Original Article

Prevalence of optimal cardiovascular screening activities and associated factors among apparently healthy school teachers in Kota Bharu, Kelantan

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Received 16 May 2017; revised 24 October 2017; accepted 31 October 2017; Available online 24 November 2017

Abstract

Objectives: This study aimed to determine the prevalence of optimal cardiovascular disease (CVD) screening activities and the associated factors among apparently healthy school teachers.

Methods: A cross-sectional analytical observational study was conducted among 380 secondary school teachers in Kelantan, Malaysia. A self-administered questionnaire addressing sociodemographic data and factors influencing CVD screening activities was administered. Descriptive analysis, simple and multiple logistic regression analyses were performed.

Results: A total of 348 teachers responded to the questionnaire, with a response rate of 91.6%. The prevalence of optimal CVD screening activities was 29.3% (95% CI: 24.52, 34.08). Age, knowledge of CVD screening, family history of CVD and availability of health facilities were significantly linked to CVD screening.

Conclusion: The prevalence of optimal screening activities was low. A great majority of the factors contributing to optimal screening were modifiable. Health care providers should widely implement global health-oriented rather than disease-orientated assessment in their daily practice.

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Peer review under responsibility of Taibah University.
Introduction

A recent National Health and Morbidity survey (NHMS) in 2015 showed that hypertension, diabetes, dyslipidemia, obesity, smoking and physical inactivity among the Malaysian population has steadily increased in prevalence. The survey revealed that about 73% of deaths in Malaysia were from noncommunicable diseases (NCDs), with CVD being the biggest contributor. An estimated 35% of deaths were found to occur in individuals aged less than 60 years, an age group that represents the majority of the working population.

The NHMS in 2011 showed that at least 63% of adults aged 18 years and above had at least one NCD risk factor (either overweight/obesity, high blood pressure, high blood sugar or high blood cholesterol). The progression of NCDs is dependent on the presence and severity of risk factors. Hypertension, dyslipidemia, obesity, insulin resistance, inflammation and hypercoagulable states, physical inactivity and smoking are modifiable risk factors for CVD, while age, race, sex, and family history of CVD are nonmodifiable risk factors for CVD. The Framingham Heart Study showed that these risk factors are additive in predictive power and can be quantified to assess the risk for CVD. The total risk for a person can be estimated by the summation of risk imparted by each major risk factor. If untreated, any major risk factor has the potential to induce CVD. An assessment of global risk can be useful in identifying high-risk patients who require immediate attention and intervention, modifying risk based on total risk estimates, and motivating the patient to adhere to treatment.

McCluskey et al. suggested that population screening for CVD is an effective strategy for identifying and reducing risk among high-risk individuals, thereby playing a significant role in the prevention and control of CVD. A cardiovascular disease screening program has been launched by the Malaysia Ministry of Health under the concept of NCD control programs for promoting wellness. The cardiovascular screening program targets people who are 35 years and above or those with high-risk factors for CVD.

There are no particular guidelines or recommendations that define optimal cardiovascular screening activities. Recommendations of the various health authorities for screening and risk assessment for CVD have not defined what is optimal for CVD screening in primary care. One systematic review compared various guidelines for CVD screening but no consensus was found regarding target populations, treatments and screening tests. Optimal screening has been defined as five or more screening activities (i.e., assessment of blood pressure, blood glucose level, blood cholesterol, body mass index (BMI) and smoking), based on the recommendation of several guidelines. No local data are available on the magnitude of apparently healthy people who have undergone CVD screening. This study aimed to determine the prevalence of optimal cardiovascular screening activities and the associated factors among apparently healthy school teachers.

Materials and Methods

Population and sample

This cross-sectional analytical observational study was conducted among secondary school teachers in Kota Bharu district, Kelantan, Malaysia. Teachers aged 40 years and above and not known to have CVD were included in this study. The cut-off point of age 40 years and above was used because the health care delivery model for prevention of CVD is generally focused on screening for people between the ages of 20 and 40 years and is focused on risk assessment for those ages 40 and above. Teachers with a history of diabetes mellitus, hypertension, cerebrovascular accident, peripheral vascular disease, active malignancy, mental illness and those on hormone replacement therapy were excluded from the study.

Multistage random sampling was applied. Simple random sampling of 14 out of 38 secondary schools was used based on a list of government secondary schools in Kota Bharu. In each school, 27 teachers were randomly selected by disproportionate sampling. Prior to actual data collection, a pilot study among 47 teachers was conducted to pretest the questionnaire for understandability, to estimate the length of time required to complete and to obtain information for sample size calculation. The sample size was calculated using a single proportion formula based on the prevalence of 34% from the pilot study. Taking precision of 0.05 with 95% confidence, the minimum required sample size was 345. After considering a nonresponse rate of 10%, the required sample size was 380.

Research tools

Self-administered questionnaires consisting of three sections were administered. Section 1 queried sociodemographic data such as age, sex, household income (in MYR), education level, race, and marital status. Section 2 addressed the factors associated with cardiovascular screening activities, such as availability of health facilities, accessibility of health clinics, health insurance policy, knowledge of CVD screening, family history of CVD and cost. Section 3 contained questions on cardiovascular screening activities, such as assessment of family history of CVD, history of blood pressure measurement (at least once in the previous one year), history of blood lipid measurement (at least once in the previous 5 years), history of blood glucose measurement (at least once in the previous one year), history of BMI measurement (at least once in the previous 2 years), smoking status assessment, exercise level assessment and nutritional intake assessment.

Data collection

During the first visit to the schools, the researcher briefed the teachers regarding the survey. Teachers were screened for...
eligibility prior to the survey. During the second visit, an informed consent form was obtained before collecting data from respondents. Participants were given the opportunity to ask questions before signing the consent form. The questionnaires were then distributed to eligible teachers.

Data entry and analysis

Data were entered and analysed using SPSS version 12.0 (SPSS Inc., Chicago, IL, USA). Data checking and cleaning were performed. Descriptive analysis was used to determine the prevalence of optimal cardiovascular screening activities. Simple and multiple logistic regression analyses were carried out to identify the factors associated with optimal cardiovascular screening activities. The dependent variable was optimal CVD screening. The independent variables were age, sex, race, educational level, whether treatment was sought, health consultation, increasing age factor, health promotion, accessibility to a health centre, knowledge of CVD screening, family history of CVD, cost, asymptomatic for CVD, health insurance and availability of health facilities.

Age factor was defined as being present when individuals considered increasing age as a reason for seeking treatment. Family history of CVD was defined as the presence of family history among first degree relatives (parents and siblings) of CVD, including ischaemic heart disease, hypertension, peripheral arterial disease or diabetes. Cost was defined as the medical expenses for health check-ups and treatment. Health insurance was defined as being present when the person has a health insurance policy as a factor for seeking health-related services.

Results

A total of 380 teachers were recruited. Only 348 completed the questionnaire, a response rate of 91.6%. Nonresponders were those who did not complete or failed to submit the questionnaires.

Sociodemographic characteristics of respondents

The sociodemographic characteristics of respondents (Table 1) revealed that most (84.5%) had made 1–3 visits to either a health centre, a private clinic or a hospital. Only 5.7% of respondents had never had any health consultations at all.

CVD screening activities

There were 102 respondents who had engaged in optimal screening activities; the prevalence of optimal screening activities was 29.3% (95% CI: 24.52, 34.08). Most respondents (32.8%) engaged in four CVD screening activities. Only 0.6% of respondents did not undertake any CVD screening activities.

The most frequent screening activities were blood pressure measurement and physical activity assessment (86.5%) followed by blood cholesterol measurement (73.6%), blood sugar measurement (70.7%), smoking assessment (70.1%), BMI measurement (66.4%) and assessment of family history of CVD (58.0%). Nutritional assessment (51.7%) was the least frequent screening activity.

There were various reasons for not undergoing CVD screening. The reasons identified were lack of knowledge regarding regular check-ups (25–36%), no risk of hypertension/diabetes (28–30%), lack of time (20–28%), a claim that no advice was given for regular assessment (17–35%) and lack of knowledge regarding obesity/hypercholesterolemia (18–24%). For BMI assessment, 36% of respondents were satisfied with their current weight. In smoking assessment, 70% of respondents claimed that they had been informed about the harm caused by smoking and were advised to quit. Among ever smokers, 55% had tried to quit. The most common reason for continued smoking was social pressure.

Factors associated with optimal CVD screening

Simple logistic regression analysis showed that nine variables were significantly associated with cardiovascular screening activities (Table 2). Multiple logistic regression analysis showed that increasing age factor, knowledge of CVD screening, family history of CVD and availability of health facilities were factors significantly associated with cardiovascular screening activities (Table 3). There was no significant interaction between the independent variables and no multicollinearity problem. A Hosmer–Lemeshow goodness-of-fit test was not significant ($P = 0.359$); the overall percentage in the classification table was 69.8% and the area under the curve in the receiver operating characteristic curve was 67.8%, indicating a good fit of the model.

Discussion

Prevalence of optimal CVD screening

The prevalence of optimal screening activities for CVD in this study was 29.3%. This is lower than that for individual
CVD risk factor screening, which ranged between 51% and 86%. This could be owing to the lack of comprehensive screening activities in local guidelines for the general prevention of CVD, leading to a lack of awareness among providers of health care for local populations. Most respondents made up to 3 visits to health clinics per year but the number of respondents who underwent optimal CVD screening was low. The attitude and awareness of healthcare providers and knowledge of patients have been reported as factors contributing to the low percentage of optimal screening activities.13

The prevalence of screening for hypertension in this study was comparable to that of other studies, ranging between 80 and 90%.15,17 This could be due to respondents’ educational levels, knowledge of regular blood pressure measurement and frequent health visits to the doctor. The prevalence of cholesterol screening during the previous 5 years in this study was comparable to that among other populations in the United States,18 United Kingdom21 and Greece.20 Blood glucose screening activity showed a result similar to that of another study.20 Lack of knowledge regarding obesity and BMI are among the reasons given by respondents for not measuring their BMI. The American Medical Association has reported that 66.4% and 40.8% of patients have had their weight and height measured and documented at least once in their medical records, respectively.22 Most respondents were advised regarding physical activity and the benefits of regular exercise. In contrast, another study reported that only 34% of patients who had seen a physician in the previous year were counselled about exercise.23

Factors associated with optimal CVD screening

Factors associated with optimal CVD screening activities strongly relate to the Health Belief Model, which proposes that people’s motivation to change their behaviour is affected by their beliefs about susceptibility to a disease, severity of the disease, and benefits and risks of intervention. The Health Belief Model is based on the understanding that a person will take a health-related action, such as seeking blood tests or treatment, if that

| Variables                          | Crude OR (95% CI) | Wald stat | P value |
|------------------------------------|-------------------|-----------|---------|
| Age                                | 1.02 (0.97,1.08)  | 0.57      | 0.451   |
| Sex                                |                   |           |         |
| Male                               | 1.00              |           |         |
| Female                             | 1.26 (0.78,2.04)  | 0.86      | 0.353   |
| Race                               |                   |           |         |
| non-Malay                          | 1.00              |           |         |
| Malay                              | 1.82 (0.58,5.54)  | 1.11      | 0.293   |
| Marital status                     |                   |           |         |
| Single                             | 1.00              |           |         |
| Married                            | 0.41 (0.03,6.66)  | 0.39      | 0.532   |
| Educational level                  |                   |           |         |
| Diploma                            | 1.00              |           |         |
| Degree and above                   | 1.26 (0.40,3.99)  | 0.15      | 0.699   |
| Household income (MYR)             |                   |           |         |
| <5000                              | 1.00              |           |         |
| >5000—9999                         | 0.87 (0.54,1.41)  | 0.31      | 0.580   |
| >10,000                            | 0.54 (0.14,2.03)  | 0.82      | 0.365   |
| Seeking treatment                  |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 0.52 (0.29,0.93)  | 4.79      | 0.029   |
| Health consultation                |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 2.06 (1.14,3.71)  | 5.76      | 0.016   |
| Age factor                         |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 2.25 (1.31,3.86)  | 8.62      | 0.003   |
| Health promotion                   |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 1.30 (0.74,2.29)  | 0.83      | 0.363   |
| Accessibility of health centre     |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 1.34 (0.85,2.13)  | 1.56      | 0.212   |
| Knowledge of CVD screening         |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 2.10 (1.32,3.56)  | 9.65      | 0.002   |
| Family history of CVD              |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 2.33 (1.25,4.34)  | 7.06      | 0.008   |
| Cost                               |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 0.63 (0.20,1.94)  | 0.65      | 0.420   |
| Asymptomatic for CVD               |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 0.55 (0.28,1.08)  | 2.97      | 0.085   |
| Health insurance                   |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 1.48 (0.52,4.17)  | 0.54      | 0.46    |
| Availability of health facilities  |                   |           |         |
| No                                 | 1.00              |           |         |
| Yes                                | 0.67 (0.41,1.08)  | 2.72      | 0.099   |

Abbreviations: OR, odds ratio; CI, confidence interval. a Wald statistic.

| Variables                          | Adjusted OR (95% CI) | Wald stat | P value |
|------------------------------------|----------------------|-----------|---------|
| Age factor                         | 1.00                 |           |         |
| Knowledge of CVD screening         |                      |           |         |
| No                                 | 1.00                 |           |         |
| Yes                                | 1.95 (1.08,3.52)     | 4.93      | 0.026   |
| Family history of CVD              |                      |           |         |
| No                                 | 1.00                 |           |         |
| Yes                                | 1.94 (1.00,3.74)     | 3.91      | 0.048   |
| Availability of health facilities  |                      |           |         |
| No                                 | 1.00                 |           |         |
| Yes                                | 0.43 (0.25,0.75)     | 8.86      | 0.003   |

Abbreviations: OR, odds ratio; CI, confidence interval. a Wald statistic.
person (i) feels that a negative health condition such as CVD, can be avoided; (ii) has a positive expectation that by taking a recommended action, a negative health condition can be avoided (for example, blood pressure measurement can detect hypertension and initiating treatment will reduce the risk of stroke) and (iii) believes that taking up a recommended health action will successfully prevent a negative health condition (for example, lifestyle change can prevent obesity, diabetes and CVD-related disease). This theory focuses on individuals’ attitudes and beliefs about certain health-related behaviours. The patient, healthcare provider and health care system factors are interrelated and influence preventive screening activities. In this study, age, knowledge of CVD screening, family history of CVD and availability of health facilities were factors significantly associated with optimal CVD screening activities.

The respondents in this study considered that increasing age made them more vulnerable to CVD. A study in Greece found that participants aged 65 years were 15 times more likely to seek preventive testing for CVD.\(^{20}\) The age group 45–64 years is associated with positive health behaviour changes,\(^{14}\) which is a precursor for health promotion and primary prevention in modifying CVD risk factors. O’Donnell, Sullivan, and Hegarty\(^{24}\) reported that age is significantly associated with screening for blood cholesterol. Other studies have reported that increasing age is an important determinant for compliance because as age increases, people perceive that they are at increased risk for CVD.\(^{25,26}\)

Knowledge of CVD screening is a significant factor for optimal CVD screening activities. In this study, most respondents had a high educational background and were exposed to various sources of information, such as mass media, internet and health promotional activities in the workplace, which builds knowledge regarding CVD. This leads to regular healthcare visits; most respondents had at least one health consultation every year. A Canadian study reported that a higher educational background is related to good knowledge of CVD and better access to care and health promotional activities, and vice versa.\(^{27}\) Similar findings in the Maldives reported that there was an association between accessibility to knowledge of CVD risk factors and preventive behaviour among residents aged more than 30 years.\(^{13}\) One study reported that educational level and income influence the utilization of health care facilities.\(^{28}\) Good knowledge of CVD screening activities help to motivate respondents to change their behaviour following regular CVD screening. This coincides with reports that respondents who received an annual check-up discussed the risk for CVD with their physicians.\(^{19}\)

Based on the Health Belief Model, individuals who perceive themselves at risk seek treatment or visit health clinics for medical examination. Those with a family history of CVD perceive themselves at increased risk, which acts as a strong predictor for help seeking or behavioural change. In the current study, respondents with a family history of CVD were twice as likely to obtain CVD screening, owing to a perception of higher CVD risk, than respondents without such a history. However, contradictory findings have also been reported. In Sweden, a family history of CVD did not have any effect on CVD preventive activities, but individuals with personal experience of the illness were more inclined to change their behaviour toward a healthier lifestyle.\(^{29}\) Among inpatients who were admitted for bypass surgery, angioplasty, myocardial infarction and ischaemia, only 17.8% had family members who had been screened for CVD.\(^{30}\)

Availability of health care facilities showed a negative association with optimal CVD screening activities. This can be explained by several possibilities. First, respondents may neither perceive themselves at risk of CVD nor feel motivated to change by undergoing screening for CVD. This is evident and supported by Shaw, Brittain, Tansey, and Williams\(^{25}\) who found that lack of knowledge regarding the disease and awareness regarding treatment discouraged respondents from seeking health care. Second, respondents may not regard healthcare facilities as appropriate for screening activities and opt for alternatives such as a private laboratory or health promotion camps. Third, the healthcare provider and patient encounter may not be fully utilized for preventive activities. Nearly 30% of the respondents in the present study reported not having their blood glucose or blood cholesterol levels checked because no healthcare provider had advised them to do so.

The attitude of doctors toward preventive care is an important barrier to reducing the CVD burden. A study in Canada among general physicians showed that they had good knowledge of cardiac risk prevention strategies but limited knowledge about implementing preventive activities.\(^{16}\) The physicians were sceptical regarding the effectiveness of lifestyles changes, such as, interventions for obesity, exercise and smoking cessation.\(^{16}\) A study in Malaysia among private practitioners reported that there were differences in CVD risk factor screening between patients with chronic and acute disease, with a greater focus on acute care patients.\(^{15}\) Another study in Europe among general practitioners showed that there was a gap between knowledge and practice in their daily clinical encounters.\(^{31}\) These findings showed that even if people make frequent visits to the doctor, a lack of effort in providing preventive care remains on the part of health professionals.

This cross-sectional study was conducted with limited personnel and financial resources. Ideally, objective assessment of blood pressure, blood cholesterol, blood sugar and BMI are necessary. Healthcare providers should widely implement health assessment and counselling for smoking, nutrition and physical activity in their daily encounters with patients, to improve outcomes and reduce mortality owing to CVD.

**Conclusion**

The prevalence of optimal screening activity for CVD in this study was 29.3%. Increasing age, knowledge of CVD screening, family history of CVD and utilization of health facilities were factors significantly associated with optimal CVD screening activities.
Ethics approval

This study was approved by the research and ethics committee of the School of Medical Sciences, Universiti Sains Malaysia and the Ministry of Education. Permission from school principals was obtained and the confidentiality of all respondents was maintained.

Authors’ contributions

NAR conceived and designed the study, conducted the research, collected and analysed the data and wrote the article. NMN conceived and designed the study, analysed and interpreted the data. RM conceived and designed the study. HMY conceived and designed the study. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

Conflict of interest

The authors have no conflicts of interest to declare.

Acknowledgement

The authors would like to acknowledge the staff of Kelantan State Education Department and USM Incentive Grant (BL 254849) for supporting this study.

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How to cite this article: Noraza RA, Norhayati NM, Rosediani M, Harmy YM. Prevalence of optimal cardiovascular screening activities and associated factors among apparently healthy school teachers in Kota Bharu, Kelantan. *J Taibah Univ Med Sc* 2018;13(2):188–194.