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Awareness of Cardiovascular diseases (CVD) and its associated factors among general adult population in Malaysia: A Cross-Sectional Study

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Abstract

Background: Cardiovascular disease (CVD) is a major cause of morbidity and mortality in Malaysia. However, awareness of CVD and its risk factors remain limited, especially among older adults and underserved groups. This lack of knowledge often results in underestimating risks and delaying treatment, compounded by sociodemographic, cultural, and healthcare access factors. Aim: This study aimed to assess the level of cardiovascular disease (CVD) awareness among the general adult population in Malaysia and to explore the influence of behavioral and lifestyle factors, the role of technology, coping and relieving mechanisms, and healthcare-related determinants in shaping CVD awareness among respondents. Method: A cross-sectional study was conducted among 454 Malaysian adults using convenience sampling. Data were collected through an online self-administered questionnaire distributed via social media. The survey captured sociodemographic details, lifestyle practices, CVD awareness, and sources of health information. Chi-square tests were applied to examine associations between awareness and lifestyle or sociodemographic variables, with significance set at $p<0.05$. Results: Out of 454 respondents, the majority were younger adults, with 55.1% having attained secondary education and 69.6% residing in West Malaysia. Overall, 92.7% demonstrated good awareness of CVD, while 7.3% showed poor awareness. Significant associations were found between higher awareness levels and non-smoking status ($p=0.001$), longer duration of physical activity ($p=0.009$), and balanced dietary practices ($p=0.004$). Technology-based platforms emerged as crucial sources of health information, with social media (38.1%) and health websites (25.3%) being the most frequently cited. Despite high awareness, gaps persisted in first-aid knowledge such as aspirin use during acute cardiac events. Conclusion: The findings highlighted considerable gaps in CVD awareness despite generally high reported knowledge levels. Targeted public health strategies, including culturally sensitive educational campaigns, community-based programs, and enhanced digital health communication, were essential to improve preventive practices, timely recognition of symptoms, and accessed to healthcare services in Malaysia.

Keywords: *Cardiovascular disease, Awareness, Adults, Malaysia*

Introduction

Cardiovascular disease (CVD) is a major public health challenge in Malaysia, contributing substantially to morbidity and mortality.[1] According to a 2016 report by the Ministry of Health Malaysia, cardiovascular diseases were the leading cause of death, accounting for 22.7% of fatalities in government hospitals and 27.7% in private hospitals.[1] Khaw et al. (2022), using data from the National Health and Morbidity Survey

(NHMS) 2019, reported that chronic diseases such as cardiovascular disease (CVD) and cancer are among the most prevalent and costly health conditions, though largely preventable. Unhealthy lifestyle practices remain widely recognized as major contributors to chronic disease and premature mortality.[2] Moreover, the rising prevalence of CVD has been linked to aging demographics, urbanization, and unhealthy lifestyle choices.

According to the Malaysian Heart Foundation (MHF), about 1 in 4 adults in Malaysia were living with hypertension, a key risk factor for CVD.[3] The NHMS 2019 reported a prevalence of hypertension was 30.3%, with 8.6% undiagnosed.[4] This was concerning given that hypertension was one of the primary risk factors for both stroke and heart disease.

Diabetes affects 18.3% of adults, many undiagnosed , while obesity is also rising, with almost half of adults overweight or obese, among the highest rates in Southeast Asia.[5] Obesity had become a rising concern, with nearly 50% of Malaysian adults classified as overweight or obese, which significantly contributed to the burden of CVD.[5] Aging further compounds the problem, with those aged 65 and above increasing from 8.3% in 2000 to 9.3% in 2020.[7] The NDR highlighted that men face higher CVD risk at younger ages, though women's risk rises sharply after menopause.[6] This demographic shift was expected to exacerbate the burden of cardiovascular disease in the coming decades.

Mat Rifin et al. (2025), using data from the National Health and Morbidity Survey 2023 in Malaysia, reported rising rates of diabetes, hypertension, and hypercholesterolemia, particularly among younger adults. The survey also highlighted the high prevalence of overweight, obesity, and mental health issues, all of which place an increasing burden on the healthcare system through non-communicable diseases and their related complications.[5] Cultural and social factors add complexity. Diets rich in fat, salt, and sugar contribute to obesity, hypertension, and diabetes, while cultural practices encourage frequent consumption of calorie-dense foods.[4] Social norms may delay care-seeking, especially in rural or conservative settings, where stigma sometimes prevents women from openly addressing health concerns.[3]

Barriers to prevention and management persist. In 2019, almost 40% of adults had never been screened for hypertension or diabetes despite available programs.[3] Awareness about the connections between these conditions and heart disease remains limited. Public education often focused on single diseases rather than overall risk management.[3] Access to healthcare was also uneven; while private services offer advanced care, affordability was a challenge, and public hospitals were often overstretched, leading to long waits and suboptimal care.[8]

Awad et al. (2014) examined public knowledge of cardiovascular disease (CVD) in Kuwait, focusing on risk factors and socio-demographic variables such as age, gender, education, and income, with the sample showing relatively high education and income levels.[9] The study assessed body weight and BMI, revealing discrepancies between self-reported weight and actual BMI, with many participants classified as overweight or obese. It also highlighted poor awareness of key health indicators, as many did not monitor blood pressure, cholesterol, or glucose regularly.[9]

In Malaysia, CVD has emerged as a leading cause of death, with cases increasingly affecting younger adults. The NCVD-ACS Registry reported that nearly one-quarter of patients were below 50 years, a younger onset compared to other countries.[10] Educational level and family history significantly influenced risk, with lower education and a family history of heart attacks linked to higher vulnerability. Despite widespread risk factors, awareness and diagnosis remained limited, as many failed to monitor their health status, leading to undetected conditions.[10]

Chan et al. (2021) found that Malaysians aged 50 and above had higher rates of modifiable risk

factors, including diabetes (23.3%), hypertension (42.2%), and hypercholesterolemia (35.6%). Multiple risk factors were common, and physical inactivity was associated with risk clustering.[11] More broadly, studies show that over 80% of older adults had at least one modifiable risk factor, while three-quarters had two or more. Hypertension, obesity, diabetes, smoking, and high cholesterol remain the most prevalent contributors to CVD in this age group.

Public awareness of cardiovascular disease (CVD) is crucial for prevention, particularly in Malaysia where it remains a leading cause of illness and death. More than 80% of adults aged ≥50 reported at least one modifiable risk factor, and three-quarters had two or more, mainly hypertension, obesity, hypercholesterolemia, diabetes, and smoking. [1,9,11] Awareness, however, was limited and strongly influenced by education, age, and residence, with those lacking formal education more likely to have multiple risks. This highlights the importance of health literacy and the need for campaigns promoting regular screening and monitoring of blood pressure, cholesterol, and glucose.[11,12]

Studies in Kuantan showed women had better CVD knowledge than men, possibly due to greater health engagement, while 96% of participants agreed that regular exercise helps prevent CVD (Mohammad et al., 2018).[13] Moreover, social and media campaigns were more effective when tailored to the literacy levels and cultural contexts of target populations.[10,13] Despite the growing prevalence of CVD, awareness among Malaysian adults remains low.[3] Most studies have focused on the prevalence of risk factors rather than perceptions, leaving gaps in understanding how the public views modifiable risks like hypertension, diabetes, cholesterol, smoking, and inactivity compared with non-modifiable ones such as age, gender, and genetics.[14,15] International evidence links awareness to preventive behaviors, but limited Malaysian data hinder targeted interventions. Van der Heide et al. (2024) emphasized that these knowledge gaps restrict the design of effective, population-specific strategies.[16]

Understanding these disparities was essential for designing culturally sensitive and inclusive health promotion strategies. Furthermore, Malaysia's ethnically and culturally diverse population presents unique challenges in addressing CVD awareness.[9] Research has indicated that cultural and ethnic differences significantly influence health behaviors and risk perceptions, but there are few studies about how these differences affect awareness of CVD in Malaysia.[6,13]

Addressing these gaps requires examining knowledge, perceptions, and information-seeking behaviors within different demographic, socioeconomic, and cultural contexts to guide targeted interventions and reduce the CVD burden.[14] Therefore, this study aimed to assess CVD awareness among Malaysian adults and identify the socio-demographic, cultural, and healthcare-related factors influencing it.

Methodology

Study Design

The design of our research work was a cross-sectional study that was carried out over two months during 2024, among the general adult population of Malaysia. Participants in our study consisted of general adults aged 18 years and above, regardless of nationality, who had access to internet facilities and were coherent in both English and Bahasa Melayu.

Sample Size

The sample size for this study was calculated using the OpenEpi sample size calculator. The estimated population of adults in Malaysia was 34.1million.[17] According to previous study done by Mujamammi AH et al., 2020, the estimated good awareness of cardiovascular disease risk factors among those above 18 years old was 47.1%.[18] By considering 95% confident interval (95% CI) and the design effect (for cluster surveys—DEFF) was set at 1, the minimum sample required in this study was 383 as shown in Figure 1. Taking into consideration the

10% non-response rate, the final sample size required in our study was 421. However, we managed to recruit 456 samples out of which the people who disagreed were excluded. Therefore, the final sample size analyzed in this study was 454.

Sample Size for Frequency in a Population

Population size(for finite population correction factor or fpc) (*N*):	34100000
Hypothesized % frequency of outcome factor in the population (*p*):	47.1% +/-5
Confidence limits as % of 100(absolute +/- %)(*d*):	5%
Design effect (for cluster surveys-*DEFF*):	1

Sample Size(*n*) for Various Confidence Levels

ConfidenceLevel(%)	Sample Size
95%	383
80%	164
90%	270
97%	470
99%	662
99.9%	1080
99.99%	1510

Equation

Sample size $n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$

Results from OpenEpi, Version 3, open source calculator--SSPropor
Print from the browser with ctrl-P
or select text to copy and paste to other programs.

Figure 1. Sample size calculation by using open epi software

Sampling Method & Procedure

For this study, a non-probability convenience sampling method was used. A Google survey form was sent to potential respondents through social media platforms such as WhatsApp, emails, Facebook, Instagram, etc. The inclusion criteria were adults aged 18 years and above residing in Malaysia, regardless of ethnicity or nationality, who provided consent to participate. Exclusion criteria included individuals unwilling to participate or those who submitted incomplete responses. Data was collected through a primary survey conducted over three weeks in 2024.

Data Collection Tools

An online questionnaire was created using Google Forms and shared via multiple social media platforms, such as WhatsApp, Instagram, and Facebook, to reach potential participants. The study targeted the general adult population in Malaysia, with specific inclusion and exclusion criteria to ensure the responses were relevant and of high quality.

The questionnaire consisted of six sections: Participant Information Sheet and Informed Consent, Socio-demographic Information, Knowledge of Cardiovascular Disease (CVD), Risk Factors, and Complications, Attitudes toward CVD Prevention, Perceptions of Personal Responsibility in Managing CVD Risk Factors, Health-Related Practices, focusing on managing risk factors

The data collection tools for this study were adapted from two questionnaires used in previous studies.[9,13] The questionnaire developed by the research team underwent content validation through expert ratings and feedback from six specialists before being implemented in the study. Section 1 included the Participant Information Sheet and Informed Consent. Section 2 contained 10 questions on socio-demographic information, covering gender, age, ethnicity, nationality, occupation, family income, relationship status, highest education level, field of study/work, and area of residence. Section 3 assessed knowledge of CVD and its risk factors in three subsections: (1) Knowledge of CVD and Risk Factors, (2) Knowledge of CVD Complications, and (3) Knowledge of Managing Risk Factors, with a total of 27 questions. Section 4 used a Likert scale to assess attitudes toward preventing CVD, consisting of 11 questions. Section 5 used a Likert scale to evaluate perceptions of personal responsibility in managing CVD risk factors, such as hypertension, dyslipidemia, and obesity, with 7 questions. Section 6 evaluated CVD-related practices using a Likert scale, focusing on managing and addressing risk factors, with 11 questions. The questionnaire assessed the general knowledge, attitudes, and perceptions (KAP) of the Malaysian population regarding CVD and its risk factors. It also explored the relationship between sociodemographic factors and KAP. The level of awareness of CVD was assessed with 11 questions, and participants were scored as having “good” or “poor” knowledge based on the mean score. The awareness levels in

this study were classified using Bloom's cut-off point, a widely applied method in knowledge, attitude, and practice (KAP) research. Typically, Bloom's criteria divide scores into three categories: Good awareness: ≥80%, Moderate awareness: 60–79%, Poor awareness: <60%.[19] However, consistent with previous studies, the moderate and good categories were combined into a single "good awareness" group (≥60%), while those scoring below 60% were categorized as having "poor awareness." This approach had been adopted in several health literacy and non-communicable disease awareness studies to simplify interpretation when a large proportion of participants score within the higher range.[20-22]

The questionnaire was evaluated for content validity using the Content Validity Index (CVI). A panel of 5 subject matter experts reviewed the questionnaire for relevance, clarity, and comprehensiveness. Each item was assessed on a 4-point Likert scale for relevance, and the CVI was calculated by dividing the number of items rated as "highly relevant" (3 or 4) by the total number of items. The overall CVI score was found to be 1.00, indicating excellent content validity and unanimous agreement among experts regarding the relevance of the tool for the research objectives.[23]

Data Collection Methods

The questionnaire was created using Google Forms and included an information sheet and participant consent form. The student researchers distributed the link through their social media accounts to reach potential participants. Access to the questionnaire was restricted to individuals meeting the inclusion criteria. The researchers regularly monitored the responses to ensure that only eligible participants were included. Once the target sample size was achieved, all responses collected via Google Forms were transferred to a Microsoft Excel spreadsheet for analysis.

Data Processing and Analysis

The data was processed and analyzed using the SPSS (Version 29) software and the results were presented through frequency counts and other descriptive statistics. Under the inferential statistics, chi-square test for analysis was selected to measure the association between independent and dependent categorical variables. The significant level (p-value) was set up at 0.05 with 95% confidence interval.

Ethical Consideration

Before completing the questionnaire, participants were provided with an information sheet that outlined all relevant aspects of the study. This approach enabled participants to make well-informed decisions about their participation while safeguarding their privacy and preventing any undue pressure or influence. In order to ensure understanding and the freedom to withdraw at any moment, written informed permission was provided prior to enrolment of the study. Anonymized data were safely preserved, with only the research team having access to the data. The ethical approval was obtained from research management Research Ethics Committee, Manipal University College Malaysia (MUCM). (Ref: MUCM/ Research Ethics Committee – 003FOM/01/2025).

Results

Study Selection

Table 1 presented the sociodemographic characteristics of the 454 respondents. Over half were aged 18–29 years (55.1%), while only 13% were 50 years and above. Females (56.6%) slightly outnumbered males (43.0%). Most participants had at least secondary education (55.1%), with only 0.4% lacking formal schooling, reflecting a generally educated sample. Regarding health status, 68.3% reported no comorbidities, whereas 31.7% did. Overall, the sample mainly comprised younger, educated individuals from moderate-income households in West Malaysia, with notable Indian and Malay representation, which may have shaped their awareness and perceptions of CVD.

Table 2 summarized the behavioral and lifestyle factors of the 454 respondents. About one-quarter (25.3%) reported smoking, reflecting continued challenges with tobacco use. Although most engaged in physical activity, 31.7% reported low-

intensity exercise and 35.7% exercised for less than 30 minutes, pointing to insufficient activity levels. In terms of diet, over half (56.8%) described their meals as moderately balanced, while 33.6% rated them as less balanced or were unsure, indicating room for improvement in dietary awareness and practices.

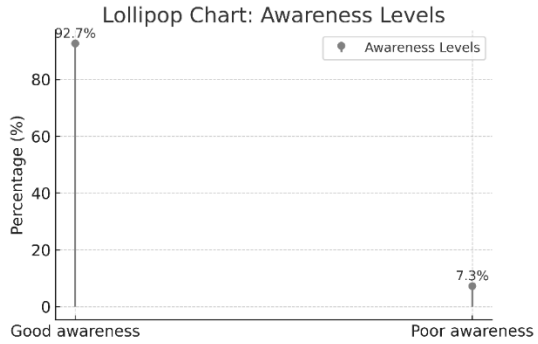

Figure 2. Level of awareness about cardiovascular diseases among the respondents (n=454)

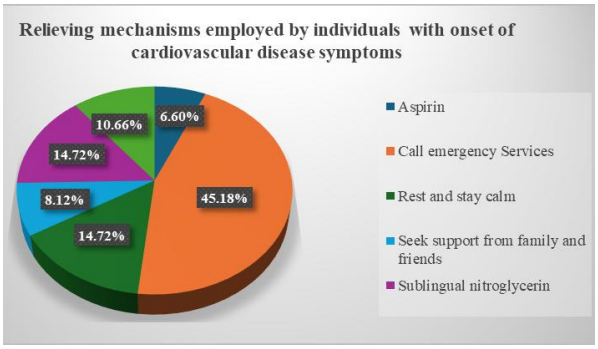

Figure 3. Relieving mechanisms employed by individuals with onset of cardiovascular disease symptoms among respondents (n=454)

Table 3 highlighted the significant role of technology in cardiovascular disease awareness among the respondents. Social media emerged as the primary source of information, used by 38.1%, followed by health websites (25.3%) and healthcare professionals (14.1%). Digital platforms were perceived favorably, with 46.5% rating their effectiveness highly. While 42.5% utilize mobile health applications, a substantial majority (73.9%) either agree or strongly agree that technology can contribute to reducing cardiovascular disease risks. These findings underscore the potential of technology to empower individuals in managing their heart health.

Table 1. Sociodemographic characteristics of the respondents (n=454)

Variables	n (%)
Age (years)	
18-29	250 (55.1)
30-39	94 (20.7)
40-49	51 (11.2)
50 and above	59 (13.0)
Gender	
Male	195 (43.0)
Female	257 (56.6)
Other	2 (0.4)
Monthly household income	
B 40	86(18.9)
M 40	267(58.8)
T 20	101(22.3)
Education level	
No formal education	2(0.4)
Primary school	12 (2.6)
Secondary school	250 (55.1)
Tertiary	190 (41.9)
Residency	
East Malaysia	138 (30.4)
West Malaysia	316 (69.6)
Marital status	
Single	283(62.3)
Married	171 (37.7)
Ethnicity	
Malay	76(16.7)
Chinese	87(19.2)
Indian	274(60.4)
Others	17(3.7)
Nationality	
Malaysian	309 (68.1)
Non-Malaysian	145 (31.9)
Family history of cardiovascular disease	170 (37.4)
Yes	256 (56.4)
No	28 (6.2)
Not sure	
Previous history of comorbidity	
Yes	144(31.7)
No	310(68.3)

Table 4 summarized the coping mechanisms for cardiovascular disease symptoms among 454 respondents. The majority (77.3%) reported no symptoms, while 20.7% experienced symptoms and 2.0% selected “others.” Among those with

symptoms, the most common response was contacting emergency services (19.6%). Other coping strategies included chewing aspirin and resting (6.4% each), using sublingual nitroglycerine (4.6%), and practicing breathing exercises or seeking family support (3.5% each). Overall, respondents mainly relied on professional assistance and first-aid measures, although the use of some strategies remained low.

Table 2. behavioral and lifestyle among the respondents (n=454)

Variables	n (%)
Smoking	
Yes	115(25.3)
No	339(74.7)
How many days of physical activity	
0 days	31(6.8)
1-2days	138(30.4)
3-4 days	169(37.2)
5-6 days	93(20.5)
7 days	23(5.1)
How long do physical activity	
Less than 30 min	162(35.7)
30 minutes-1hour	234(51.5)
>1 hour	58(12.8)
Intensity of physical activity	
Low	144(31.7)
Moderate	257(56.6)
High	53(11.7)
How often felt overwhelmed	
Never	46(10.1)
Almost never	19(19.8)
Sometimes	231(50.9)
Fairly often	64(14.1)
Very often	23(5.1)
How often felt stressed and anxious	
Never	52(11.5)
Almost never	78(17.2)
Sometimes	233(51.3)
Fairly often	71(15.6)
Very often	20(4.4)
Nutrient balance in daily meals	
Very balanced	39(8.6)
Moderately balanced	258(56.8)
Somewhat balanced	112(24.7)
Not balanced	32(7.0)
Unsure	13(2.9)

Table 5 presented the chi-square analysis of lifestyle and behavioral variables in relation to awareness of cardiovascular diseases. Smoking status showed a significant association, with χ^2 = 16.06 (df = 1, p = 0.001). Since the p-value was

Table 3. Role of technology in awareness of cardiovascular disease and level of awareness among the respondents(n=454)

Variables	n (%)
Source of information used	
Television	21(4.6)
Social media	173(38.2)
Mobile health app	51(11.2)
Health websites	115(25.3)
Traditional media	30(6.6)
Healthcare professional	64(14.1)
How effective is digital platforms	
1(not effective)	7(1.5)
2	17(3.7)
3	118(26.1)
4	211(46.5)
5 (very effective)	101(22.2)
Used any mobile health applications	
Yes	193(42.5)
No	261(57.5)
Believe technology can encourage help reduce risks of cardiovascular diseases	
Strongly disagree	11(2.4)
Disagree	16(3.5)
Neutral	137(30.2)
Agree	223(49.1)
Strongly agree	67(14.8)

below 0.05, the null hypothesis was rejected, indicating that smokers were less likely to demonstrate good awareness compared to non-smokers. In contrast, the number of days of physical activity did not show a significant association (χ^2 = 2.87, df = 4, p = 0.629). However, the duration of physical activity yielded a significant result (χ^2 = 9.564, df = 2, p = 0.009), suggesting that respondents who exercised for longer periods had higher awareness levels. The intensity of physical activity was not significantly associated (χ^2 = 2.315, df = 2, p = 0.314). Similarly, perceived stress variables, including feelings of being overwhelmed (χ^2 = 2.170, p = 0.705) and anxiety about unexpected events (χ^2 = 2.566, p = 0.615), showed no significant relationships. Nutritional balance, however, demonstrated a

significant association (χ^2 = 15.337, df = 4, p = 0.004), indicating that respondents with more balanced diets were more likely to have good awareness of cardiovascular diseases. Overall, smoking, duration of physical activity, and dietary balance emerged as significant predictors of awareness, underscoring the influence of lifestyle factors on cardiovascular health knowledge.

Table 4. coping mechanisms about cardiovascular diseases and level of awareness among the respondents (n=454)

Variables	n (%)
Had any symptoms given	
Yes	94(20.7)
No	351(77.3)
Others	9(2.0)
Mode of relieving agents used	
Call emergency services	89(19.6)
Chew aspirin	12(2.6)
Rest and stay calm	29(6.4)
Sublingual nitroglycerine	29(6.4)
Engage in breathing exercises	21(4.6)
Seek support from family /friends	16(3.5)

Table 6 presented the analysis of the role of technology in influencing cardiovascular disease awareness. The source of information showed a significant association (χ^2 = 11.258, df = 5, p = 0.048), indicating that awareness levels varied depending on the information source. The perceived effectiveness of digital platforms was also highly significant (χ^2 = 26.745, df = 4, p < 0.001), suggesting that respondents who considered digital platforms effective were more likely to demonstrate higher awareness. In contrast, mobile app usage was not significantly associated with awareness (χ^2 = 0.141, df = 1, p = 0.141). However, respondents' belief in technology's role in reducing cardiovascular disease risk showed a significant association (χ^2 = 14.677, df = 4, p = 0.005), with stronger beliefs linked to better awareness. Overall, these findings emphasized the

Table 5. Association between behavioral and lifestyle factors and awareness of cardiovascular disease and level of awareness among the respondents using chi-square test (n=454)

Variables	Level of awareness		x2 (df)	OR (95% CI)	p-value
	Poor	Good			
Currently smoking					
Yes	18(15.7)	97(84.3)	16.06(1)	0.249(0.121-0.513)	0.001
No	15(4.4)	324(95.6)			
Days of physical activity					
0	4(12.9)	27(87.1)			
1-2	11(8)	127(92.7)	2.87(4)	-	0.629
3-4	9(5.3)	160(94.7)			
5-6	7(7.5)	86(92.5)			
7	2(8.7)	21(91.3)			
How long					
<30min	16 (9.9)	146(90.1)	9.364(2)	-	0.009
30min – 1 hour	9(3.8)	225(96.2)			
>1hour	8(13.8)	50(86.2)			
Rate your intensity					
Low	12(8.3)	132(91.7)	2.315(2)	-	0.314
Moderate	15(5.8)	242(94.2)			
High	6(11.3)	47(88.7)			
In the past month – Felt overwhelmed or unable to control impact					
Never	2(4.3)	44(95.7)			
Almost never	8(8.9)	82(91.1)	2.170(4)	-	0.705
Sometimes	19(8.2)	212(91.8)			
Fairly often	3(4.7)	61(95.3)			

Very often	1(4.3)	22(95.7)			
In the past month – how often felt stressed or anxious about unexpected events or challenge					
Never	1(1.9)	51(98.1)			
Almost never	6(7.7)	72(92.3)	2.666(4)	-	0.615
Sometimes	18(7.7)	215(92.3)			
Fairly often	6(8.5)	65(91.5)			
Very often	2(10.0)	18(90.0)			
Nutritional balance in daily meals					
Very balanced	2(5.1)	37(94.9)			
Moderately balanced	10(3.9)	248(96.1)	15.337(4)	-	0.004
Somewhat balanced	14(12.5)	98(87.5)			
Not balanced	4(12.5)	28(87.5)			
Unsure	3(23.1)	10(76.1)			

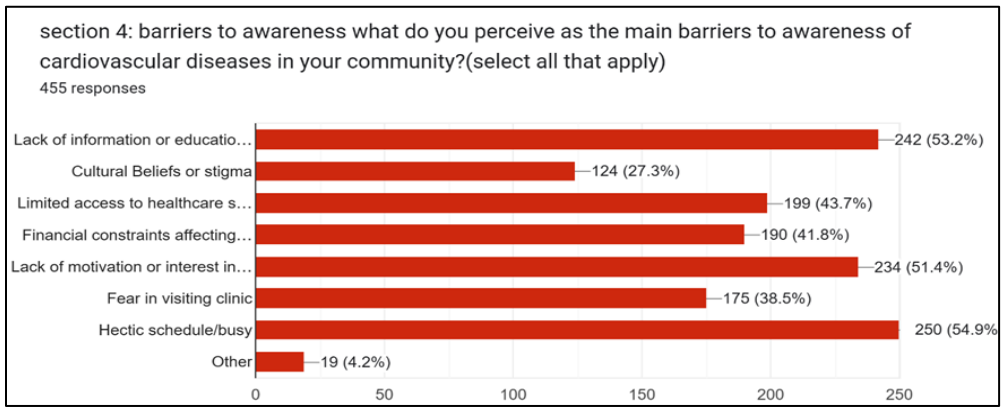

Figure 4. main barriers to awareness of cardiovascular diseases among the respondents (n=454)

importance of technology, particularly digital platforms and trusted information sources, shaping cardiovascular health awareness.

Table 7 presented the analysis of the association between experiencing cardiovascular disease symptoms and awareness levels. A highly significant association was observed between having experienced symptoms and awareness (χ^2 = 24.904, df = 2, p < 0.001), with symptomatic individuals more likely to demonstrate good awareness. The mode of relieving agents used for managing symptoms also showed a significant association (χ^2 = 15.206, df = 6, p = 0.019), indicating that approaches to symptom management were linked to awareness levels. Overall, these findings suggested that personal experience of symptoms and their management played an important role in shaping cardiovascular disease awareness among respondents.

Figure 2 showed the level of awareness about cardiovascular diseases among 454 respondents. A significant majority of respondents, 421 (92.7%), demonstrated good awareness of cardiovascular diseases. In contrast, only 33 respondents (7.3%) exhibited poor awareness. Figure 3 illustrated the relieving mechanisms employed by respondents upon experiencing cardiovascular disease symptoms (n = 454). Nearly half of the participants (45.2%) reported that they would call emergency services, reflecting an appropriate first response.

Smaller proportions indicated resting and staying calm (14.7%) or taking sublingual nitroglycerin (14.7%) as their immediate actions. Seeking support from family and friends (8.1%) and the use

of aspirin (6.6%) were less commonly reported. Notably, the relatively low use of aspirin and reliance on non-medical support highlight gaps in awareness of evidence-based emergency measures, underscoring the need for public education to improve timely and effective responses to acute cardiovascular events.

Figure 4 showed the main barriers to awareness of cardiovascular diseases among respondents (n = 454). The most frequently reported barriers were a hectic schedule or being busy (54.9%) and lack of information or education (53.2%), followed closely by lack of motivation or interest (51.4%). Other barriers included limited access to healthcare services (43.7%), financial constraints (41.8%), and fear of visiting clinics (38.5%). Cultural beliefs or stigma (27.3%) and other factors (4.2%) were less commonly reported. These findings indicated that both personal and systemic factors played a role in limiting awareness.

Table 6. Association between the role of technology in enhancing awareness of cardiovascular disease among the respondents by using chi -square test (n=454)

Variables	Level of awareness		x2 (df)	OR (95% CI)	p-value
	Poor	Good			
Which source used to learn					
Television	5(23.8)	16(76.2)			
Social media	11(6.4)	162(93.6)	11.258(5)	-	0.048
Health websites	8(7)	107(93)			
Traditional media	0(0)	30(100)			
Healthcare professionals	5(7.8)	59(92.2)			
How effective do u think digital platform is					
1	3(42.9)	4(57.1)			
2	4(23.5)	13(76.5)	26.745(4)	-	<0.001
3	13(11)	105(89)			
4	9(4.3)	202(95.7)			
5	4(4)	97(96)			
Used any mobile app					
Yes	13(6.7)	180(93,3)	0.141(1)	-	
No	20(7.7)	241(92.3)			
Do you believe in technology can encourage lifestyle change to reduce risk of CVD					
Strongly disagree	1(9.1)	10(90.9)			
Disagree	5(31.3)	11(68.8)	14.677(4)	-	0.005
Neutral	9(6.6)	128(93.4)			
Agree	15(6.7)	208(93.3)			
Strongly agree	3(4.5)	64(95.5)			

Table 7. Association of relieving mechanisms in enhancing awareness of cardiovascular disease among the respondents by using chi-square test (n=454)

Variables	Level of awareness		x^2 (df)	OR (95% CI)	p-value
	Poor	Good			
Have you suffered from any of the symptoms					
Yes	33(7.3)	421(92.7)	24.904(2)	-	<0.001
No	14(4)	337(96)			
Others	2(22)	7(77.8)			
Mode of relieving agent					
Call emergency services	11(12.4)	78(87.6)	15.206(6)	-	0.019
Aspirin	1(8.3)	11(91.7)			

Rest and stay calm	5(17.2)	24(82.8)
Sublingual nitroglycerin	4(13.8)	25(86.2)
Engaging in breathing exercise	2(9.5)	19(90.5)
Seeking support from family and friends	1(6.3)	15(93.8)

Discussion

This study provided important perspectives on factors shaping cardiovascular disease (CVD) awareness among Malaysians, considering sociodemographic, lifestyle, and technological aspects. The participant profile was largely young, female, and from moderate-income households, with most respondents having at least secondary education and residing in West Malaysia. Indians formed the largest ethnic group represented, which is noteworthy given national reports highlighting their higher burden of CVD risk factors such as diabetes and hypertension.[24,25] The predominance of urban and educated participants may reflect recruitment approaches that favored individuals with better access to digital platforms and greater interest in health-related topics. These characteristics broadly correspond with Malaysia's demographic structure, where a substantial proportion of the population is under 40 years of age.[7] Comparisons with other regional and international studies further contextualized these findings within broader patterns of CVD awareness.

The findings indicate that 92.7% of respondents exhibited good awareness of CVD, which is likely influenced by Malaysia's National Strategic Plan for Non-Communicable Diseases (2016–2025). These public health initiatives focus on community-based education and preventative strategies. However, significant disparities in awareness levels are evident, particularly between urban and rural populations. Research by Singh K et al. (2024) highlighted the limited knowledge of CVD symptoms and risk factors in rural populations, especially among those from lower-income brackets, emphasizing the urban-rural divide in CVD awareness. This study's sample, which primarily consists of urban, educated individuals, likely contributes to the observed high awareness levels, underscoring the need for targeted interventions in underserved regions to bridge these gaps.[26]

In terms of behavioral and lifestyle factors, the study found that 25.3% of respondents were smokers, while the majority (74.7%) identified as non-smokers. The prevalence of smoking in the Malaysian population is concerning, as it has been linked to increased CVD risk.[27] The study also revealed suboptimal physical activity levels, with 31.7% reporting low-intensity activities and 35.7% engaging in less than 30 minutes of daily exercise. These findings were consistent with the study done by Ismail et al., 2020 which reported that physical inactivity (27.7%) and poor dietary habits are significant contributors to Malaysia's escalating non-communicable disease burden.[28] The relatively high smoking prevalence and low levels of physical activity identified in this study mirror the findings of Lim HK et al. (2020), who identified tobacco use as a major public health challenge, particularly among urban youth. Thus, effective strategies, including stricter tobacco control policies and smoking cessation programs, remain critical in addressing these issues.[27]

The study also emphasized the role of technology in disseminating health information. The increasing reliance on social media (38.1%) and health websites (25.3%) for CVD knowledge reflects Malaysia's growing digital engagement, with 73.9% of respondents confident in the ability of technology to reduce CVD risks.[29] According to the study done by Xuan et al., 2024, Malaysia's internet penetration rate exceeds 89%, facilitating digital health communication, particularly among young adults. However, the study also pointed to a moderate adoption of mobile health applications (42.5%), which, if strategically implemented, could enhance health literacy and promote behavioral change.[30] This aligned with the findings of Alanzi TM et al., 2021, whereby digital health platforms as an effective means to reach large populations with health-related information. The

growing use of digital platforms necessitates the curating of accurate, evidence-based content to combat misinformation and improve public health knowledge.[31]

Coping strategies for CVD symptoms were highlighted in this study. Although nearly one-fifth of respondents sought emergency services when symptoms arose, only a small fraction (2.6%) reported using aspirin, despite its role as a first-line intervention in acute cardiac events. This limited use suggests gaps in public knowledge of basic first-aid practices. Similar findings were reported by Svensson et al., 2016; a prospective study done in Japan found that misconceptions and poor awareness often contribute to delayed responses in CVD emergencies. Strengthening community education on symptom recognition and immediate management is therefore essential, as early intervention can greatly improve outcomes.[32]

In this study, the analysis revealed strong links between lifestyle practices and awareness of CVD. Smoking status, physical activity duration, and dietary balance were all significant predictors, with non-smokers, those exercising regularly, and individuals maintaining healthier diets showing greater awareness. This highlighted how positive health behaviors often align with better knowledge, supporting the Ministry of Health Malaysia, called for integrated lifestyle interventions to curb non-communicable diseases.[8]

The barriers to awareness were also analyzed, with hectic schedules (54.9%) and lack of information (53.2%) identified as significant obstacles. These logistical and informational barriers reflect the pressures of urbanized lifestyles and gaps in health literacy. Studies on rural populations have found that financial constraints and cultural stigmas are more prominent obstacles in these regions, further illustrating the diverse challenges faced by different demographic groups.[14]

The observed high awareness levels may partly reflect the sample composition, which consisted mainly of younger, urban, and educated individuals. Awareness patterns could differ significantly in rural and underserved populations where access to health information and services was more limited. Future studies employing stratified sampling or reweighting approaches were needed to ensure findings were more representative of Malaysia's diverse demographic profile.

Conclusion

In conclusion, the study offers a comprehensive overview of the factors shaping CVD awareness in Malaysia, demonstrating commendable awareness levels but also highlighting significant disparities linked to urbanization, socioeconomic status, and resource access. Addressing these gaps requires a multi-pronged approach, including the strengthening of digital health initiatives, expanding community outreach in rural areas, and prioritizing lifestyle education. Bridging these divides will enable Malaysia to reduce the burden of cardiovascular diseases and improve health outcomes across all segments of society. This study revealed considerable gaps in cardiovascular disease (CVD) awareness among Malaysian adults, despite the high prevalence of modifiable risk factors such as hypertension, diabetes, obesity, and physical inactivity. Awareness was significantly shaped by sociodemographic characteristics, while cultural beliefs and limited healthcare access further restricted proactive health management.

Recommendations

Targeted public health initiatives were essential to address these gaps. Community-tailored educational campaigns, regular screening programs, and improved accessibility to healthcare services should be prioritized. Incorporating digital health tools, school- and workplace-based interventions, and culturally sensitive strategies can further strengthen awareness and prevention. A coordinated, multi-level approach was needed to empower individuals, promote healthier lifestyles, and reduce the national burden of CVD

Limitations

This study's cross-sectional design limited causal inference, and non-probability sampling introduced selection bias, with younger, urban, educated, and Indian respondents (60.4% vs. 6.8% nationally) overrepresented. This urban and ethnic

bias limited the generalizability of findings to Malaysia's broader population, particularly rural and older groups. Reliance on chi-square tests without multivariate adjustment reduced the ability to identify independent predictors. Self-reported measures, including diet, may have been affected by recall or social desirability bias, while cultural beliefs, healthcare access, and exposure to health campaigns were not assessed. Although reweighting to national demographics (22.7% rural, 11.7% ≥60 years) was being considered, future studies should adopt probability-based sampling such as stratified random sampling, longitudinal designs, and multivariate or mixed-methods approaches to improve representativeness and link awareness more clearly to outcomes and behavior change.

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