Cardiovascular risk assessment between urban and rural population in Malaysia

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ABSTRACT

Introduction: Cardiovascular disease (CVD) caused significant burden to Malaysia as it accounted for 36% of total deaths. This study aims to evaluate the burden of cardiovascular risk factors among Malaysian adult and assess the difference between urban and rural population in the selected communities.

Methods: This study is part of the ongoing Prospective Urban Rural Epidemiology (PURE) database, whereby the baseline data were collected since June 2008. CVD risk was measured using INTERHEART risk score which comprised of eleven risk factors i.e. age and gender, family history of heart attack, smoking status, exposure to second hand smoke, diabetes mellitus, hypertension status, waist-hip ratio, self-reported stress, depression, dietary habits and physical activity status.

Results: Majority of the studied participants had low cardiovascular risk (57%). Participants from rural area were generally older, had lower educational status, higher prevalence of smokers, obesity, hypertension, diabetes, and more likely to be depressed. In comparison, urbanites had lower physical activities and more likely to be stressful. Mean INTERHEART score among rural participants were higher, especially for male, in comparison to urbanite (11.5±5.83 vs. 10.01±5.74, p<0.001).

Conclusion: Contradict to common beliefs, participants in rural areas generally have higher cardiovascular risk factors compared to their urban counterparts. The rural population should be targeted for focused preventive interventions, taking account the socioeconomic and cultural context.

KEY WORDS:
Cardiovascular disease, risk factors, urban and rural population, adult, Malaysia

INTRODUCTION

The World Health Organization (WHO) estimate that cardiovascular disease (CVD) contributed to 17.5 million deaths in 2012 which represents nearly one third of total death worldwide.[1] But a more disconcerting statistic was three quarter of these deaths occur in the developing countries despite the more ageing population in developed countries, which is a strong predictor for CVD. Conceivably the prevalent of CVD related deaths have declined in those countries as a result of their excellent improvement in the management and healthcare system.[2] On the other hand, CVD deaths were on the rise especially in developing countries, which undergo rapid industrialisation and urbanisation. Malaysia for instance sustained substantial economic growth since gaining independence in 1957, evidenced by 249% increment in the number of urban centres within Peninsular Malaysia.[3] Recent figures from The World Bank showed that 75% of Malaysian lives in urban area compared to only 27% five decades ago.[4] Urbanisation mediated by rapid economic development however may foster adverse impact concerning population health status. This negative influence directed particularly towards sedentary lifestyle that can further magnify the risk of developing CVD.

This disease has been the top leading cause of death in Malaysia since 1980's and seems to stay as number one killer in the future, underscoring the importance of prevention.[5] Among the preventive strategies commonly practiced by clinicians is subjecting asymptomatic individuals for CVD risk assessment and stratified them to different level of risk in developing CVD at later life. There are up to 21 validated risk models ready to be used, each with its own strength and limitation. This includes popular tools such as Framingham Risk Score (FRS), Systematic Coronary Risk Evaluation (SCORE) and QRISK (risk score using QRESEARCH database).[6] None of them were perfect though, as one of the obvious flaw were the absence of integrating modifiable risk factors, particularly dietary habits and physical activity.[6-7] In recent years, a few CVD risk assessment tools have taken this into account, one of them is the INTERHEART risk score. This tool was constructed based on multi-ethnic study sample from 52 countries of the world, which considerably an essential advantage over other models that were derived from American population (FRS) or primarily Caucasian (SCORE) that had variable predictability in non-white populations.[7] Generalizability of INTERHEART across diverse ethnic populations and geographic regions, as well as the comprehensiveness of the model make INTERHEART more appealing for usage in Malaysia setting.

Another important issue to be highlighted is the common belief that population who live in urban areas have higher risk of developing CVD compared to those in rural regions. Contradictory, findings from two Malaysian studies reported

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that the prevalence of CVD risk factors were high among populations in rural areas.[8-9] This point towards comparable, if not higher disease burden in rural as opposed to urban areas, which needs further investigatigation. From other perspective, this revelation provide opportunity to healthcare providers to optimise health care resources and prioritise prevention strategies to specified locality with the highest needs. However current evidence may not be convincing as there is limited studies exploring the influences of urban-rural differences towards development of CVD in Malaysia. This study aims to evaluate the burden of cardiovascular risk factors among Malaysian adult and assess the CVD risk differences between urban and rural population using the INTERHEART risk score.

MATERIALS AND METHODS

This study is part of the ongoing Prospective Urban Rural Epidemiology (PURE) project, a multi-national study comprised of 17 countries with a wide range of socioeconomic background. Malaysia was one of ten countries selected to represent middle income nation based on the World Bank classification. Details on PURE study participant selection methodology was described by Teo *et al.*[10] A total of 8530 participants were recruited begining in June 2008 in Universiti Kebangsaan Malaysia (UKM) Malaysia. Several urban and rural population were conveniently selected in state of Selangor and Kuala Lumpur with the aim to achieve feasibility of long-term follow up. These population fulfilled specific criteria according to PURE protocol. Apart from gazetted as rural territory by local government, ideally those rural population should be populated by less than 150 population per square kilometre. Participants were subsequently recruited from selected households within these population. The eligibility criteria for participants were; 1) aged between 35 and 70 years old; and 2) must be the household populations for at least four years. All participants were required to fill up written informed consent. For each participant, the household and individual data were collected respectively. A total of 5505 collected were analysed.

Variable definition

Study variables included were demographic factors such as age (rounded to nearest year), gender, ethnicity (Malay or non-Malay), marital status (single or married) and educational level (none, primary, secondary or tertiary). Participants who resided in Ampang, Cheras and Kuala Lumpur were classified as urban populations while those living in Tanjung Karang, Kuala Selangor, Sabak Bernam, and Kuala Kubu Bharu were classified as rural populations.

INTERHEART risk score was used to estimates the risk of CVD.[7,11] The score consists of 11 risk factors which are: 1) age and gender, categorised to man 55 years or older OR woman 65years or older and man younger than 55 years or woman younger than 65 years; 2) family history of heart attack, from either or both biological parents; 3) Smoking status, categorised to never, current smoker (smoked regularly in the last 12 months) and former smoker (last smoked more than 12 month ago); 4) second hand smoke, categorised to no exposure (less than one hour or no exposure) and had exposure (one or more hours exposure per week); 5) diabetes mellitus (DM) status; 6) hypertension status, both diseases were self-reported; 7) waist-hip ratio (WHR), calculated as waist circumference (cm) divided by hip circumference (cm), and categorised into <0.875, 0.875 to 0.920, 0.920 to 0.967 and >0.967; 8) stress level was measured from self-reported (never or some periods and several periods or permanent stress); 9) depression was based on self-reported of being sad or "blue"; 10) dietary habits, based on self-reported frequency of participants' dietary intake. They were labelled as having an unhealthy diet if they consumed salty foods ≥1 time/daily OR deep fried foods or snacks ≥3 times/week OR meat and/or poultry ≥2 times/daily; and finally 11) physical activity status, based on self-reported response to an item "How active are you during your leisure time?" The response was categorised into sedentary/mild exercise and moderate to high exercise. Participants were considered to have low physical activity if they reported sedentary or mild exercise during leisure time. Risk factors assessed in this study used similar definitions to those reported in other INTERHEART publications but excluded laboratory investigation.[7,11-12] Each positive risk factor was given the designated score. The total scores ranged from 0 to 48, with the highest indicates greatest risk. The score were classified to low risk (score between 0-9), moderate risk (score between 10-15) and high risk (score between 16-48) based on previous studies.[7,11]

Body mass index (BMI) and information on household device (HHD) were also gathered. BMI was categorised as obese and non-obese using cut-off point 27.5 kg/m^2 (according to WHO BMI criteria for Asian). Quantity and ownership of HHD items such as bicycle, motorcycle, cars, computers, television, telephone, radio, washing machine and refrigerator were obtained for each participant based on dichotomous response categories (1=Yes and 0=No).

Ethical Approval

This study was approved by Medical Research Ethics Committee of Universiti Kebangsaan Malaysia. Consent forms were distributed to all participants of selected households. This research conformed to the principles embodied in the Declaration of Helsinki.

Statistical analysis

All data were analysed using Statistical Package for Social Sciences (SPSS) version 21. The frequencies of all listed variables were tabulated. The association between each variable were analysed according to participants' locality analysed using Chi-square test for categorical variables while independent t test and ANNOVA for continuous variables. Results produced were presented in frequency and percentage. The level of significant were set at p-value of <0.05. For the household device, participant's score was rescaled from 0 to 100 using Rasch model analysis as follows:

USCALE = (wanted range)/(current range)

UMEAN = (wanted low) – (cuurent low x USCALE)

RESULTS

Majority of participants were female, recruited from rural areas, of Malay ethnicity, and married, and 60% attained at least secondary level education. Their mean age was 51 years old, they were predominantly non-smokers, many were

Table I: Sociodemographic and health status of the study population

Characteristic	Frequency, %	Mean (SD)
Age—year*		51.1 (10.29)
Gender		
Male	2382 (43.3)	
Female	3123 (56.7)	
Ethnicity		
Malay	4817 (87.5)	
Non Malay	688 (12.5)	
Locality		
Urban	1848 (33.6)	
Rural	3657 (66.4)	
Marital Status		
Single	570 (10.4)	
Married	4935 (89.6)	
Educational Level		
None	382 (6.9)	
Primary level	1866 (33.9)	
Secondary level	2509 (45.6)	
Tertiary level	744 (13.5)	
Monthly Household Income (RM)†		1500 (1000, 2500)
Smoking status		
Never	4133 (76.4)	
Current Smoker	950 (17.6)	
Former Smoker	327 (6.0)	
BMI		
Underweight	167 (3.2)	
Normal	926 (18.0)	
Overweight	1971 (38.3)	
Obese	2086 (40.5)	
Abdominal Obesity		
Hypertension	1386 (25.2)	
Diabetes	757 (13.8)	

† Median (1st IQR, 3rd IQR) IQR: Interquartile range

obese, 14% was diagnosed with diabetes and 1 in 4 suffered from hypertension. Household monthly median income was RM 1500 (Table I).

In comparison with the urbanites, populations from the rural area were generally older, had lower educational level, many were smokers, consumers of unhealthy diet, obese, higher proportion of those with hypertension and diabetes, and more likely to be depressed. In contrast, their reported amount of physical activity on average were higher, had lower percentage of former smokers and less likely to be stressful compared to their urban counterparts. More importantly however, populations from rural area had higher risk of acute myocardial infarction as their INTERHEART score were cumulatively higher, especially for male in comparison to the urbanite (Table II).

Number of male was substantially larger in high risk group compared to the low risk. Proportion of Malays, populations in rural area and individual with low educational level steadily increased as the risk score categorisation increased. Median monthly household income for low and moderate risk group was equivalent but significantly lower for the high risk group. Mean BMI and percentage of those with abdominal obesity also significantly increased as the risk increased. In terms of household device ownership, there was no clear pattern seen even though it was conspicuous that majority of participants owned three or more devices. In addition, those in low risk group had significantly higher proportion of computer ownership in comparison to moderate and high risk group. Majority of the study population had low cardiovascular risk (57%) with slightly more than a quarter fell under moderate risk (27%). A substantial number of participants however were considered at high cardiovascular risk (Table III).

DISCUSSION

There are several interesting revelations in this study. The Malaysian pool showed that population living in rural areas had higher risk of cardiovascular event compared to the urban population. Even though this finding contradicted with the global PURE cohort which consist of 150,000 participants, results from high income countries in the same study revealed similar higher INTERHEART risk score among population in rural areas in comparison to those that live in urban vicinities.[12] Despite being a middle income country, cardiovascular risk among Malaysian resembled those from high income nations due to larger burden of cardiovascular risk factors attributed to higher BMI, more sedentary lifestyle and higher cholesterol levels. A survey in Shaanxi province of China, country that ranked similar to Malaysia also revealed that population in rural area had a 27.6% increased risk of having metabolic syndrome that could lead to higher

Table II: Characteristics of the study population in the rural and urban area, stratified by gender

Characteristic	Urban (n=1848)		p-value	Rural (n=3657)		p-value
	Male (n=787)	Female (n=1061)		Male (n=1595)	Female (n=2062)	
Age—year*	48.9 ±10.52	47.2 ±9.86	<0.001	52.3 ±10.22	51.2 ±9.86	<0.001
Low educational level—no (%) †	117/787 (14.9)	233/1061 (22.0)	<0.001	755/1594 (47.4)	1153/2059 (56.0)	<0.001
Married —no. /total no. (%)	748/787 (95.0)	939/1061 (85.5)	<0.001	1499/1595 (94.0)	1749/2062 (84.8)	<0.001
Malay Ethnicity—no. / total no. (%)	669/787 (85.0)	858/1061 (80.9)	0.022	1414/1595 (88.7)	1876/2062 (91.0)	0.023
Family history —no. /total no. (%)	141/787 (17.9)	192/1061 (18.1)	0.921	185/1595 (11.6)	247/2062 (12.0)	0.724
Smoking status— no. / total no. (%)						
Current Smoker	243/782 (31.1)	11/1059 (1.0)	<0.001	663/1558 (42.6)	33/2011 (1.6)	<0.001
Former Smoker	123/782 (15.7)	12/1059 (1.1)	<0.001	175/1558 (11.2)	17/2011 (0.8)	<0.001
Second hand smoke	176/787 (22.4)	356/1061 (33.6)	<0.001	405/1595 (25.4)	793/2062 (38.5)	<0.001
Unhealthy Diet— no. / total no. (%)§	112/787 (14.2)	162/1061 (15.3)	0.552	726/1595 (45.5)	984/2062 (47.7)	0.193
Low physical activity — no. / total no. (%)¶	214/663 (32.2)	175/882 (19.8)	<0.001	306/1288 (23.8)	250/1676 (14.9)	<0.001
Hypertension — no. /total no. (%)‖	152/787 (19.3)	218/1061 (20.5)	0.519	371/1589 (23.3)	645/2058 (31.1)	<0.001
Diabetes— no. /total no. (%)**	105/787 (13.3)	118/1061 (11.1)	0.149	312/1585 (15.2)	222/2053 (14.0)	0.321
BMI > 27.5— no. /total no. (%)††	279/779 (35.8)	448/1042 (43.0)	0.002	522/1454 (35.9)	837/1875 (44.6)	<0.001
Waist hip ratio > 0.967— no. /total no. (%)	138/787 (17.5)	64/1061 (6.0)	<0.001	344/1595 (21.6)	247/2062 (12.0)	<0.001
Abdominal obesity	374/787 (47.5)	630/1061 (59.4)	<0.001	784/1595 (49.2)	1494/2062 (72.5)	<0.001
Self-reported of being sad or "blue"— no. /total no. (%)	60/787 (7.6)	107/1061 (10.1)	0.071	136/1595 (8.5)	217/2062 (10.5)	0.048
General feeling of stress — no. /total no. (%)§§	69/787 (8.8)	114/1061 (10.7)	0.181	119/1595 (7.5)	113/2062 (5.5)	0.017
INTERHEART Risk Score‡‡	10.01 ± 5.74	6.8 ± 5.04	<0.001	11.5 ± 5.83	8.9 ± 5.61	<0.001
HHD score‡	73.8 ±18.45	70.3±20.70	<0.001	65.0 ±28.48	66.2 ± 27.19	0.23

* Plus-minus value are means ±SD
† Low educational level was defined as no education, primary education or unknown educational level
§ An unhealthy diet was determined if the participants consumed salty foods ≥1time/daily OR deep fried foods or snacks≥3times/week OR meat and/or poultry ≥2times/daily
¶ Participant were considered to have low physical activity if they reported sedentary or mild exercise during leisure time
‖ Participant were considered to have hypertension if they reported a history of hypertension
** Participants were considered to have diabetes if they reported having diabetes
§§ Stress was defined as if the participants have feeling of stress in the last year for several periods OR permanent periods
†† The body-mass index (BMI) is the weight in kilograms divided by the square of the height in meters.
‡‡ The INTERHEART Risk Score, for which data were available for nearly all participants, is a validated score for quantifying risk-factor burden without the use of laboratory testing. Scores range from 0 to 48, with higher scores indicating greater risk-factor burden.
‡ The HHD score was calculated using Rasch model analysis. It ranges from 1 to 100, with higher scores indicating high household device ownership

Table III: Characteristics of the study population according to INTERHEART risk score categorization

Characteristic	Low risk n=3141 (57%)	Moderate Risk n=1489 (27%)	High Risk n=875 (16%)	p-value
Age—year*	47.8 (9.6)	52.5 (10.2)	56.1 (9.3)	<0.001
Male—no. /total no. (%)	1107/3141 (35.2)	784/1489 (52.7)	491/875 (56.1)	<0.001
Malay ethnicity—no. /total no. (%)	2682/3141 (85.4)	1335/1489 (89.7)	800/875 (91.4)	<0.001
Live in rural area —no. /total no. (%)	1931/3141 (61.5)	1071/1489 (71.9)	655/875 (74.9)	<0.001
Low educational level— n (%) †	1048 (33.4)	716 (48.1)	494 (56.5)	<0.001
Monthly Household Income (RM)‡	1500 (1000,2907)	1500 (1000,2100)	1450 (1000,2000)	<0.001
Married —no. /total no. (%)	2833/3141 (90.2)	1321/1489 (88.7)	781/875 (89.3)	0.28
BMI *	26.33 (5.26)	27.19 (4.98)	28.40 (5.48)	<0.001
BMI > 27.5— no. /total no. (%)††	1085/2974 (36.5)	599/1381 (43.4)	402/795 (50.6)	<0.001
Number of household device ownership				
1 device	201/2886 (7.0)	88/1365 (6.4)	62/790 (7.8)	0.223
2 devices	776/2286 (26.9)	403/1365 (29.5)	236/790 (29.9)	
3 or more devices	1665/2886 (57.7)	772/1365 (56.6)	439/790 (55.6)	
Type of device ownership				
Computer	933/2886 (32.3)	387/1365 (28.4)	236/790 (29.9)	0.026
Car	1841/2886 (63.8)	838/1365 (61.4)	477/790 (60.4)	0.119
Television	2590/2886 (89.7)	1239/1365 (90.8)	722/790 (91.4)	0.296
Ownership of common item	443 (15.3)	219 (16.0)	119 (15.1)	
Ownership of luxurious item	2443 (84.7)	1146 (84.0)	671 (84.9)	0.789

* Plus-minus value are means (SD)
† Low educational level was defined as no education, primary education or unknown educational level
‡ Median (1st IQR, 3rd IQR) IQR: Interquartile range
†† The body-mass index (BMI) is the weight in kilograms divided by the square of the height in meters.
∂ Abdominal obesity is defined as waist >90cm for male and >80cm in female

cardiovascular risk compared to the urban populations. Studies in low income countries such as in Benin, Tamil Nadu, India and Ayacucho and Lima, Peru on the other hand all demonstrated that the urbanites generally had higher proportion of cardiovascular risk factors including metabolic syndrome.[13-15] These observations may imply that the risk of cardiovascular event for Malaysian in rural area is comparable to their counterparts in high income countries. Recent evidence suggest that even in low income countries, there is alarming tendency of population in rural areas to have high risk of cardiovascular events in rapid pace as demonstrated by a few studies and a systematic review in India and Cameroon.[16-19]

Higher risk of cardiovascular event among population in rural area in this study is clearly due to aggregation of important cardiovascular risk factors, that possibly attributable to variation in sociodemographic structure, environment and lifestyle. Disadvantaged rural areas that are peripheral in socioeconomic sense influence migration as young population leave the area due to lack of opportunities.[20-21] The remaining relatively older population are known to be at higher cardiovascular risk since age is a strong cardiovascular event predictor.[22] Their generally lower educational status as demonstrated in this study may partly explained the differences in risk factor levels, resembled what was found in Vasterbotten Intervention Program study in Sweden. For instance, those with only primary school education and lived in rural areas had consistently higher cholesterol levels and prevalence of hypertension than those living in urban areas and those with higher educational levels.[23] Findings from a local study surveying 11,959 participants noted that prevalence of hypertension and smoking were highest among those without education, although hypercholesterolaemia and overweight were contrastingly highest among men with tertiary education but not for women.[24] On the other hand, higher educational status is likely to be associated with better knowledge of tobacco adverse effects, and perhaps with greater peer pressure against tobacco use.[14] Researchers from MONICA study suggested that lower education in rural areas could enhance or mediate cardiovascular risk, but causality is difficult to prove.[21]

It is possible that those who stayed in the rural areas may have a less healthy lifestyle and therefore have higher levels of risk factors, particularly weight issue. This study demonstrate that obesity is a major health problem among population in the rural area particularly women. Across age groups and by health status, women is at increased risk of being overweight especially for those of childbearing age.[25] This problem may have additionally affected women in the rural area due to association with low socioeconomic status which linked to consumption of less nutritious foods, more likely to devour calorie-dense foods such as soda, sugar-sweetened beverages, other processed foods and poor consumption of fruit and vegetable.[26] In conjunction, other studies have shown that prevalence of obesity and overweight were higher in rural populations up to 50%. A recent United Stated of America (USA) report noted more obesity in rural settings, possibly causing higher risk of diabetes.[27] Little awareness and knowledge of the risks of CVD among rural populations may worsen the desire for healthy lifestyle and regular health monitoring which translate to poor diet, inadequacy of leisure physical activities and delay in seeking healthcare.[28] This also may relate to higher proportion of low educational level among population in urban areas as found in this study.

Smoking is another important modifiable cardiovascular risk factor that is more prevalent among populations of rural area in this study. This finding is parallel with result from a large USA survey among 355,710 adults that shown those residing in rural areas were significantly more likely to smoke cigarettes compared to populations in urban and more likely to use smokeless tobacco. Rural populations were also more likely than those living in urban areas to report of second hand smoke both at home and at work.[29] A similar nationwide study in Brazil found that among estimated 25 million smokers in the country, the proportion of current smokers was higher in rural than in urban areas.[31] Besides different cultural and lifestyle, one of the factor that may offer probable explanation to this phenomenon is that rural participants reported policies that afforded less protection from tobacco smoke both at home and in the workplace. Among these is lower percentages of exposure to tobacco information were seen in rural than in urban areas. The percentage of smokers who reported noticing health warnings on cigarette packages was lower in the rural than in urban areas.[29] To compound things further, the most popular tobacco product in the rural area was hand-rolled cigarette.[30]

To our knowledge, PURE is the first study in Malaysia that used INTERHEART in a large population study to assess cardiovascular risk. A few comparable studies adopted FRS that predict ten-year risk of CVD with the outcome categorisation into low, moderate and high risk group. Other research including the nationwide National Health Morbidity Survey (NHMS) mostly looked at the prevalence of each risk factors without analysing the composite risk that can predict future cardiovascular event.[24,31-33] One of the few studies employing FRS carried out survey among urban dwellers in Kuala Lumpur that found more than a third of the participants estimated to have moderate risk (38.5%) whereas 1 in 5 have high risk of CVD (20.5%).[34] Another FRS study which recruited participants from semi-rural region in Kuala Langat district discovered even greater proportion of men at high risk, as half of them were predicted to more likely experience cardiovascular event in the next 10 years (55.8%). Their overall mean projected cardiovascular risk is also high at 20% to 25% compared to medium at 11% to 13% for women.[35] Result from these studies clearly showed a larger proportion of those with high cardiovascular risk, contradictory to our findings that demonstrated only 16% with similar risk. This discrepancy probably can be explained by two factors. Firstly, the selection of study population that lacked heterogeneity whereby those studies were carried out either at urban or rural area and not generalized at both localities as our study. Hence no direct comparison can be made due to the absence of sample that represent both population. Cardiovascular risk among urbanites supposed to be lower but study by Tin Su *et al.* restrict selection to only low income participants who are known to have higher

cardiovascular risk in comparison to those with more affluent socioeconomic status.[34] Secondly, our larger cohort with recruitment from multiple recruitment center perhaps was more representative of Malaysian public in comparison to those studies that focus on more localised and smaller study sites.

In comparison to the neighbouring country, the pattern of risk factors were opposite to our findings as Thais who live in urban had higher prevalence of hypertension, diabetes and obesity compared to rural population. Smoking rate however was similarly worse among those live in rural area. Researcher in this study also concluded that differences between age and sex structure of the urban and rural populations in Thailand are small and do not explain the observed urban–rural differences in risk factor levels. It is likely, therefore, that the variation reflects behavioural differences relating to factors such as nutrition and exercise, as appears to be the case for many other populations.[36]

There was narrow gap between median income of low and high risk groups in our study although the difference remain significance. Besides recruitment predominantly of almost two-third from rural area, we postulate that this observation could also be attributed to smaller margin of income between population in rural and urban area. The economic profile especially for peri-urban rural territories may underwent diminishing role for agricultural related activities and act as more of flanking areas for nearby urban areas with mutual benefit.[20] There may have been more of small to medium-sized enterprises (SME) in rural area that drive further the economic growth of this nation as they become less dependence on natural resources related activities. As reported by Asian Development Bank, the population that lives below poverty line has shrunken to only 1.7% that represent a significant reduction in income inequalities between citizens.[37] Furthermore, due to urbanisation phenomenon, there has been more poor-urban population especially those who lived in community housing projects funded by government with household salary of less than RM 2,000.[34] Their lower socioeconomic status as opposed to their more affluent neighbours may have equalled to those live in rural area, thus contributed to smaller socioeconomic gap seen in this study.

In this sense, we include common household device ownership in our analysis since wealth index which is based on asset ownership could be considered as an indicator of long term economic status, as household assets are unlikely to change in response to short term economic shocks.[14] Material household capital reflects wealth and may be a more reliable indicator than self-reported income.[38] Furthermore, household possession showed stronger positive associations with cardiovascular risk factors than other socioeconomic indicators.[14] However this study did not find similar cardiovascular risk association with common household device ownership. We find it compelling that ownership of television in our study reached 90% whereas three quarter of participants owned either computer or vehicle despite majority of them were from rural area. Half of the participants on the other hand at least owned three most common household devices or more. This is opposed to findings in the main PURE cohort whereby only 36% of those from upper-middle income countries owned equal number of household devices whereas the proportion dropped significantly to 13% among those from lower-middle income countries.[39] This is a strong indicator that proved Malaysia is unlike any other developing, middle income countries as most of its citizens afford to live comfortably as ownership of television, computer, and vehicle has become a must instead of luxury. Furthermore, many of these participants owned not one, but two or more of the same type device such as motorcycles and cars. This scenario partly offer some explanation on why cardiovascular risk score in our study resembled more of high income nation as ownership of all these devices may contributed to a more sedentary lifestyle, hence higher risk of CVD.

The major strength of the present study is the sheer number of participants recruited which was larger than most local studies and the recruitment was carried out to best represent both urban and rural population in the country. Even though Malay ethnicity was over represented in the analysis, this problem seem to be encountered in many local health research including those studies that are comparable to ours.[9,24,33-34] Since this is among the first study in Malaysia to use INTERHEART, our findings provide further impetus to healthcare providers to start utilise this scoring for cardiovascular events prediction. In addition, our study emphasized on material possession as indicator of socioeconomic status which has rarely being studied before, especially in in this country and offer a different revelation as no significant association with cardiovascular risk factors observed.

There are several limitations identified. The definition of urban and rural in our study was subjective and based on classification gazetted by local authorities. This simplicity is opposed to variety of rural setting which in general can be distinguished to core rural, remote and disadvantaged, and per-urban rural as laid by Cabus and Vanhaverbeke.[20] Classification in accordance to local authorities may not suited our intention and expectation of differences between these territories as small population lying very close to a town or city might reflect a different way of living compared with small population in very remote areas.[21] Participants may also report living in a rural setting but spend time working closed to a city. However our study was able to demonstrated differences in the distribution of cardiovascular risk factors. With regards to risk prediction model, at the time being FRS is the only tool validated in Malaysia.[40] To add further, as with most observational studies, causality cannot be firmly established. The associations observed between higher cardiovascular risk factors among populations in rural area may be accounted for by unmeasured confounders and complex heterogeneity of social context. The present analysis should therefore prompt further research of cardiovascular risk factors among population in both urban and rural vicinity.

CONCLUSION

As opposed to the larger PURE cohort, our study showed that participants in rural area generally have higher CVD risk

factors compared to urban populations due to ageing, lower educational status and unhealthy diet. This disparity could be attributed to many social, environmental and cultural differences between these population. Thus, population in rural population must be considered for focused preventive actions especially strengthening of community based program and healthcare resource allocation.

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