

# TRADITIONAL CARDIOVASCULAR RISK-FACTORS AMONG HEALTHCARE WORKERS IN KELANTAN, MALAYSIA

<sup>1</sup>Helmy Hazmi, <sup>2</sup>Wan Rosli Wan Ishak, <sup>1</sup>Rohana Abd Jalil, <sup>1</sup>Gan Siew Hua, <sup>2</sup>Noor Fadzlina Hamid, <sup>2</sup>Rosliza Haron, <sup>1</sup>Mohd Nazri Shafei, <sup>1</sup>Mohd Ismail Ibrahim, <sup>1</sup>Wan Mohamad Wan Bebakar, <sup>1</sup>Shaiful Bahri Ismail and <sup>1</sup>Kamarul Imran Musa

<sup>1</sup>School of Medical Sciences, <sup>2</sup>School of Health Sciences, Universiti Sains Malaysia Health Campus, Kubang Kerian, Kelantan, Malaysia

**Abstract.** We conducted a cross sectional study of cardiovascular risk factors among healthcare workers at four government hospitals in Kelantan, Malaysia. We randomly selected 330 subjects fulfilling the following study criteria: those who had been working for at least one year at that health facility, Malaysians citizens and those with some form of direct contact with patients. We conducted an interview, obtained physical measurements, a fasting blood sugar and fasting lipid profiles among 308 subjects. The mean age of the subjects was 43.5 years, 82% were female; 30.8%, 14.3%, 10.4%, 1.3% and 1.6% of the subjects had dyslipidemia, hypertension, diabetes mellitus, a history of stroke and a history of ischemic heart disease, respectively. Forty-two percent of subjects had at least one medical condition. The mean body mass index (BMI) was 27.0 kg/m<sup>2</sup> (SD=4.8) and 24.3% had a BMI  $\geq$ 30 kg/m<sup>2</sup>. The mean systolic and diastolic blood pressures were 121.5 mmHg (SD=14.0) and 76.5 mmHg (SD=9.7), respectively and the mean waist-hip ratio was 0.84 (SD=0.1). The mean fasting blood sugar, total cholesterol, triglyceride, high density lipoprotein and low density lipoprotein were 5.8 mmol/l (SD=2.4), 5.5 mmol/l (SD=1.0), 1.4 mmol/l (SD=0.9), 1.5 mmol/l (SD=0.3) and 3.5 mmol/l (SD=0.9), respectively. Our study population had a smaller proportion of hypertension than that of the general Malaysian population. They had higher fasting total cholesterol, slightly lower fasting blood sugar, with a large proportion of them, obese and had diabetes. Immediate intervention is needed to reduce the traditional cardiovascular risk factors in this population.

**Keywords:** cardiovascular risk factors, health care workers, Malaysia

## INTRODUCTION

In 2006, the third decennial National Health and Morbidity Survey (NHMS) was conducted by the Ministry of Health Ma-

Correspondence: Dr Kamarul Imran Musa, Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia. E-mail: drkamarul@usm.my

laysia. This nationwide survey examined more than 50,000 respondents to determine the prevalence of high blood pressure, hypercholesterolemia, obesity, physical inactivity, unhealthy diets and diabetes mellitus among the general adult Malaysian population (aged  $\geq$  18 years) and found the prevalences to be 25.7%, 53.3%, 48.6%, 60.1%, 72.8% and 14.9%, respectively (Institute of Public Health, 2008).

In Malaysia, rapid transformation and modernization have improved the quality of life index and average life expectancy from 68.9 to 73.5 years for males and from 71.7 to 74.5 years for females between 1990 and 2007 (Ministry of Health, 2010). Despite these improvements, 61% of the adult population has at least one cardiovascular risk factor (Ahmad *et al*, 2011).

Between 1975 and 1989, coronary heart diseases and cerebrovascular diseases were the two leading causes of death in Malaysia (Khoo *et al*, 1991). In 2009, there were 147,843 admissions for cardiovascular diseases at Malaysian government hospitals (6.91% of total admissions) (Ministry of Health, 2010). Of all cardiovascular deaths in 2009 in Malaysia, 16% were due to coronary artery disease, and 8% were due to cerebrovascular accidents making cardiovascular diseases the leading cause of death (Ministry of Health, 2010). In 2010, cardiovascular diseases accounted for 24.5% of all deaths at government hospitals (Ministry of Health, 2010).

This study was conducted to evaluate traditional cardiovascular risk factors based on medical history, clinical findings, anthropometry and biochemistry tests among healthcare workers in Kelantan, Malaysia. This information is necessary to assess the prevalence of these cardiovascular risk factors among health care workers in Malaysia.

## MATERIALS AND METHODS

### Study design and population

We conducted a cross sectional study at four government hospitals: two tertiary hospitals and two district hospitals in Kelantan, Malaysia. Using Microsoft Excel 2010 (Microsoft, Redmond, WA), we

randomly chose 330 subjects from a list of all health care workers registered at the four selected hospitals. Inclusion criteria were: health care workers who had been working for at least one year at that health facility, Malaysian citizens and those who worked directly with patients.

### Body mass index and waist-hip ratio

The weight of each subject was measured to the nearest 0.1 kg while they were wearing their uniform without shoes, with emptied pockets and without wristwatches, using a SECA 762 mechanical personal scale (Model 762, Hamburg, Germany). The height was measured to the nearest 0.1 cm using a SECA 206 mechanical measuring tape with wall stop (Model 206, Hamburg, Germany). The waist-to-hip ratio was measured using a plastic flexible tape measured in cm. The waist circumference was measured between the lower rib and the superior iliac crest, and the hip circumference was measured at the widest part of the hip.

### Biochemical profile

Study subjects were requested to fast overnight. The blood was collected and examined for total cholesterol, triglycerides, high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol and fasting blood sugar at BP Clinical Lab, a private laboratory in Kelantan, Malaysia.

The total cholesterol was measured using enzymatic method to determine cholesterol esterase and cholesterol oxidase conversion (Siemens, Erlangen, Germany). A direct-HDL cholesterol (D-HDL) method was used to measure the HDL cholesterol level. The glucose oxidase (GLUO) method was used to measure the glucose level based on the method of Keston (Siemens, Erlangen, Germany). The glucose level was determined after

enzymatic oxidation in the presence of glucose oxidase. The triglyceride (TRIG) level was measured using a method based on the Fossati three-step enzymatic reaction (Siemens, Erlangen, Germany). All analyses were conducted using the Advia Chemistry System by Siemens Healthcare Diagnostics (Siemens, Erlangen, Germany).

### Ethics

Ethical approval was obtained from the Universiti Sains Malaysia (USM) Ethics and Research Committee (USMKK/PPP/JEPeM [204.4(1.4)]) and from the Office of the Deputy Director General of Health (Research and Technical), Ministry of Health, Malaysia (NMRR-08-1440-2874).

### Statistical analysis

The data were entered into Epidata Entry (Lauritsen, 2000) and analyzed using the Statistical Package for Social Sciences (SPSS), version 18 (IBM, Armonk, NY). The main objective of the study was to evaluate descriptively cardiovascular risk factors; therefore, we only used means and standard deviations to describe numerical variables and numbers with percentages for categorical variables.

## RESULTS

Of the 330 health workers invited to participate, 308 (93.3%) came for the examination. The demographics of the subjects are shown in Table 1. The mean age of the subjects was 43.5 years; 82% were females, 93% were ethnic Malays and the majority had either a diploma or a certificate of qualification. More than 90% came from paramedical or nursing categories.

Thirty-one percent, 14% and 10% had a history of dyslipidemia, hypertension and

Table 1  
Socio-demographic characteristics of study subjects ( $n=308$ ).

Socio-demographic characteristics	No. (%)
Age (years)	43.5 (9.3) <sup>a</sup>
Gender	
Male	57 (18.5)
Female	251 (81.5)
Ethnic group	
Malay	288 (93.5)
Chinese	15 (4.9)
Indian	2 (0.6)
Siamese	1 (0.3)
Others	2 (0.6)
Marital status	
Married	283 (91.9)
Widowed	15 (4.8)
Unmarried	10 (3.2)
Occupation	
Medical specialist	2 (0.6)
Medical officer	26 (8.4)
Nurse	226 (73.4)
Assistant nurse	13 (4.2)
Assistant medical officer	41 (13.3)
Mean years working in the health sector	19.1 (9.2) <sup>a</sup>
Smoking status	
Never smoked	290 (94.2)
Previous smoker	1 (0.3)
Current smoker	17 (5.5)

<sup>a</sup>Mean (SD)

diabetes mellitus, respectively (Table 2). All subjects with hypertension and diabetes mellitus were undergoing pharmacologic treatment. These high treatment rates may be due to compulsory screening for these diseases of all employees at Malaysian government hospitals and subsequent referral to family physicians for treatment.

Fifty-eight percent of subjects had no history of dyslipidemia, hypertension,

Table 2  
History of medical conditions and treatment (*n*=308).

Medical conditions	No. (%)	On pharmacological treatment No. (%)
Dyslipidemia		
Yes	95 (30.8)	57 (60.0)
No	213 (69.2)	
Hypertension		
Yes	44 (14.3)	44 (100.0)
No	264 (88.7)	
Diabetes mellitus		
Yes	32 (10.4)	32 (100.0)
No	276 (89.6)	
Stroke		
Yes	4 (1.3)	4 (100.0)
No	304 (98.7)	
Ischemic heart disease		
Yes	5 (1.6)	2 (40.0)
No	303 (98.4)	

diabetes mellitus, stroke, heart attack, abnormal digestion, arrhythmias or joint diseases (Table 3). Twenty-four percent had a single chronic medical condition and 40% had from one to three medical conditions.

The mean blood pressure reading and anthropometric measurements are shown in Table 4. The mean weight and body mass index (BMI) were 65.8 (SD=12.6) kg and 40.1 (SD=8.6) kg/m<sup>2</sup>, respectively. Thirty-six point four percent had a normal BMI, 38% were pre-obese (BMI : 25-29.9) and 24.3% were obese (BMI ≥30). The mean systolic blood pressure (SBP) was 121 (SD=14) mmHg, the mean diastolic blood pressure was 77 (SD=10) mmHg and the mean waist circumference was 84.8 (SD=11.5) cm.

Table 5 shows the biochemistry results for the subjects. The mean fasting blood sugar, total cholesterol, triglyceride

Table 3  
Subjects with concurrent medical conditions.

Number of medical conditions*	No. (%)
No conditions known	178 (57.8)
1 medical condition	74 (24.0)
2 concurrent medical conditions	37.0 (12.0)
3 concurrent medical conditions	12 (3.9)
4 concurrent medical conditions	3 (1.0)
5 concurrent medical conditions	1 (0.3)
7 concurrent medical conditions	1 (0.3)
8 concurrent medical conditions	2 (0.6)

\*Medical conditions were identified based on a) abnormal lipid profile, b) high blood pressure, c) diabetes melitus, d) stroke, e) heart attack, f) abnormal digestion, g) arrhythmias and h) joint diseases. No subject had six concurrent medical conditions.

(TG), high-density lipoprotein cholesterol (HDL-cholesterol) and low-density lipoprotein cholesterol (LDL-cholesterol) levels were 5.8 (SD=2.4) mmol/l, 5.5 (SD=1.0) mmol/l, 1.4 (SD=0.9) mmol/l, 1.5 (SD=0.3) mmol/l and 3.5 (SD=0.9) mmol/l, respectively. Eight percent had an abnormal fasting blood glucose (≥7.8 mmol/l), 27% had an undesirable TG level and 19.2% had an undesirable HDL level.

## DISCUSSION

We conducted this cross sectional study to evaluate traditional cardiovascular risk factors among healthcare workers in Kelantan, Malaysia. Our subjects (*n*=308) had more favorable mean blood pressures, total cholesterol and fasting HDL cholesterol levels and less favorable LDL cholesterol and triglyceride levels than among the general Malaysian population. A large proportion of the subjects were obese and had diabetes mellitus, two major cardiovascular risk factors.

Table 4  
Subjects' blood pressures and anthropometric measurements.

Physical findings	No. (%)
Mean weight (kilograms)	65.8 (12.64)
Mean height (meters)	1.6 (0.08)
Mean body mass index (kg/m <sup>2</sup> )	
All	27.0 (4.8)
Male	26.7 (4.1)
Female	27.1 (4.9)
Body Mass Index category <sup>a</sup>	
Underweight (<18.5 kg/m <sup>2</sup> )	4 (1.3)
Normal (18.5-24.9 kg/m <sup>2</sup> )	112 (36.4)
Pre-obese (25.0-29.9 kg/m <sup>2</sup> )	117 (38.0)
Obese Class I (30.0-34.9 kg/m <sup>2</sup> )	58 (18.8)
Obese Class II (35.0-39.9 kg/m <sup>2</sup> )	13 (4.2)
Obese Class III (≥40 kg/m <sup>2</sup> )	4 (1.3)
Mean systolic blood pressure (mmHg)	121.5 (14.0)
Mean diastolic blood pressure (mmHg)	76.5 (9.7)
Mean waist circumference (cm)	84.8 (11.54)
Mean hip circumference (cm)	101.5 (10.34)
Mean waist to hip ratio	0.84 (0.1)
Signs of dyslipidemia	7 (2.3)
Yes	301 (97.7)
No	

<sup>a</sup>Source: Malaysian Association for the Study of Obesity (2012).

One of the most important risk factors for stroke and coronary artery disease is smoking (Ohiro and Iso, 2013). In this study, 5.5% of subjects were current smokers and 0.3% had a history of smoking. During the population-based National Health Morbidity Survey (NHMS) study conducted in Malaysia in 2010, the prevalence of smokers was 10.8% (Mustafa *et al*, 2011). When we stratified this analysis, we found that none of the female subjects smoked, but 32% (18/57) of the male subjects were either current smokers or had smoked previously and quit. This is lower than the findings of the NHMS in 2010 where the prevalence of current male smokers was 46.4%.

In our study, 14.3% (44/308) of subjects

reported having a history of hypertension. Based on our blood pressure findings, 9.7% of subjects were newly diagnosed as having hypertension (systolic blood pressure ≥140mmHg or diastolic blood pressure ≥90mmHg). Therefore, the overall proportions of subjects with hypertension in our study was 24%. One study from Malaysia found 52% of subjects had hypertension (Mustafa *et al*, 2011). In the NHMS general population survey conducted in 2006, the prevalence of hypertension was 74% (Kiau *et al*, 2013). In another study among elderly Malaysians, the rate of hypertension was 77.0% (CI: 75.4-78.6) among elderly Malays, 71.8% (CI: 69.5-74.2) among elderly Chinese, and 70.0% (CI: 65.0-75.1) among elderly Indians (Nuur Amalina *et al*, 2012).

Table 5  
Subject biochemistry results.

Test	No. (%)
Mean fasting blood sugar	5.8 (2.4) <sup>a</sup>
Fasting blood sugar category	
Normal (<7.8 mmol/l)	283 (91.9)
Abnormal (≥7.8 mmol/l)	25 (8.1)
Mean fasting total cholesterol level	5.5 (1.0) <sup>a</sup>
Fasting total cholesterol category	
<5.2 mmol/l	132 (42.9)
5.2-6.1 mmol/l	100 (32.5)
>6.1 mmol/l	76 (24.7)
Mean fasting triglyceride level	1.4 (0.9)
Fasting triglyceride category	
Desirable (<1.7 mmol/l)	225 (73.1)
Undesirable (≥1.7 mmol/l)	83 (26.9)
Mean fasting HDL-cholesterol level	1.5 (0.3)
Fasting HDL cholesterol category	
Desirable <sup>a</sup>	249 (80.8)
Undesirable	59 (19.2)
Mean fasting LDL-cholesterol level	3.5 (0.9)
Fasting LDL-cholesterol category	
<2.6 mmol/l	55 (17.9)
2.6-4.0 mmol/l	180 (58.4)
>4.0 mmol/l	69 (22.4)

<sup>a</sup>>1.0 mmol/l in male, >1.2 mmol/l in female.

However, the prevalence of hypertension in rural Malaysia in one study was found to be only 28.2% (Rashid and Am, 2011). In our study, all subjects with a history of hypertension were undergoing pharmacological treatment, compared to only 42.4% in a nationwide survey in 2006 (Kiau *et al*, 2013).

The mean fasting total cholesterol in our study was 5.5 mmol/l compared to 4.64 mmol/l in the general Malaysian adult population (Nuur Amalina *et al*, 2012) and 4.91 mmol/l in the rural Malaysian males and 5.17 mmol/l among rural Malaysian females (Wai *et al*, 2000). The mean fasting total cholesterol in our subjects was the same as among a general survey among

Malays patients (5.5 mmol/l) but slightly higher than among Chinese patients (5.1 mmol/l) and Indian patients (also 5.1 mmol/l) registered in the Malaysia Non-Communicable Diseases (NCD) database (Lu and Bin Nordin, 2013). Total cholesterol is an important risk factor for cardiovascular diseases; for every 1 mmol/l increase in total cholesterol, there is a 35% increase in the risk of coronary death, a 25% increase in the risk of fatal and non-fatal stroke and a 20% decrease in the risk of hemorrhagic stroke (Zhang *et al*, 2003).

In our subjects, the mean LDL-cholesterol was 3.5mmol/l, HDL-cholesterol was 1.5 mmol/l and triglyceride was 1.4

mmol/l. These values are similar to those among the Malaysian general population aged 45-54 years: of 3.7 mmol/l, 1.2 mmol/l and 1.8 mmol/l for males, and 3.6 mmol/l, 1.5 mmol/l and 1.4 mmol/l for females, respectively. A study of 148 factory workers in Kelantan, Malaysia found the mean levels of LDL-cholesterol, HDL-cholesterol and triglyceride were 3.9 mmol/l, 1.4 mmol/l and 1.7 mmol/l, respectively (Nazri *et al*, 2008).

The mean fasting blood sugar among our subjects was 5.8 mmol/l, compared to 4.9 mmol/l among 148 Malaysian factory workers in Kelantan, Malaysia (Nazri *et al*, 2008) and 6.2 mmol/l among Malaysian males and 6.0 mmol/l among female Malaysian females aged 45-54 years from a large cohort study in Malaysia (Jamal *et al*, 2014). Based on past medical history, 10.4% of our subjects had diabetes. When we analyzed the fasting blood sugar levels of our subjects, 4.4% (12/262) had blood sugar levels  $\geq 7.8$  mmol/l, a level consistent with diabetes mellitus. This gives a total prevalence of diabetes mellitus among our study subjects of 14.4%. Nationwide surveys in Malaysia during 1986 and 1996 found that the prevalence of 8.3% and 14.3%, respectively (Institute of Public Health, 2008). Diabetes increases the risk of coronary heart disease twofold, ischemic stroke 2.3 times and hemorrhagic stroke 1.6 times (Sarwar *et al*, 2010).

The mean BMI among our study subjects was 27.0 kg/m<sup>2</sup>, which is slightly higher than in the Malaysian population of 26.0 for males and 26.5 for females aged 45-54 years (Jamal *et al*, 2014). Twenty-four point three percent of our study subjects were obese (BMI  $\geq 30.0$  kg/m<sup>2</sup>), higher than 5.8% for a study conducted in 1996 reported among Malaysian adults aged 30-65 years (Ismail *et al*, 2002) and higher than the 19.3% for a study conducted in

2006 among Malaysian adults aged 25-55 years (Institute of Public Health, 2008).

We evaluated the traditional cardiovascular risk factors among healthcare workers in Malaysia, and our findings form important recent baseline results for comparisons. The use of anthropometric measurements and laboratory results were the major strengths of the study.

We concluded that the proportion of healthcare workers in Malaysia with hypertension was smaller than that of the general Malaysian population. Our healthcare workers had higher fasting total cholesterol but slightly lower fasting blood sugar than seen in the general Malaysian population. The proportions of workers with obesity and diabetes were large. The findings suggest need for immediate intervention to reduce traditional cardiovascular risk factors in this population who act as role models and health care gate-keepers for Malaysians.

#### ACKNOWLEDGEMENTS

The authors would like to thank the Director-General for Health, Ministry of Health, Malaysia and The Kelantan State Health Director for their full support with this study. Many thanks also to Ms Kartini Daud for assistance with data entry and to the Universiti Sains Malaysia for funding the study (Research University Grant: 1001/PPSP/811082).

#### REFERENCES

- Ahmad WA, Ramesh SV, Zambahari R. Malaysia-ACute CORonary syndromes Descriptive study (ACCORD): Evaluation of compliance with existing guidelines in patients with acute coronary syndrome. *Singapore Med J* 2011; 52: 508-11.
- Institute of Public Health. The Third National Health and Morbidity Survey 2006 (NHMS

- III). Kuala Lumpur: Institute of Public Health, Malaysia, 2008.
- Ismail MN, Chee SS, Nawawi H, Yusoff K, Lim TO, James WP. Obesity in Malaysia. *Obes Rev* 2002; 3: 203-8.
- Jamal R, Syed Zakaria SZ, Kamaruddin MA, *et al.* Cohort profile: The Malaysian Cohort (TMC) project: a prospective study of non-communicable diseases in a multi-ethnic population. *Int J Epidemiol* 2014; 0: 1-9.
- Khoo KL, Tan H, Khoo TH. Cardiovascular mortality in Peninsular Malaysia: 1950-1989. *Med J Malaysia* 1991; 46: 7-20.
- Kiau HB, Kaur J, Nainu BM, *et al.* Prevalence, awareness, treatment and control of hypertension among the elderly: the 2006 National Health and Morbidity Survey III in Malaysia. *Med J Malaysia* 2013; 68: 332-7.
- Lauritsen JM, ed. EpiData Entry, Data management and basis statistical analysis system. Odense: EpiData Association, 2000.
- Lu HT, Bin Nordin R. Ethnic differences in the occurrence of acute coronary syndrome: results of the Malaysian National Cardiovascular Disease (NCVD) Database Registry (March 2006-February 2010). *BMC Cardiovasc Disord* 2013; 13: 97.
- Malaysian Association for the Study of Obesity (MASSO). Defining obesity. Kuala Lumpur: MASSO, 2012. [Cited 2014 Nov 10]. Available from: <http://www.maso.org.my/spom/chap3.pdf>
- Ministry of Health. Number of discharges and deaths in government hospitals. Kuala Lumpur: Ministry of Health, Malaysia, 2010. [Cited 2013 Dec 15]. Available from: [http://www.moh.gov.my/images/gallery/stats/health\\_fact/health\\_facts\\_2010.pdf](http://www.moh.gov.my/images/gallery/stats/health_fact/health_facts_2010.pdf)
- Ministry of Health, Health Informatic Centre, Planning and Development Division. Health facts 2009. Kuala Lumpur: Ministry of Health, 2010: 1.
- Mustafa N, Kamarudin NA, Ismail AA, *et al.* Prevalence of abnormal glucose tolerance and risk factors in urban and rural Malaysia. *Diabetes Care* 2011; 34: 1362-4.
- Nazri SM, Tengku MA, Winn T. The association of shift work and hypertension among male factory workers in Kota Bharu, Kelantan, Malaysia. *Southeast Asian J Trop Med Public Health* 2008; 39: 176-83.
- Nuur Amalina AG, Jamaiyah H, Selvarajah S. Geographical variation of cardiovascular risk factors in Malaysia. *Med J Malaysia* 2012; 67: 31-8.
- Ohiro T, Iso H. Cardiovascular disease epidemiology in Asia: an overview. *Circ J* 2013; 77: 1646-52.
- Rashid AK, Am A. Prevalence of hypertension among the elderly Malays living in rural Malaysia. *Australasian Med J* 2011; 4: 283-90.
- Sarwar N, Gao P, Seshasai SR, *et al.* Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. *Lancet* 2010; 375: 2215-22.
- Wai TN, Lin KG, Siong TE, *et al.* Nutritional assessment of rural villages and estates in peninsular Malaysia: total blood cholesterol values in children, adolescents and adults. *Asia Pac J Clin Nutr* 2000; 9: 115-21.
- Zhang X, Patel A, Horibe H, *et al.* Cholesterol, coronary heart disease, and stroke in the Asia Pacific region. *Int J Epidemiol* 2003; 32: 563-72.