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The Prevalence of Cardiovascular Disease Risks among Working People in Malaysia: Findings from the National Health and Morbidity Survey 2015

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ABSTRACT

Introduction: Cardiovascular disease (CVD) is prevalent globally and associated with the risk of premature mortality among the economically productive population. This article aimed to determine the prevalence of seven types of diseases and risk factors that contribute to CVD among working people (18-64 years) in Malaysia. **Methods:** A cross-sectional study among a nationally representative sample in Malaysia was conducted using a validated questionnaire. Registered nurses performed the clinical procedures to measure glucose, cholesterol, body mass index and blood pressure. The prevalence was calculated via the complex samples menu of the IBM SPSS version 25 data analysis to ensure population representativeness. **Results:** The overall prevalence of CVD risks among working people was 14.1%, 17.3%, 24.5%, 28.3%, 31.7%, 45.9% and 94.2% for diabetes, obesity, hypertension, inactive, tobacco smoking, hypercholesterolemia and inadequate fruit and vegetable (FV) intake, respectively. This study found that the older age group of working people has a higher prevalence of diabetes, hypertension, and hypercholesterolemia. In terms of gender, males significantly have a higher prevalence of hypertension and tobacco smoking than females. Whereas females significantly have a higher prevalence of hypercholesterolemia, obesity, and physically inactive than males. Those who worked as a manager & senior officials and clerical workers were inactive, while skilled workers had the highest prevalence of tobacco smoking at 60%. **Conclusions:** This study highlighted that working people have significant CVD risks and they vary according to socio-demographic and occupational characteristics. Thus, a workplace intervention should be conducted by the employers in line with the mainstream health services at the health facility to reduce premature morbidity and maintain productivity.

KEYWORDS: Cardiovascular disease (CVD), occupation, industry classification, working people, National Health & Morbidity Survey (NHMS)

INTRODUCTION

Cardiovascular disease (CVD) is a group of diseases, and the most common are ischemic heart disease and stroke. The main target organs for CVD are the heart and blood vessels. The traditional risk of CVD is related to maladaptive behaviour such as tobacco use, unhealthy diet, obesity, physically inactive, and harmful alcohol use [1]. The global burden of disease study in 1990-2019 listed ischemic heart disease as the top leading cause of disability-adjusted life-years (DALYs), followed by stroke and diabetes among people aged 50-74 years [2]. An annual report of the National Cardiovascular Disease Database in Malaysia stated that the number of patients undergoing percutaneous coronary intervention increased from the year 2015-2016 compared to 2017-2018 [3]. Therefore, the National Health and Morbidity Survey (NHMS) was conducted in Malaysia to monitor the trends of CVD risks among the Malaysian adult population. The NHMS was used to estimate the prevalence of diabetes mellitus, hypertension, hypercholesterolemia, tobacco use, physically inactive and obesity for each 4-year cycle since 2011 [4,5].

CVD may cause premature death, and three-quarters of all premature deaths occur in low- and middle-income countries [1]. Thus, the recommendation of targeted CVD screening as early as 30 years was mentioned in the recent Malaysian Clinical Practices Guidelines on Primary & Secondary Prevention of Cardiovascular Disease 2017 [6]. The age range of 18 to 64 years is the most productive age for working and maintaining their family's needs [7]. Unfortunately, younger adults were associated with low awareness of CVD risk, as found by previous local studies [8,9].

Working age refers to the age of 15 to 64 years in many countries, including Malaysia. In addition, there is a standard occupation classification according to the main job title and industry classification [7,10]. Occupation exposes people to occupational hazards that may have health effects in the long run, which mostly manifest after the individual has left the job [11,12]. Ischemic heart disease remains the leading cause of mortality worldwide. Working people may have an uncovered prevalence of sudden CVD attacks due to a lack of awareness of early screening programs [13]. CVD complications can be prevented if the working population is aware of the risk factors and take preventive action as documented in the national guideline [6]. CVD is grouped under non-communicable diseases (NCDs) and accounts for 38% of the total NCDs' premature mortality [1]. It can be considered a work-related disease (WRD) due to indirect and multifactorial causes, such as a sedentary lifestyle, sedentary work, hereditary factors and occupational characteristics [14]. The prevalence of CVD among workers was estimated from previous studies in certain occupations, such as mining workers [15,16], public servants [17], healthcare workers [18], farmers [19], industrial sector workers [20] and community restaurants' food handlers [21]. Those who worked in the forest faced stressful working conditions with limited access to healthcare facilities [22], while truck drivers may have maladaptive behaviour [23] to meet their job demands. The prevalence of obesity, diabetes and hypertension among the mining workforce was 4.5%, 11.7%, and 18.2% respectively [15]. Another study reported that the prevalence of university staff with metabolic syndrome was 20.6% [17].

The occupational characteristics in Malaysia were not explored in detail in previous NHMS until in NHMS 2015, a group of occupational experts proposed a new instrument for collecting data on occupational characteristics. In 2015, the total number working population was 14.5 million persons as reported by the Department of Statistics Malaysia [7]. This study aims to estimate the prevalence of seven types of diseases or risk factors that may contribute to CVD among working people in Malaysia. The identified diseases or risk factors for CVD included in this study consisted of seven groups namely diabetes mellitus, hypertension, hypercholesterolemia, obesity, smoking, physical inactivity and inadequate fruit and vegetable (FV) intake.

MATERIALS AND METHODS

Data were obtained from the NHMS 2015, a scheduled nationwide household survey since 1986. The data were used to review health priorities and plan the strategy and resources for delivering health care services, particularly NCD and its risk factors.

Population and sampling

The NHMS used a national representative sample; hence, multistage random cluster sampling was applied to cover urban and rural areas in all thirteen states and three federal territories (FT) in Malaysia. Malaysia's geographical areas were divided into enumeration blocks (EB) with 80 to 120 living quarters (LQs) per EB. It may also consist of an average of 500 to 600 people. The Department of Statistics Malaysia provided the sampling frame. The primary sampling unit was the EBs, and the LQs were the secondary sampling unit. All households in the selected LQs and members in the household were eligible to participate in this study. The NHMS 2015 required 10,428 LQs to meet the core objectives based on a single proportion formula for prevalence estimation. A few adjustments were made to the total sample size considering the design effect and non-response rate of 35%. Urban and rural areas were taken into consideration and were calculated proportionally to population size. This study utilized a cross-sectional study design and covered all age groups. Further details of the methodology of this study have been published in the technical report which can be accessed publicly [5]. This analysis focused on the

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respondents who answered the question "Are you working?" referring to the past month among respondents aged 18 to 64 years. The defined age for the labour force in Malaysia was 15-64 years [24]. However, the age of 18 years was taken because the CVD prevalence was only measured for adults aged 18 years and above in the NHMS survey.

Instruments and training

This survey used a validated questionnaire and a standard clinical procedure of point-of-care testing [25]. An added questionnaire on occupational characteristics was incorporated into this NHMS cycle. The questionnaire was developed by a panel of experts in occupational health and underwent a pre-test session. The main job title was based on the Malaysia Standard Classification of Occupations (MASCO) 2013, and it has ten groups of main job titles [10]. The industry classification was adapted from Malaysia Standard Industrial Classification (MSIC) 2008 from the alphabet A to U classification groups [24]. The process of developing occupational characteristics questionnaires and the occupational questionnaire and original local classifications is attached in *Supplement 1*. The clinical measurements included anthropometric measurements for weight and height and capillary blood sampling to measure fasting blood glucose and cholesterol. The Tanita Personal Scale HD 319, SECA Stadiometer 213 and CardioChek® PA Analyzer were utilized in this survey [26]. Blood pressure was measured using the Omron Japan Model HEM-907. Before the actual survey, a one-week formal data collection training was held in Peninsular Malaysia and Sabah & Sarawak. The data collection team consisted of temporary personnel who conducted the interviews while the permanent staff nurses undertook the clinical procedures. Adherence to the safety procedure and standard clinical waste disposal was ensured.

Variable definitions

The sociodemographic variables were age group, gender and education level. The working status was elaborated in terms of main job title, industrial classification, job sector, working time and duration of working. The age of working adults was further categorized into three age groups of 18-34, 35-49 and 50 years and above as used by other studies [27,28]. The CVD risks measured in this study were the prevalence of overall diabetes, hypertension and hypercholesterolemia. It consisted of those who were newly diagnosed during the survey and those who were previously diagnosed by medical staff. In addition, current tobacco smokers, physical inactivity, obesity and inadequate FV intake were included. The definition of all variables measured in this study was according to the standard guidelines and can be referred to in the NMHS 2015 technical reports, which are publicly accessible via this link http://iku.gov.my/nhms-2015 [4,5].

Ethical approval and consent to participate

This survey obtained approval from the Medical Research and Ethics Committee (MREC), Ministry of Health and was registered with the National Medical Research Registration with NMRR ID–14-1064-21877. Written consent was obtained from each respondent before data collection. This study was conducted following the Declaration of Helsinki.

Statistical analysis

IBM SPSS Statistics for Windows, Version 25 software was used to calculate the NCD prevalence among the Malaysian population via the complex sample design. A weightage was applied in the data analysis due to multiple stages of sampling selection, such as EBs and LQ selection. In addition, the weightage calculation also considered the non-response rate and population factors such as age, gender, ethnicity, strata and state. The findings were tabulated in Table 1 for a descriptive analysis whereas Table 2 showed the prevalence according to socio-demographic profiles. The bivariate analysis via the Rao-Scott adjusted chi-square statistic was also conducted and a p-value of less than 0.05 was considered a significant finding.

RESULTS

The overall response rate for the national representative of the NHMS household survey was 86.4% of the total 9,433 eligible LQs and 30,548 individual respondents. This study focused on analysing 11,543 respondents aged 18 to 64 years who were working during the survey duration. The figure can be further estimated to be 12.9 million working people and may represent the working population in Malaysia. More than half of the

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respondents (52.1%) were 18 to 34 years old. Table 1 shows the sociodemographic of working people in Malaysia. Of the total respondents, 61.6% were males, and only 21.7% of the total respondents resided in urban areas. The overall occupational characteristics are shown in the lower part of Table 1 describing the main job title, industry classification, working time system and total duration of work. Approximately 60% of the respondents were from the private sector, 14.8% were from the government sector, and the remaining respondents were reported as self-employed.

The main job title showed that one-third were general workers or unskilled groups, and only 4.8% were managers and senior officials. According to the new instrument industry classification used in this study, 14.6% of the respondents worked in industries other than the twelve listed industries. The top three industries with the highest proportion of workers were manufacturing, wholesale and retail trade and the repair of motor vehicles and motorcycles, followed by agriculture and forestry and fishing, at 12.2%, 12.1%, and 10.1%, respectively.

Table 1 The sociodemographic of working people (18-64 years) in NHMS 2015; n=11,543

Variables	Unweighted count	Weighted % (95% CI)	Estimated population
Age group (years)			
18-34	4,880	50.6 (49.1, 52.1)	6,508,718
35-49	4,164	33.9 (32.5, 35.3)	4,355,816
50 and above	2,499	15.5 (14.6, 14.6)	1,996,088
Gender			
Male	6,922	62.8 (61.6, 63.9)	8,072,641
Female	4,621	37.2 (36.1, 38.4)	4,787,980
Strata			
Urban	4,406	21.7 (20.4, 23.0)	2,788,707
Rural	7,137	78.3 (77.0, 79.6)	10,071,914
Level of education			
Primary	3,394	31.7 (29.9, 33.5)	4,068,718
Secondary	5,682	47.4 (45.8, 49.0)	6,090,628
Tertiary	2,458	20.9 (19.3, 22.7)	2,691,299
Main job title classification (MASCO 2013)			
G1. Managers & senior officials	464	4.8 (4.2, 5.5)	611,904
G2. Professionals	1,394	11.8 (10.8, 13.0)	1,515,814
G3. Technician & associate professionals	588	5.5 (4.9, 6.1)	700,968
G4. Clerical workers	935	7.5 (6.8, 8.2)	963,861
G5. Services & sales workers	1,565	14.7 (13.7, 15.8)	1,891,744
G6. Skilled workers	2,125	19.7 (18.5, 20.9)	2,526,680
G7. Unskilled or general workers	4,461	36.0 (34.2, 37.9)	4,626,623
Industry classification (MSIC 2008)			
1. Manufacturing	1,294	12.2 (11.2, 13.4)	1,571,170
2. Wholesale & retail trade; repair of motor vehicles & motorcycles	1,218	12.1 (11.1, 13.1)	1,549,604
3. Agriculture, forestry & fishing	1,459	10.1 (8.8, 11.6)	1,301,650
4. Construction	759	7.5 (6.7, 8.3)	955,858
5. Accommodation & food service activities	915	7.6 (6.8, 8.6)	979,656
6. Education	771	5.8 (5.1, 6.6)	745,318
7. Public administration & defence; compulsory social security	994	6.7 (6.0, 7.5)	856,508
8. Administrative & support service activities	719	6.7 (6.1, 7.4)	860,495
9. Transportation & Storage	595	5.6 (5.0, 6.3)	720,100
10. Human health & social work activities	385	3.4 (3.0, 3.9)	439,912
11. Financial & insurance/takaful activities	324	3.8 (3.3, 4.4)	489,449
12. Professional, scientific and technical activities	357	3.8 (3.3, 4.4)	488,525

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13. Others	1,737	14.6 (13.5, 15.7)	1,868,094
Working Sector			
Government & semi government	2,167	14.8 (13.5, 16.2)	1,903,681
Private	5,934	60.7 (58.8, 62.6)	7,808,584
Self-employed	3,441	24.5 (23.1, 25.9)	3,147,856
Working in more than one sector	298	2.8 (2.3, 3.3)	355,261
Working time system			
Regular working time	5,950	53.2 (51.7, 54.8)	6,836,805
Extended hours	1,235	12.1 (11.1, 13.2)	1,556,066
Staggered days	3,015	22.9 (21.6, 24.3)	2,945,103
Shift hours	1,147	10.2 (9.1, 11.4)	1,308,739
Long haul	28	0.2 (0.1, 0.4)	29,186
Part-time	157	1.3 (1.0, 1.6)	167,628
Mean duration of work (years)	-	9.0 (8.7, 9.2)	-
Total duration of work (years)			
5 and below	5,219	50.3 (48.7, 51.8)	6,419,471
6 to 10	2,373	20.1 (19.1, 21.2)	2,571,445
>10 years	3,882	29.6 (28.3, 30.9)	3,782,051

Table 2 shows the overall prevalence of CVD risks among working people in Malaysia. There were 14.1%; (95% CI: 13.1, 15.0), 24.5%; (95% CI: 23.4, 25.6), 45.9%; (95% CI: 44.4, 47.4), and 17.3%; (95% CI: 16.3, 18.3), for diabetes, hypertension, hypercholesterolemia, and obesity, respectively. The prevalence of diabetes is nearly equal between the sexes. Males significantly had a higher prevalence of hypertension and current tobacco smokers than females. In contrast, females significantly had a higher prevalence of hypercholesterolemia, obesity and physically inactive than males. In terms of age groups, younger adults significantly had a higher prevalence of current tobacco smokers and inadequate FV intake, 32.8% (95% CI: 30.8, 34.8), and 95.0% (95% CI: 93.9, 95.9), respectively. Older adults significantly had a higher prevalence of diabetes mellitus (27.8%; 95% CI: 25.4, 30.2), hypertension (49.1%; 95% CI: 46.5, 51.7) and hypercholesterolemia (64.5%; 95% CI: 61.8, 67.1). The CVD risks based on the main job title highlighted that the managers and senior officials significantly had a higher prevalence of hypercholesterolemia (50.7%; 95% CI: 44.7, 56.7), the skilled worker group had a higher prevalence of smoking (60.1%; 95% CI: 57.0, 63.1), while obesity and physical inactivity were prevalent among those in the administrative work or white-collar group. By industry classification, diabetes was the highest among those who work in transportation & storage; hypertension was the highest among public administration & defence staff; compulsory social security and inadequate FV intake among construction workers. The prevalence of hypercholesterolemia was the highest among working people in the education industry. The transportation and storage industry has a higher prevalence of multiple CVD risks, including diabetes, hypertension, smoking, obesity and inadequate FV intake.

Table 2 The prevalence of CVD risks among working people in Malaysia

Variables	Diabetes mellitus	Hypertension	Hypercholesterolemia
	% (95% CI)	% (95% CI)	% (95% CI)
Overall prevalence	14.1(13.1, 15.0)	24.5 (23.4, 25.6)	45.9 (44.4, 47.4)
Age group (years)	*	*	*
18-34	8.4 (7.4, 9.5)	13.2 (11.9, 14.5)	34.0 (32.1, 35.9)
35-49	16.3 (14.7, 17.9)	30.1 (28.4, 32.0)	55.2 (52.9, 57.5)
50 and above	27.8 (25.4, 30.2)	49.1 (46.5, 51.7)	64.5 (61.8, 67.1)

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Variables	Diabetes mellitus	Hypertension	Hypercholesterolemia
	% (95% CI)	% (95% CI)	% (95% CI)
Gender	NS	*	*
Male	14.5 (13.3, 15.6)	26.8 (25.4, 28.3)	44.0 (42.3, 45.8)
Female	13.4 (12.1, 14.8)	20.5 (19.1, 22.0)	49.1 (46.9, 51.2)
Level of education	*	*	NS
Primary	17.0 (15.0, 19.3)	31.2 (28.4, 34.1)	47.3 (44.2, 50.3)
Secondary	14.3 (13.1, 15.7)	24.2 (22.7, 25.7)	45.6 (43.7, 47.5)
Tertiary	11.7 (10.3, 13.3)	20.5 (18.7, 22.5)	45.5 (43.1, 48.0)
Main job title classification (MASCO 2013)	NS	NS	*
G1. Managers & senior officials	12.5 (9.0, 17.0)	23.8 (19.2, 29.1)	50.7 (44.7, 56.7)
G2. Professionals	14.6 (12.2, 17.3)	23.6 (20.9, 26.4)	50.6 (47.0, 54.1)
G3. Technician & associate professionals	14.1 (11.1, 17.8)	25.1 (20.9, 29.8)	46.2 (40.9, 51.5)
G4. Clerical workers	12.4 (9.9, 15.5)	20.7 (17.7, 24.1)	43.0 (39.0, 47.0)
G5. Services & sales workers	11.4 (9.5, 13.5)	22.9 (20.5, 25.5)	43.1 (40.0, 46.3)
G6. Skilled workers	14.9 (13.2, 16.9)	25.1 (22.8, 27.5)	46.5 (43.5, 49.7)
G7. Unskilled or general workers	15.1 (13.6, 16.7)	25.9 (24.1, 27.8)	45.0 (43.0, 47.1)
Industry classification (MSIC 2008)	*	*	*
1. Manufacturing	14.7 (12.2, 17.6)	21.9 (19.0, 25.0)	44.4 (40.7, 48.1)
2. Wholesale & retail trade; repair of motor vehicles & motorcycles	11.1 (9.3, 13.2)	24.6 (21.4, 28.0)	37.5 (34.2, 41.0)
3. Agriculture, forestry & fishing	13.9 (11.5, 16.6)	28.9 (25.5, 32.7)	46.3 (42.6, 50.0)
4. Construction	12.5 (9.8, 15.9)	23.5 (19.4, 28.0)	43.7 (39.1, 48.5)
5. Accommodation & food service activities	16.2 (13.2, 19.7)	25.1 (21.9, 28.6)	49.3 (45.2, 53.4)
6. Education	17.7 (14.5, 21.5)	26.0 (22.5, 29.9)	55.1 (50.3, 59.8)
7. Public administration & defence; compulsory social security	15.5 (12.9, 18.4)	29.0 (25.4, 32.8)	49.8 (45.5, 54.1)
8. Administrative & support service activities	11.2 (8.7, 14.4)	19.4 (16.2, 23.1)	43.1 (38.6, 47.6)
9. Transportation & Storage	19.1 (15.1, 23.9)	27.6 (23.3, 32.3)	47.9 (42.3, 53.5)
10. Human health & social work activities	13.5 (9.9, 18.3)	25.3 (20.0, 31.4)	54.0 (47.5, 60.4)
11. Financial & insurance/takaful activities	12.4 (8.2, 18.2)	23.7 (18.9, 29.3)	47.4 (39.6, 55.3)
12. Professional, scientific and technical activities	11.7 (8.5, 15.8)	19.8 (15.3, 25.2)	45.4 (39.2, 51.7)
13. Others	14.3 (12.3, 16.5)	23.6 (21.1, 26.2)	46.1 (42.9, 49.3)
Working Sector	*	*	*
Government & semi government	17.2 (15.1, 19.5)	29.5 (27.0, 32.2)	54.4 (51.2, 57.6)
Private	12.0 (10.9, 13.2)	21.3 (19.9, 22.8)	42.6 (40.8, 44.5)
Self-employed	17.2 (15.5, 19.1)	29.3 (27.2, 31.4)	48.9 (46.5, 51.3)
Working time system	*	*	*
Regular working time	14.1(12.9, 15.4)	24.0 (22.6, 25.4)	47.0 (45.1, 49.0)
Extended hours	13.2 (11.2, 15.6)	23.3 (20.2, 26.8)	42.4 (38.8, 46.0)
Staggered days	16.1 (14.4, 17.9)	29.3 (27.0, 31.6)	47.6 (45.0, 50.2)
Shift hours & part-time	10.9 (8.9, 13.1)	18.8 (16.4, 21.5)	41.0 (37.7, 44.3)

Note: Rao-Scott adjusted chi-square statistic p-value. Significance is based on the adjusted F and its degrees of freedom.
* p-value < 0.05, NS=not significant

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Table 2 The prevalence of CVD risks among working people in Malaysia (cont'd)

Variables	Tobacco smoking	BMI ≥ 30 kg/m^2	Inactive	Inadequate FV intake
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Overall prevalence	31.7 (30.3, 33.1)	17.3 (16.3, 18.3)	28.3 (27.1, 29.6)	94.2 (93.4, 94.9)
Age group (years)	*	*	NS	*
18-34	32.8 (30.8, 34.8)	15.7 (14.4, 17.1)	29.3 (27.6, 31.1)	95.0 (93.9, 95.9)
35-49	32.5 (30.5, 34.6)	19.1 (17.6, 20.8)	26.7 (24.9, 28.7)	93.9 (92.8, 94.9)
50 and above	26.1 (24.0, 28.4)	18.1(16.2, 20.2)	28.5 (26.2, 31.0)	92.4 (90.6, 93.9)
Gender	*	*	*	NS
Male	49.4 (47.6, 51.3)	15.4 (14.2, 16.7)	24.5 (23.1, 26.0)	94.5 (93.6, 95.3)
Female	1.7 (1.2, 2.5)	20.5 (18.9, 22.1)	34.7 (32.9, 36.7)	93.8 (92.7, 94.7)
Level of education	*	*	*	*
Primary	41.9 (38.9, 45.0)	12.8 (11.1, 14.9)	20.4 (18.4, 22.6)	95.4 (94.2, 96.3)
Secondary	37.0 (35.2, 39.0)	18.7 (17.4, 20.0)	27.0 (25.4, 28.8)	94.3 (93.3, 95.2)
Tertiary	16.8 (15.3, 18.5)	18.2 (16.5, 20.0)	35.4 (33.2, 37.5)	93.3 (91.8, 94.5)
Main job title classification (MASCO 2013)	*	*	*	*
G1. Managers & senior officials	23.7 (19.1, 28.9)	19.4 (15.6, 23.9)	39.0 (33.9, 44.4)	92.5 (89.3, 94.9)
G2. Professionals	14.6 (12.4, 17.2)	20.8 (18.1, 23.9)	36.2 (32.9, 39.6)	92.0 (89.8, 93.8)
G3. Technician & associate professionals	32.8 (28.1, 37.8)	17.7 (14.1, 22.0)	30.2 (25.6, 35.3)	94.2 (91.1, 96.3)
G4. Clerical workers	9.3 (7.2, 11.9)	20.4 (17.3, 23.8)	39.7 (35.5, 44.0)	94.4 (92.2, 96.1)
G5. Services & sales workers	22.5 (19.8, 25.4)	17.1 (14.8, 19.7)	31.6 (28.5, 34.8)	93.4 (91.3, 95.0)
G6. Skilled workers	60.1 (57.0, 63.1)	17.3 (15.3, 19.5)	24.8 (22.5, 27.4)	94.6 (93.3, 95.8)
G7. Unskilled or general workers	42.0 (40.0, 44.1)	15.3 (13.9, 16.8)	22.0 (20.3, 23.8)	95.2 (94.2, 96.1)
Industry classification (MSIC 2008)	*	*	*	*
1. Manufacturing	34.7 (31.3, 38.2)	15.1 (12.7, 17.8)	24.7 (21.7, 28.0)	94.9 (93.1, 96.2)
2. Wholesale & retail trade; repair of motor vehicles & motorcycles	28.6 (25.5, 31.9)	13.7 (11.6, 16.1)	32.0 (28.4, 35.8)	93.2 (91.2, 94.8)
3. Agriculture, forestry & fishing	49.8 (46.1, 53.6)	11.9 (9.7, 14.5)	12.0 (9.9, 14.4)	93.1 (91.0, 94.8)
4. Construction	51.6 (46.4, 56.9)	12.9 (10.1, 16.5)	17.4 (14.1, 21.3)	96.6 (94.8, 97.7)
5. Accommodation & food service activities	28.1 (23.5, 33.1)	19.8 (16.5, 23.6)	24.3 (20.8, 28.3)	94.0 (91.7, 95.6)
6. Education	6.2 (4.2, 9.1)	24.9 (21.0, 29.2)	36.5 (32.3, 40.9)	90.0 (85.8, 93.0)
7. Public administration & defense; compulsory social security	33.3 (29.3, 37.5)	21.8 (18.7, 25.3)	31.4 (27.5, 35.6)	93.8 (91.4, 95.6)
8. Administrative & support service activities	16.5 (13.2, 20.4)	19.2 (15.9, 23.1)	40.1 (35.4, 44.9)	95.3 (93.2, 96.7)
9. Transportation & Storage	54.1 (48.5, 59.5)	20.1 (15.8, 25.3)	27.2 (22.7, 32.3)	93.1 (89.3, 95.7)

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Variables	Tobacco smoking	BMI ≥ 30 kg/m^2	Inactive	Inadequate FV intake
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
10. Human health & social work activities	11.9 (8.4, 16.6)	21.4 (16.6, 27.3)	30.9 (25.6, 36.9)	92.5 (88.6, 95.2)
11. Financial & insurance/takaful activities	11.9 (8.2, 16.9)	16.8 (12.7, 21.9)	43.5 (37.5, 49.8)	95.7 (92.0, 97.8)
12. Professional, scientific and technical activities	22.8 (17.6, 28.9)	16.8 (12.4, 22.5)	33.3 (27.6, 39.5)	91.9 (87.8, 94.7)
13. Others	30.8 (27.6, 34.1)	19.1 (16.7, 21.8)	30.8 (27.7, 33.9)	96.6 (95.2, 97.7)
Working Sector	*	*	*	*
Government & semi government	23.0 (20.5, 25.7)	22.7 (20.3, 25.4)	33.9 (31.2, 36.7)	92.4 (90.1, 94.2)
Private	32.0 (30.1, 33.9)	15.8 (14.5, 17.1)	29.3 (27.6, 31.0)	95.1 (94.2, 95.9)
Self-employed	36.1 (33.8, 38.5)	17.7 (16.0, 19.5)	22.6 (20.7, 24.8)	93.1 (91.8, 94.2)
Working time system	*	NS	*	NS
Regular working time	26.0 (24.4, 27.8)	18.2 (16.8, 19.5)	32.0 (30.4, 33.7)	94.1 (93.0, 95.0)
Extended hours	38.8 (34.8, 42.9)	16.8 (14.2, 19.7)	21.9 (19.8, 24.1)	94.3 (92.4, 95.7)
Staggered days	41.0 (38.5, 43.6)	15.5 (13.9, 17.3)	23.3 (20.0, 27.0)	94.2 (92.9, 95.3)
Shift hours & part-time	31.4 (27.9, 35.1)	17.6 (14.8, 20.6)	28.7 (25.7, 31.9)	94.7 (93.0, 96.0)

Note: Rao-Scott adjusted chi-square statistic p-value. Significance is based on the adjusted F and its degrees of freedom.
* p-value < 0.05, NS=not significant

DISCUSSION

This study used household survey data to estimate the prevalence of CVD risks among working people in Malaysia aged 18-64 years, representing 12.9 million working people. This figure reflected the working population as estimated by the Department of Statistics Malaysia in 2015 [7]. The occupational categorization can be simplified into two categories of white and blue-collar workers. The white collar refers to the professional, educated, office environment, managerial and administrative task of work and usually earning a higher income level [29]. However, this classification is too general, as the industries have both types of workers. This study utilized a newly developed questionnaire by occupational health experts for NHMS 2015 survey. The questionnaire collected detailed occupational characteristics, which included main job title, industry classification, working sector, working time and duration of working. The industry classification is limited to 13 groups instead of 21 groups according to local guideline MISC 2008, which need further improvement in a future survey [24].

A similar occupational characteristics classification was conducted in Australia, but the study used 19 groups of industry classification (30). There were scarce data on the prevalence of CVDs among working people in Malaysia using a large sample of respondents. A local study from a Malaysian cohort population estimated the prevalence of type 2 diabetes, hypercholesterolemia, and obesity according to 21 industry classifications; however, the study recruited participants between 2006 and 2012 [31]. Thus, this study focused on estimating seven CVD risks among working people using a recent national household population in 2015. Many studies have described increasing trends in diseases or risk factors that may contribute to CVD in low-income countries, but developed countries also face a similar pattern, but mortality is much lower than that in low-income countries [16,23,32,33].

According to age categories, working people aged 50-64 years had a higher prevalence of diabetes, hypertension, and hypercholesterolemia, but tobacco smokers were more likely among younger age working people. The higher prevalence of smoking among younger age groups may contribute to more young working people developing sudden attacks of ischemic heart disease. Following this, an early screening for

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CVD was recommended as early as 30 years [3,6]. Younger age with CVD may increase sick leave usage and affect work quality and productivity. In terms of sex, this study found that males have a higher prevalence of hypertension and smoked tobacco. The concurrent findings had the same results as those of previous studies [17,34]. Females had a higher prevalence of hypercholesterolemia and obesity and were physically inactive, which may contribute to a higher risk of CVD at later ages [35].

Current smoking alone is the strongest risk factor for CVDs and is among the modifiable CVD risks [6]. This study found that tobacco smokers were higher in the male gender, had low educational status, and were unskilled or general workers. By industry, smoking was associated with agriculture, forestry & fishing and transportation & storage workers. These findings show that smoking was prevalent among blue-collar workers due to many possible reasons, such as a lack of awareness of CVD, abundant supply or maladaptive behaviour towards job stress, less effort-reward imbalance and less social support at work [36–38].

In terms of the transportation & storage industry, working people in this industry had a higher prevalence of smoking. Some other studies found that transportation & storage workers had a higher prevalence of unideal cardiovascular health metrics, as they have a higher prevalence of physical inactivity, higher BMI, smoking and hypertension [39,40]. This group also had the highest prevalence of diabetes and a higher prevalence of hypertension, smoking, and obesity than workers in another twelve groups of new industrial classification. The transportation and storage workers were associated with a higher prevalence of smoking, diabetes, hypertension and obesity. A previous local study found that those working in transportation & storage had a higher prevalence of diabetes mellitus, but the study did not examine smoking status [31]. The mentioned study used a population of 35 to 65 years old, which contributes to their findings. Smoking was associated with transportation and storage workers because of their maladaptive behaviour in facing job demands to stay awake for a long duration [41].

According to the working sectors, the government & semi-government sector workers had a higher prevalence of multiple CVD risks, such as diabetes, hypertension, hypercholesterolemia, smoking and obesity, as found in previous studies [17,33,42]. There are many possible reasons for this finding, such as older age and sedentary working. Furthermore, government servants may be less likely to use private facilities for joining any screening program due to expensive fees. A local study noted higher odds of non-participation in community health screening programmes among those working in the private sector [13]. Thus, a workplace intervention program is important to reduce the prevalence of CVD among working people [43].

Strength and limitations

This study utilized a nationally representative sample of the Malaysian population and applied population weightage for better estimation. One of the limitations of this study was that industry classification might need revision because the highest proportion came from "Other industry", meaning that other than the listed industry classification. In addition, the study design was a cross-sectional survey that can only estimate the current status of CVD risks among working people in Malaysia.

Conclusion

CVD risks are prevalent among the working population in Malaysia, and they vary according to sociodemographic profiles and occupational characteristics. Those who work in sedentary working industries have a higher prevalence of obesity and hypercholesterolemia. Those in blue-collar or laborious work also had CVD risks from tobacco smoking. A holistic approach targeting those with unhealthy lifestyles and promoting a healthy workplace with strong commitment from the employer may decrease the CVD risk and prolong their productivity.

List of abbreviations

CVD: cardiovascular disease;
CI: confidence interval;
DALYs: disability-adjusted life-years;
EBs: enumeration blocks;
LQs: living quarters;
FV: fruit and vegetable;

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NHMS: National Health and Morbidity Survey;
MASCO: Malaysia Standard Classification of Occupations;
MSIC: Malaysia Standard Industrial Classification;
NCDs: noncommunicable diseases;
WRD: work-related disease.

Ethics approval and consent to participate

This survey obtained approval from the Medical Research and Ethics Committee (MREC), Ministry of Health and was registered with the National Medical Research Registration with NMRR ID–14-1064-21877. Written consent was obtained from each respondent before data collection. This study was conducted following the Declaration of Helsinki.

Availability of data and material

The dataset for this study is available upon request. The main author kept the dataset according to the National Institutes of Health Malaysia research data repository guidelines.

Conflict of interest

Authors declare none.

Author contributions

MFMY, LKK, RMR and SMA contributed to the design of the study, data cleaning, data analysis, and interpretation of the findings. SMA, NSS, TATL and MM drafted the manuscript. The paper is reviewed and criticized by MFMY, LKK and RMR in the second stage and finally, all authors approved the last version.

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