lim KK, Lim KH, Yeo PS, Kee CC, et al. Lifestyle, chronic diseases and self-rated health among Malaysian adults: results from the 2011 National Health and Morbidity Survey (NHMS). BMC Public Health. 2015 Aug 6;15(1).

31. Seong AC, John CKM. A review of coronary artery disease research in Malaysia [Internet]. Vol. 71, Medical Journal of Malaysia. 2016 [cited 2020 Jun 7]. p. 42–57. Available from: http://www.e-mjm.org/2016/v71s1/coronary-artery-disease-research.pdf

32. Chin SP, Jeyaindran S, Azhari R, Azman WAW, Omar I, Robaayah Z, et al. Acute coronary syndrome (ACS) registry - Leading the charge for National Cardiovascular Disease (NCVD) Database. Med J Malaysia [Internet]. 2008 [cited 2020 Jun 7];63(SUPPL.C):2936.Availablefrom:https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=Acute+coronary+syndrome+%28ACS%29+registryleading+the+charge+for+National+Cardiovascular+Disease+%28NCVD%29+Database&btnG=

33. Venketasubramanian N, Yoon BW, Pandian J, Navarro JC. Stroke epidemiology in the south, east, and south-east Asia: A review [Internet]. Vol. 19, Journal of Stroke. 2017 [cited2020Jun7].p.286–94. Availablefrom https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5647629/

34. Loo KW, Gan SH. The burden of stroke in Malaysia. Int J Stroke. 2012 Feb;7(2):165–7.

35. Neelamegam M, Looi I, Cheah WK, Narayanan P, Abdul Hamid AM, Ong LM. Stroke incidence in the southwest district of Penang Island, Malaysia. PEARLs: Penang acute stroke research longitudinal study. Prev Med (Baltim) [Internet]. 2013 [cited 2020 Jun 7];57(SUPPL).Availablefrom:https://www.sciencedirect.com/science/article/pii/S0091743512006391

36. Kooi CW, Peng HC, Aziz ZA, Looi I. A review of stroke research in Malaysia from 2000 – 2014 [Internet]. Vol. 71, Medical Journal of Malaysia. 2016 [cited 2020 Jun 8]. p. 58–69. Available from: http://www.e-mjm.org/2016/v71s1/stroke-research.pdf

37. Beaglehole R, Yach D. Globalisation and the prevention and control of non-communicable disease: The neglected chronic diseases of adults. Lancet [Internet]. 2003 [cited 2020 Jun 8];362(9387):903–8. Available from: www.thelancet.com

38. Gwatkin DR, Guillot M HP. The burden of disease among the global poor. Vol. 354, Lancet. 1999. p. 586–9.

39. Nikolic IA, Stanciole AE, Zaydman M. Chronic Emergency : Why NCDs Matter [Internet].2011[cited2020Aug13]. Availablefrom:https://openknowledge.worldbank.org/handle/10986/13591

40. Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: A review of the literature [Internet]. Vol. 88, Circulation. 1993 [cited 2020 Aug 13]. p. 1973–98. Available from: http://ahajournals.org