ORIGINAL ARTICLE

Urban Health and the Prevalence of Non-Communicable Diseases in Malaysia

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ABSTRACT

Introduction: Urbanisation is a key determinant of population health. Malaysia's exemplary economic growth in the early 1990s and the consequent development and urbanisation led to significant changes in health, lifestyle and quality of life. Rising expectations, changing demographics and nutrition and disease transitions were challenges synonymous to an increasingly urban Malaysia. As the Government targets optimal population health, this paper aims to explore one of the many challenges of urbanisation, namely the prevalence of non-communicable diseases or NCDs. For the purpose of this paper, NCD is proxied by Diabetes Mellitus. **Methods:** This study is based the 2015 National Health and Morbidity Survey, which is a cross-sectional population-based survey, involving 30,000 respondents. Given the binomial nature of the survey variables, the multinomial Probit model was employed using the STATA statistical software. **Results:** Generally, age, gender and race are significant in determining health outcomes. Socioeconomically, all three variables of income, education and employment are significant. For lifestyle factors, findings show that only the weight and physically active status have a role in determining health outcomes. Finally, the urban variable is also positive and significant. **Conclusion:** Findings show that the prevalence of Diabetes Mellitus, is rising along with urbanisation and that there is a health penalty for the urban population and also for those who do not embrace healthy lifestyles. Additionally, other factors are equally important as urban health determinants, encompassing both the demographic and socioeconomic factors.

Keywords: Non-communicable Diseases, Diabetes Mellitus, Socioeconomic Factors, Lifestyle; Urbanisation

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INTRODUCTION

Health is a priority for individuals, communities, nations and even globally. It is a necessary condition, which among others, enables individuals to be better students, better employees and enjoy a better quality of life. Urbanisation plays an increasingly important role in population health, given that more than half the world population live in urban areas (1). Resource-constrained governments, especially in low- and middle-income countries where urbanisation is either in the initial or acceleration stage (2) are hard-pressed to meet the growing demand for infrastructure and services (3). Though overall, health improves from urbanisation through better sanitation and more accessible health services, conversely it affects population health through pollution, widening income inequalities and poor lifestyle (3,4).

Urban health risks, such as traffic accidents, violence and crime, poses serious threats to the health and wellbeing of the urban population and consequently to their financial wellbeing due to higher healthcare costs. Malaysians, in general, have enjoyed better health through better standards of living and longer life expectancy (Fig. 1). Urban population in Malaysia more than doubled within a space of five decades, from a mere 33% in 1970 to 75% by 2017 (United Nations Population Division. World Urbanization Prospects: 2018 Revision). This paper aims to establish if urbanisation has contributed to the increasing non-communicable diseases (NCDs) prevalence in urban areas. NCDs are currently the major cause of morbidity and mortality globally, causing about 70% of deaths worldwide while 80% of premature deaths are also attributed to NCDs (5). Rapid unplanned urbanisation, unhealthy diet, lack of physical activity, tobacco and alcohol consumption all give rise to NCD prevalence.

Urbanisation has brought about changes in lifestyle, diets, the way people work, commute and spend leisure time and these changes has a distinct impact on people's health and wellbeing (6,7). In Malaysia, NCDs caused the highest number of deaths, (including premature deaths) and disabilities than communicable

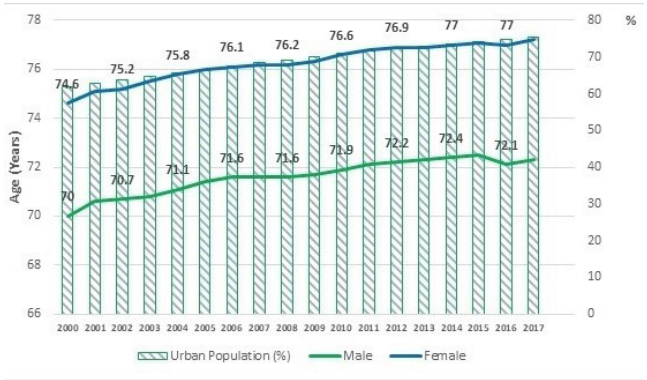

Figure 1: Urbanisation Rate and Life expectancy at birth by Gender, Malaysia, 2000 – 2017. Source: Population and Demographic Statistics Division, Department of Statistics, Malaysia; World Development Indicators (Updated: 11/14/2018)

diseases and injuries combined. It requires prolonged care and high treatment costs and curtails productivity and workforce efficiency. Between 1990 and 2017, risk of NCDs became increasingly prevalent in Malaysia (Fig. 2). The chart on the left depicts the sum of years of healthy life lost while the other is the death rate for every 100,000 people. Given the gravity of the situation, it is a priority to ascertain if NCDs are more prevalent in urban areas and to conceive appropriate remedial actions to address the same.

NCDs are a development challenge as its exorbitant treatment costs push people into poverty and the disabilities ensuing NCDs significantly lessens productivity, thus compromising workforce efficiency. Since it is a preventable condition, it is important for countries to establish the risks and predictors of NCDs. Risks related to NCDs are risks that can be eliminated and/or reduced effectively i.e. unhealthy diet, physical inactivity, tobacco use and alcohol abuse. According to the World Health Organisation, if these risks are eliminated, approximately 75% of global heart disease, stroke and type 2 diabetes could be prevented; and 40% of cancer would be prevented (8). Urbanisation creates an environment where disease can spread easily but the development and affluence that follow growth also provides the means for better cure and prevention (9). According to d Groot (10), Diabetes Mellitus was found to be more prevalent in urban areas at 11% compared to rural at 5% and hypertension also had the same trend at 25% and 12% respectively.

The health transition urban populations undergo involves changes in disease type, from communicable diseases to chronic diseases. Urban health transition entails changes in demography (receding fertility and mortality rates), type of risks (sanitation, pollution) and healthcare accessibility. Urbanisation affects all three elements, even health services where better facilities offer survival chances (11). Although there are numerous studies that link increasing health challenges with rising urbanisation, there are few which support the contrary (12,13).

MATERIALS AND METHODS

Data

This study employs data from the National Health and Morbidity Survey (NHMS) in 2015(14). It is a cross-sectional population study and its nationally-representative sample selection was based on the sampling frame provided by the Department of Statistics, Malaysia. The NHMS2015 was conducted to provide community-based health data and information, encompassing morbidity rates, health service utilization, health expenditure and specific health problems i.e. hypertension, diabetes mellitus and acute respiratory infections. Given the limitations stemming from employing secondary data, we proxy diabetes mellitus for NCDs. Although the results may not be generalised to represent NCDs as a whole, we assume the results could be used as an indication for the impact of urbanisation. This is primarily because the data for DM was most comprehensive, with minimal missing values.

Statistical analysis

In this study, the aim is to determine the impact

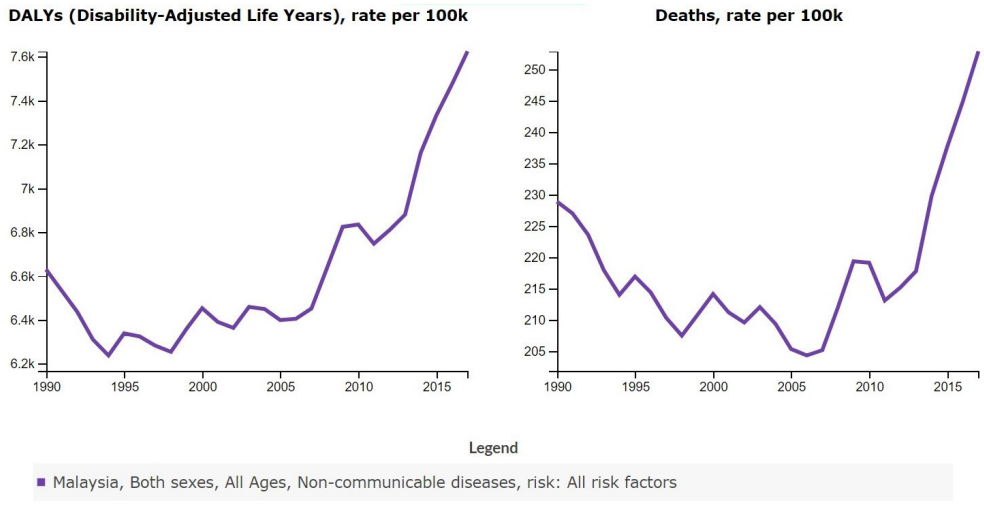

Figure 2: Malaysia Non-Communicable Diseases Risk Profile. Source:http://ghdx.healthdata.org/gbd-results-tool?params=gbd-api-2016-permalink/36aea 5143 d161dd 3 3488e2362a 9ddada

of urbanisation on NCDs prevalence, where both descriptive and multivariate techniques were applied to explore the impact of urbanisation on NCD prevalence. Specifically, given the binomial nature of the survey variable, the Probit regression was employed using the STATA statistical software. The Probit model, which is adapted from (15,16), is a probability model with a binary dependent value that has either a 0 or 1 value and it is subject to the value of the independent variables. The marginal effects of each independent variable from the regression provide evidence on the relationship between the independent and dependent variables. A positive marginal effect coefficient implies that the independent variable is positively linked with NCDs (in this case) while the opposite holds true for negative coefficients. The larger the coefficient also implies a strong association.

Model

NCD is modelled as a function demographic, socioeconomic and lifestyle-related factors, prioritising the impact of urbanisation (17) as follows:

$$NCD_i = \alpha_0 + \Sigma_{j=1}^{4}\beta_j DF_i + \Sigma_{j=1}^{3}\rho_j SOE_i + \Sigma_{j=1}^{3}\delta_j LFS_i + \Phi_1 URB_i + \varepsilon_i \quad \text{Eq.1}$$

The dependent variable, NCD, is proxied by whether or not an individual has Diabetes Mellitus (DM). The independent variable DF includes age, race, gender, marital status and household size. Age is grouped into four categories, namely 0-4; 5-17; 18-59 and above 60. The first two categories were dropped from the analysis as there were no observations for the dependent variable. Race has five categories, namely Malay, Chinese, Indian, Other Bumiputeras and Others. Marital status is made up of never married; married and widowed/divorced. Malay and single were the reference categories for the race and marital status categories. Household size is also grouped into four categories – families with less than two members, between two and six members, between seven and ten members and lastly exceeding ten members.

The socioeconomic factors or SOE is represented by income, education, and employment status. Income consists of three categories – namely the bottom 40 (B40), middle 40 (M40) and top 20 (T20). Table I provides the income threshold for each of these categories. Education and employment are both categorical variables where education includes unclassified, primary, secondary and tertiary. Employment plays a role in health and disease profile, as jobs that require better skills and knowledge will offer better compensation and as such, individuals employed in such jobs are assumed to have a better quality of life. The employment categories in the survey include government, private-sector, self-employed, unpaid/housewife and retiree. For the purpose of this analysis, we designated the unspecified/no education and government as the respective reference categories for education and employment.

The lifestyle-related (LFS) variables are physical activity level, healthy diet and adult body weight. The physical activity is a dummy variable – whether the respondent is active or not. The balanced diet variable consists of two dummy variables –whether or not respondent eats adequate fruits and vegetables. Based on the Malaysian Dietary Guideline, if the respondent has at least two servings of fruits and three servings of vegetables, it is adequate. The adult body weight is proxied by the Body Mass Index or BMI. The BMI has four categories; underweight, normal, overweight and obese. Presumably, those with higher BMI are more prone to have DM. Lastly, the URB denotes if the individual is an urban resident or not. Urban dwellers are assumed to be more at risk, given that NCD-related risks are synonymous with urban lifestyle. Including this variable helps to ascertain if urban residents are more likely to be diagnosed with NCD compared to rural folks. Subsequently, to determine which of these factors are more dominant in influencing the likelihood of getting NCDs among urban residents, we truncate the data to only urban residents as shown in the following equation:

$$NCD_{URB} = \alpha + \Sigma_{j=1}^{4}\beta_j DF_i + \Sigma_{j=1}^{3}\rho_j SOE_i + \Sigma_{j=1}^{3}\delta_j LFS_i + \varepsilon_i \quad \text{Eq. 2}$$

Table I: Income Threshold

Group	2015
Top 20	≥RM8320
Middle 40 (M40)	RM3,856-RM8,319
Bottom 40 (B40)	<RM3,856

Source: Household Income Survey 2007 and Household Income and Expenditure Survey, 2014, Department of Statistics, Malaysia

RESULTS

The urban population profile is as summarised in Table II. Overall, based on the table presented, the average or mean age was 32 years. Family size was slightly smaller in 2015 at five members and the average household income was RM15,169. Malays, as the main racial group stood at 64% and men made up of 48.3% of the survey population. Married individuals were 61.6%.

Table III present the prevalence of Diabetes Mellitus (DM) and NCD-related health risk – i.e. high blood pressure and high blood cholesterol. These are prevalence rates by strata, income category and by age group. Urban residents seem to have a higher prevalence of all three

Table II: Urban Population Profile in 2015

Variable		Variable	
Age	32	Malays	64
Household Members	4.5	Male	48.3
Income	15169	Married	61.6
Urban (%)	57.3		

Source: Analysis based on NHMS2015

Table III: Prevalence of NCD – Diabetes and related risks

	Diabetes Mellitus	High Blood Pressure	High Blood Cholesterol
	2015	2015	2015
STRATA			
Urban	8.00%	13.00%	20.20%
Rural	6.30%	11.50%	15.50%
INCOME CATEGORIES			
B40	9.90%	17.10%	22.90%
M40	3.30%	5.40%	9.40%
T20	1.10%	2.00%	3.40%
AGE_CATEGORIES			
18-59	9.40%	15.60%	27.30%
60 and above	5.00%	8.90%	8.40%

Source: Analysis based on NHMS2015

conditions compared to rural in 2015. Similarly, those from the bottom forty or B40 income categories seem to fare poorly compared to the middle forty (M40) and top twenty (T20) income groups. Based on the age category, the results indicate that the working adult category (age 18-59) are more susceptible to the prevalence of NCDs compared to the older above 60 group. This necessitates a more detailed analysis of the survey data to establish factors that contribute towards the rising NCDs prevalence.

Next, the Probit regressions results are summarised in Table IV. Model 1 corresponds to Eq.1, while Models 2 refers to Eq. 2, involving only the urban population. The regressions were tested for multicollinearity, given that the model involved a lengthy list of independent variables and it was necessary to establish estimation accuracy (18,19). The Variance Inflation Factor, or VIF, results were well below 4 and hence, we deduce that multicollinearity is a non-issue in this analysis.

Under the demography, age is positive and significant at 1% in both models. Age implies that for each additional year, the individual is 0.6% and 0.7% more likely to have DM. Gender results are not significant in Model 1 (20) but for the urban population, men are 1.6% more likely to have DM compared to women. In terms of race, results for the Chinese and Indians are significant at 1% in both models while those from the Other Bumiputera is significant at 1% in just Model 1. The Chinese, generally are 5.4% less likely to have DM compared to the Malays, while the urban Chinese fare even better at -6.1% (21). Conversely, the Indians are 6.7% more likely to have DM compared to Malays and the condition for urban Indians is further exacerbated at 7.5% (22). The other Bumiputeras, similar to the Chinese, seem to fare better than Malays where they are 3% less likely to have DM. The results for both marital status and the family size is not significant.

The socioeconomic factors include employment, education and income. In terms of employment, government employees are the reference category. Results are significant for only the private sector employees in both models, while the remaining categories of self-employed, homemakers and retirees are all insignificant. Compared to government employees, private sector employees are better off health wise because their DM likelihood is lower by 2.1% in the full population and by 3.2% in the abridged urban population. Education consists of four categories - no education/ unspecified; primary; secondary and

Table IV: Impact of urbanisation on NCD: Probit Regressions Summary

Variables	Model 1		Model 2	
		ME		ME
Demographic Factors				
Age	0.024***	0.006***	0.026***	0.007***
	(0.001)	*0.000*	*(0.002)*	*0.000*
Gender - Male	0.041	0.010	0.069*	0.016*
	(0.029)	*(0.007)*	*(0.037)*	*(0.009)*
Race				
Chinese	-0.226***	-0.054***	-0.269***	-0.061***
	(0.038)	*(0.009)*	*(0.045)*	*(0.010)*
Indians	0.239***	0.067***	0.264***	0.075***
	(0.046)	*(0.014)*	*(0.053)*	*(0.016)*
Other Bumiputras	-0.117**	-0.029***	-0.068	-0.020
	(0.046)	*(0.011)*	*(0.070)*	*(0.018)*
Others	-0.029	-0.008	-0.001	0.000
	(0.056)	*(0.014)*	*(0.073)*	*(0.019)*
Marital Status				
Married	0.031	0.015	0.056	0.021
	(0.042)	*(0.011)*	*(0.054)*	*(0.014)*
Divorced/Widowed	0.022	0.012	0.014	0.010
	(0.063)	*(0.016)*	*(0.084)*	*(0.020)*
Size of Family	0.017	0.005	0.024	0.007
	(0.028)	*(0.007)*	*(0.038)*	*(0.010)*
Socioeconomic factors				
Employment				
Private	-0.080*	-0.021*	-0.120**	-0.032**
	(0.042)	*(0.011)*	*(0.052)*	*(0.014)*
Self-Employed	-0.036	-0.009	-0.067	-0.017
	(0.045)	*(0.012)*	*(0.058)*	*(0.015)*
Homemaker	0.084*	0.021	0.001	-0.002
	(0.049)	*(0.013)*	*(0.062)*	*(0.016)*
Retired	0.096	0.020	0.013	-0.003
	(0.063)	*(0.016)*	*(0.080)*	*(0.020)*
Education				
Primary	-0.073	-0.016	-0.100	-0.024
	(0.056)	*(0.015)*	*(0.084)*	*(0.023)*
Secondary	-0.118**	-0.026*	-0.153*	-0.035
	(0.056)	*(0.015)*	*(0.083)*	*(0.023)*
Tertiary	-0.164**	-0.037**	-0.195**	-0.045*
	(0.064)	*(0.017)*	*(0.089)*	*(0.024)*
Income Category				
M40	-0.023	-0.007	-0.037	-0.010
	(0.030)	*(0.008)*	*(0.038)*	*(0.010)*
T20	-0.114**	-0.029***	-0.122**	-0.031**
	(0.046)	*(0.011)*	*(0.054)*	*(0.013)*

Continue.....

Table IV: Impact of urbanisation on NCD: Probit Regressions Summary (Continued)

Variables	Model 1		Model 2	
Lifestyle-factors		ME		ME
Body-Mass Index (BMI)				
Normal	0.037	0.012	-0.059	-0.010
	(0.068)	*(0.015)*	*(0.088)*	*(0.021)*
Overweight	0.310***	0.080***	0.186**	0.049**
	(0.068)	*(0.015)*	*(0.088)*	*(0.021)*
Obese	0.519***	0.141***	0.428***	0.118***
	(0.070)	*(0.016)*	*(0.090)*	*(0.022)*
Physically Active	-0.086***	-0.022***	-0.084**	-0.021**
	(0.027)	*(0.007)*	*(0.034)*	*(0.009)*
Healthy Diet	0.045	0.011	0.040	0.010
	(0.029)	*(0.007)*	*(0.037)*	*(0.009)*
Strata - Urban	0.078***	0.020***		
	(0.027)	*(0.007)*		
Constant	-2.083***		-1.956***	
	(0.127)		*(0.166)*	
Observations	15331	15331	9032	9032
Pseudo R2	10%		10%	
Actual	21.19%		20.56%	
Predicted	20.10%		19.92%	
Percent correctly classified	80.1%		80.44%	

Source: Analysis based on NHMS2015
Notes: ME – Marginal Effects
Reference categories for categorical predictors: Gender(Male); Race (Malay); Marital Status (Single); Employment (Government); Education (Unspecified or No Education); Income Category(B40), and BMI (Underweight).
Standard errors in parentheses
Significance levels * p < 0.1, ** p < 0.05, *** p < 0.01

tertiary. The no education/unspecified was the reference category. Primary education results were not significant in both models. Both secondary and tertiary education was negative and significant at 10% and 5% respectively. Compared to individuals without education, those with secondary level education were 2.6% less likely to have DM in Model 1.

As for the urban population, secondary school seemed to improve health by reducing the likelihood of getting DM by 3.5%. Tertiary education also contributes to overall health wherein Model 1, the likelihood is reduced by 3.7% and among urban dwellers, it is 4.5%. As for income, the reference category was the bottom forty or B40 income groups. Findings show that the M40 coefficients are not significant in both models while the T20 results are. Based on the said coefficients, we could deduce that compared to the B40s, individuals under the T20 income category are about 3% less likely to have DM and the results are significant at 1%. Lifestyle factors are somewhat similar where higher BMI spells higher likelihood of having DM. Compared to those who are underweight, overweight and obese individuals are 8% and 14% more likely to have DM (significant at 1%).

Coefficients for the normal weight category is insignificant. Interestingly, however, the overweight and obese individuals in urban areas have a weaker likelihood of having DM at 5% and 11.8% respectively, compared to those in the underweight category. Expectantly, coefficients for active individuals in both Models 1 and 2 are negative and significant at 1% and 5%. The likelihood of getting DM is lowered by about 2.1-2.2% for individuals who are physically active. Results for diet, however, are not significant for getting NCDs.

Overall, from Model 1 we deduce that urban residents are 2% more likely to have DM and this is significant at 1%. As an added robustness measure, we attempted to include interaction terms between lifestyle and urbanisation but the results were all insignificant and as such, no further inference on interaction terms is included. The Probit model is quite a good fit given that the average of predicted probabilities for the likelihood of having diabetes is about 20% in both Models 1 and 2, which is similar to the actual frequency of having diabetes at 21.19% for total observations and 20.56% for the urban population. The Probit model, correctly predicts 80% on average, of the values for diabetes while the rest are misclassified.

DISCUSSION

Urbanisation, and the rapid environmental, economic and social changes that ensue it increase the prevalence of major risk factors for NCDs, especially in terms of diet, occupation and lifestyle. The findings based on the NHMS2015 convey similar message, demographic, socioeconomic and lifestyle related factors are key determinants of NCD prevalence. Older and heavier individuals are more at risk to have NCDs, although the results for heavier urban individuals are lower. Similarly, race also contributes to the risk of having NCDs and this perhaps is associated with other factors such as type of diet consumed, meal preparations and cultural norms. Under socio-economic factors, being private sector employee means lower likelihood of having NCDs, compared to the government employees. This may be attributed to poor dietary habits and sedentary lifestyle, given that the NHMS data shows that approximately 25% of civil servants are obese compared to only 17% obese private sector employees. This requires further investigation, especially aimed at health awareness levels amongst civil servants.

Higher education is inversely associated with NCD prevalence, where greater awareness and knowledge lead to better lifestyle choices and consequently lower risk of having NCD (15,16,23). Better income also paves the way to improved healthcare and better access to good fresh produce, that augurs well for the overall health and wellbeing. and as such reduces the likelihood of having NCDs (24). Being physically active reduces the risks from high-fat an calorie dense diets and this contributes to the lower likelihood of having NCDs (20). Lastly, the primary variable of interest is positive and significant, implying that being an urban resident spells greater risk

for getting NCDs (9,25,26). Generally, studies that link urbanisation and NCDs prevalence often conclude that urban living results in a higher likelihood for NCDs (24,27,28). It is commonly accepted that urbanisation augurs well for NCD prevalence, and findings from this research leads to a similar finding.

CONCLUSION

Findings show that the demographic, socioeconomic and lifestyle factors are all key in determining NCD prevalence. The urbanisation variable, conforms to findings from other similar studies on health and urbanisation (21,22,29). Results show that there is a health penalty for the urban population and also for those who do not embrace healthy lifestyles (24,28,30). The irony of having consistent trends, where urban living, ethnicity, physical inactivity, unhealthy lifestyle continues to augur well for diabetes mellitus prevalence despite overwhelming efforts to curb the same(31,32). Although the impact of urbanisation is distinct, other factors must be considered concurrently with urban living (33), such as the kind of dietary habits, levels of physical activity and perhaps even family history.

The NHMS 2015 is a cross-sectional study and thus is not conclusive to establish cause and effect. Findings are merely a suggestion that urbanisation contributes to the higher prevalence of NCDs, albeit a slight percentage. Therefore, policies that focus on the urban factor in terms of health resources planning and management should consider other factors that could impact population health and these factors may not be distinctly different between urban and rural population.

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