BMC Geriatrics

RESEARCH

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Cognitive impairment among older persons with chronic illness attending primary care and its association with cardiovascular risk using the Framingham risk score

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Abstract

Background Dementia is a major public health burden, particularly among the older persons with significant implications for individuals, caregivers, and society. Identifying mild cognitive impairment early can facilitate timely intervention and care.This cross-sectional study aims to investigate the association between Framingham risk score (FRS), a widely used tool for cardiovascular disease (CVD) risk prediction, and cognitive impairment among older persons with chronic illness in Malaysia.

Methods A total of 289 participants aged 60 years and above with chronic illness were recruited from Klinik Primer Hospital Tuanku Chanselor Muhriz via simple random sampling via computer generator. The Montreal Cognitive Assessment Bahasa Malaysia version (MoCA-BM) was used to assess cognitive function and the FRS was calculated on the basis of CVD risk factors.

Results The prevalence of cognitive impairment among the participants was found to be 19.7%. Multiple Logistic Regression revealed that age (AOR 1.101, 95% CI = 1.041,1.163, $p < 0.001$), systolic blood pressure (AOR 1.048, 95%CI = 1.024, 1.072, $p < 0.001$) diabetes (AOR 2.655, 95% CI = 1.194, 5.906, $p = 0.017$) increased the odds of having cognitive impairment among older persons with chronic illness whereas secondary education (AOR 0.087, 95% CI = 0.008, 0.963, $p = 0.047$) and higher education (AOR 0.037, 95% CI = 0.002, 0.833, $p = 0.038$) reduced the likelihood of having cognitive impairment. Individuals with higher FRS were more likely to have cognitive impairment (AOR 1.099, 95% CI = 1.049, 1.172, $p < 0.001$). The optimal cutoff point for the FRS to determine cognitive impairment is 30 for males with a sensitivity and specificity of 84.4% and 51.2% while the optimal cut off point for females is 18.5 with a sensitivity and specificity of 76% and 63.1% respectively.

Conclusions These findings suggest that the FRS which was originally designed for CVD risk assessment may also serve as a valuable predictive tool for cognitive impairment among older persons with chronic illness. Integrating FRS into routine primary care assessments could enhance the early identification of individuals at risk and enable appropriate cognitive screenings and interventions. Further research such as a longitudinal cohort study in a larger and more diverse population is warranted to validate the association of CVD risks with the development of dementia.

Keywords Framingham risk score, Malaysia, Older, Chronic illness, Cognitive impairment

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Background

Approximately 55 million people are estimated to have dementia worldwide, with approximately 10 million new cases diagnosed each year. Dementia is regarded as an enormous public health burden that causes disability and dependency among the older individuals around the world. It has an enormous impact not only on those with dementia but also on the caretakers and society as a whole [1]. The number of dementia cases in Malaysia is expected to increase from 142,172 in 2019 to 495,842 in year 2050 [2]. The prevalence of dementia among the older persons in Malaysia is estimated to be approximately 8.5% [3]. Evidence from a systematic review has shown that the global prevalence of cognitive impairment is around 19.7% [4] while the prevalence of mild cognitive impairment among the older individuals in Malaysia is estimated to be around 16% [3] and 21.1% [5].

In Malaysia, the older population is defined as those aged 60 years and above. This is based on the consensus made during the World Assembly on Ageing 1982 in Vienna [6]. Cognitive health is a significant aspect of older individuals as cognitive impairment can range from mild to severe. Mild cognitive impairment is defined as modest cognitive decline that does not interfere with the capacity of someone to be independent of everyday activities whereas dementia is defined as significant cognitive decline that interferes with the capacity of someone for independence in everyday activities [7].

Mild cognitive impairment is considered a precursor of dementia as in the cognitive impairment spectrum. A meta-analysis performed in 2009 of 41 robust inception cohort studies revealed a link between mild cognitive impairment and dementia where 39.2% of the mild cognitive impairment cases progressed to dementia [8]. An estimated 10–15% of individuals living with mild cognitive impairment develop dementia each year [9]. Studies have shown that dementia and the cardiovascular system share the same risk [10] and Framingham risk score (FRS) which is a widely used tool to estimate the 10-year risk of developing cardiovascular disease based on several risk factors including age, sex, blood pressure, cholesterol levels, smoking and diabetes can be used to predict cognitive decline [11]. A cohort study involving the participants from the Framingham Heart Study revealed that the incidence of dementia has declined in high-income countries over 3 decades, which was attributed to improvements in individual CVD risk prevention [12]. A population cohort study that compared the associations between CAIDE Cardiovascular Risk Factors, Aging, and Incidence of Dementia (CAIDE), FRS, and the Finnish Diabetes Risk Score (FINDRISC) revealed that the FRS in midlife and the CAIDE risk score have the ability to predict dementia [13]. This is beneficial among the local population in Malaysia as FRS are widely used in primary care on a daily basis and are validated for use in Malaysia [14].

Primary care acts as a gatekeeper, authorizing patients' access to tertiary care, which has been associated with better quality of care and lower healthcare use and expenditures [15]. Usually, primary care is the first point of contact for people with memory problems or other symptoms of dementia, but healthcare providers in general practice are reluctant to use cognitive tests and refer them for assessment [16]. A dementia diagnosis is often missed in primary care [17]. Several factors have been identified such as primary care provider factors which include lower confidence levels in recognizing neurocognitive disorders, limited time, and inadequate knowledge regarding dementia diagnosis [18, 19] causing missed opportunities for screening during primary care visits as well as patients and caregivers assuming dementia as a "part of aging" [19]. Another important barrier that has been highlighted is that there is no standardized screening tool for the detection of dementia in the primary care setting [20]. People who complain of memory problems undergo screening tools such as the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA). These tools are widely used to predict mild cognitive impairment. The Montreal Cognitive Assessment (MoCA) was translated into Bahasa Malaysia and validated in Malaysia where its optimal cutoff score for detecting cognitive impairment is 17/18 with a sensitivity of 68.2% and specificity of 61.2% [21]. The MoCA has been proven to be a sensitive cognitive screening tool with high sensitivity and specificity for detecting mild cognitive impairment [22]. Another cross-sectional study conducted at a primary care center at Universiti Kebangsaan Malaysia (UKM) reported that the prevalence of detecting mild cognitive impairment is higher than that of the MoCA-BM compared with the MMSE [23].

Primary care physicians especially those in Malaysia, use the FRS daily to determine CVD risk for each patient with chronic disease. This study aims to investigate the association between FRS and cognitive impairment. If the study proves the correlation between the FRS and cognitive impairment, this could mean that the FRS can be used beyond CVD risk prediction with additional benefits to predict cognitive impairment and dementia. Patients who are deemed at risk of cognitive impairment can be subjected to cognitive screening tools by their primary care physicians with the use of the MoCA, overcoming time constraints, cost, and effort for the primary care team to deliver optimal and appropriate care.

Methods

Study design

This cross-sectional study involved patients aged 60 years and above with chronic illness attending Klinik Primer Hospital Canselor Tuanku Muhriz (KPHCTM) for chronic illness follow-up over four months between 1st June 2022 and 30th September 2022. The minimum sample size required was 306 based on the basis of the single proportion formula with an estimated prevalence rate of mild cognitive impairment in older Malaysians of 21.1% [4], a 5% confidence limit, and a 20% dropout rate. This study used computer-generated simple random sampling. The sample was randomly generated via an online tool on an established database of 6798 older persons aged 60 years and above attending the KPHCTM. The selected patients were then reminded of their appointment one week before their scheduled clinic appointment date. The researcher met the patients on the day of the appointment to recruit them for the study. Details of the study and purpose were explained to the patient on the day, and informed consent was obtained before the study began. Patients who were detected to have mild cognitive impairment were then referred to a primary care doctor assigned for the chronic illness follow-up on the same day for further investigation and management. The data was analyzed over two months between 1st October 2022 and 30th November 2022. This study is reported following the STROBE guidelines [ref:https://www.strobe-statement.org/].

Inclusion and exclusion criteria

The inclusion criteria were patients aged 60 years and above, having chronic CVD medical conditions such as hypertension, diabetes mellitus, dyslipidemia or obesity, and stroke patients who attended regular follow up in the KPHCTM for their chronic condition, and literate in Bahasa Malaysia. Those with preexisting neurological diseases affecting cognition such as dementia and psychiatric illnesses including depression were excluded from this study to minimize confounding factors and to reduce heterogenicity as dementia and psychiatry illnesses often lead to more severe cognitive deficits which could skew the results.

Outcome measures

The primary outcome measure was the presence of cognitive assessment, assessed using the Montreal Cognitive Assessment Bahasa Malaysia version (MoCA-BM). The MoCA is a simple-to-administer screening instrument used to detect cognitive impairment and covers 6 domains – memory, executive functioning, attention, language, visuospatial, and orientation. This MoCA-BM version was validated in Malaysia in 2016 and the cutoff score used for the detection of cognitive impairment was 17/18 (one extra point for subjects with education levels less than 12 years old) with a sensitivity and specificity of 68.2% and 61.3% respectively [20]. Researcher training and certification were completed, and a license to use the MoCA-BM was obtained for this study.

Self-administered questionnaires on sociodemographic data were given to the subjects. The diagnosis of chronic illness was verified via the respondents' medical records and laboratory test results were obtained from the clinic order management system (OMS). The data collected included the latest systolic blood pressure, total cholesterol, HDL cholesterol level, presence of diabetes, presence or absence of smoking, medication for hypertension, and known vascular disease. The data obtained were then used to calculate the Framingham point score (FPS) and the FRS for the subjects was calculated via the FRS 2008 version calculator by QxMD.

Statistical analysis

All the data were analyzed via using IBM SPSS Statistics version 28.0 [24]. The variables in the study were the subject's sociodemographics, clinical profile, and Framingham risk score. The presence of cognitive impairment was used as a study outcome indicator. The data are presented as frequencies (n), percentages (%), means with standard deviations (SD), and median values with interquartile range (IQR). Normality testing revealed that the outcome variable, the presence of cognitive impairment was not normally distributed. Hence, nonparametric analysis was used to further analyze the data further. The Mann–Whitney U test and Chi-Square test were used to compare the presence of cognitive impairment across independent variables and Spearman's correlation coefficient was used to assess the strength of the association between the MoCA-BM score and FRS. Simple logistic regression was carried out where the relationships of each independent variable with the outcome were compared individually. Variables with a p-value of < 0.25 were then used to develop a multiple logistic regression model to identify the factors that could predict the dependent variable after controlling for the other confounders. The significant level was set at a p-value < 0.05 (2-sided).

Results

Characteristics and sociodemographic information

A total of 289 patients agreed to participate in this study, resulting in an overall response rate of 94.4%. 17 patients declined to participate due to lack of interest. Figure 1 summarizes the study flow chart.

The participants' mean age was 69.42 (SD 6.24) years. The majority of the participants were male (55.7%), Malay in ethnicity (53.6%), and had completed secondary

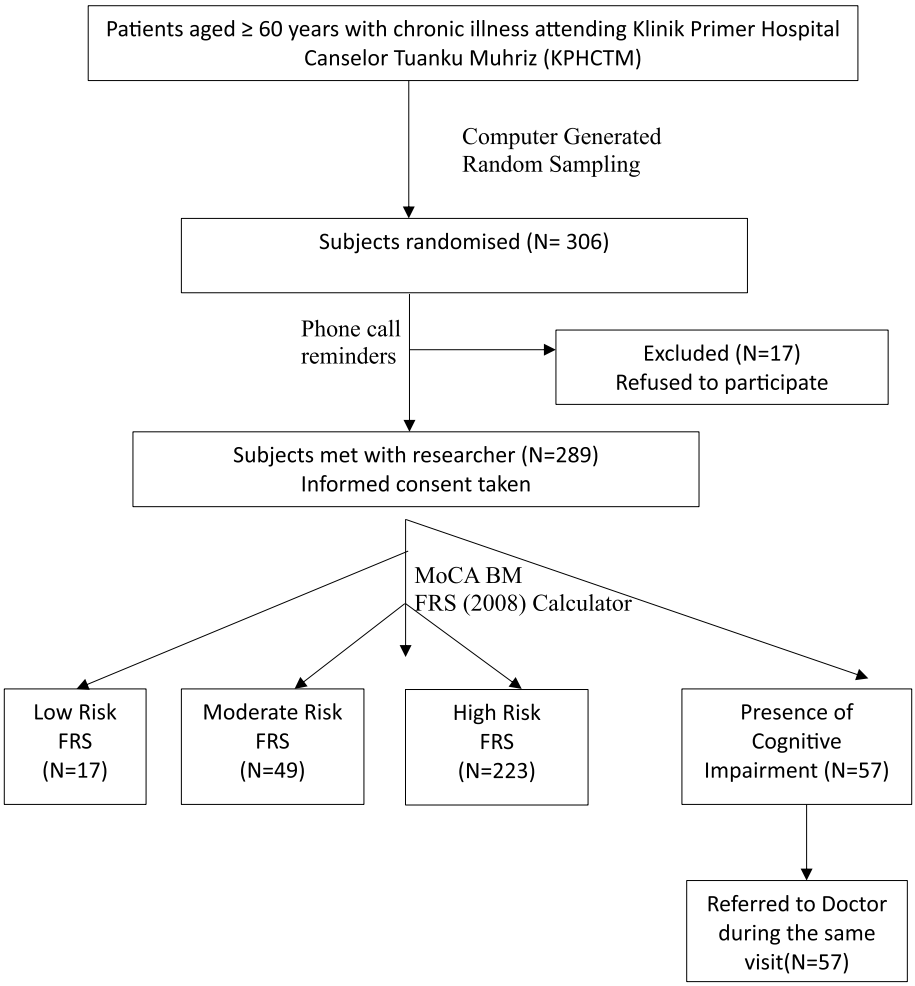

Fig. 1 Study flowchart

education (53.6%). The results revealed that 64% of the participants had diabetes mellitus, whereas 44.6% had vascular disease. Most of the participants were nonsmokers (91%). More than three-quarters (77.2%) of the participants were categorized by a high FRS of more than 20%. The mean FPS was 19.15 (SD 3.37) for the male participants and 16.55 (SD 3.89) for the female participants. The median FRS score was 28.50 (IQR 11.55) and the mean MoCA-BM score was 21.29 (SD 5.19). The prevalence of cognitive impairment among the participants was 19.7%. Table 1 summarizes the participants' detailed characteristics.

Factors associated with cognitive function among older persons with chronic illness

Table 2 presents the results of the bivariate analysis of participants' cognitive function across their sociodemographic factors, clinical profile, and FRS. In terms of sociodemographic background, age ($Z=4.784$, $p<0.001$), ethnicity ($X^2=7.641$, $p=0.022$), and education level ($X^2=34.365$, $p<0.001$) were significantly associated with the presence of cognitive impairment. Systolic blood pressure ($Z=3.501$, $p<0.001$), the presence of diabetes ($X^2=8.584$, $p=0.003$), and the presence of vascular disease ($X^2=8.077$, $p=0.004$) are clinical parameters that are significantly associated with the presence of cognitive impairment. There was also a statistically significant association between the FRS ($Z=3.786$, $p<0.001$) and cognitive impairment.

Factors associated with cognitive impairment among older persons with chronic illness

Further analysis via a multiple logistic regression model as presented in Table 3, revealed that age (AOR 1.101, 95% CI = 1.041,1.163, $p<0.001$), systolic blood pressure (AOR 1.048, 95% CI = 1.024, 1.072, $p<0.001$) and diabetes (AOR 2.655, 95% CI = 1.194, 5.906, $p=0.017$) increased the odds of having cognitive impairment

Table 1 Demographics and clinical characteristics of the study participants ($N = 289$)

Variables	Mean	SD	N (%)
Age (years)	69.42	6.24	
Gender			
Male			161 (55.7%)
Female			128 (44.3%)
Ethnicity			
Malay			155 (53.6%)
Chinese			103 (35.7%)
Indian			31 (10.7%)
Education levels			
No formal education			10 (3.5%)
Primary Education			69 (23.9%)
Secondary Education			155 (53.6%)
Higher Education			55 (19.0%)
Systolic blood pressure	135.66	15.11	
Total cholesterol	4.29	1.03	
HDL levels	1.24	0.31	
Presence of diabetes			
With Diabetes			185 (64%)
Without Diabetes			104 (36%)
Currently Smoking			
Yes			26 (9%)
No			263 (91%)
On Anti Hypertensives			
Yes			264 (91.3%)
No			25 (8.7%)
Known Vascular Disease			
Yes			129 (44.6%)
No			160 (55.4%)
FPS			
Male	19.15	3.37	
Female	16.55	3.89	
Framingham risk score Median (IQR)	28.50 (11.55)		
FRS Classification Low risk (< 10%)			17 (5.9%)
Moderate risk (10–19%)			49 (16.9%)
High risk(≥ 20%)			223 (77.2%)
MoCA-BM Score	21.29	5.19	
Presence of cognitive impairment			
Yes			57 (19.7%)
No			232 (80.3%)

among older persons with chronic illness who attained secondary education (AOR 0.087, 95% CI = 0.008, 0.963, $p = 0.047$) and higher education (AOR 0.037, 95% CI = 0.002, 0.833, $p = 0.038$) reduced the likelihood of having cognitive impairment. Table 4 shows that an increase of 1 unit of FRS (AOR 1.099, 95% CI = 1.049, 1.172, $p < 0.001$) increases the odds of having cognitive impairment among older persons with chronic illness by almost 10%.

Correlation of the FRS and MoCA-BM scores

There was a statistically significant negative correlation between the MoCA-BM Score and FRS (Spearman's rank correlation $r_s = -0.358$, p value < 0.001) as demonstrated in Fig. 2.

Cutoff for the FRS to determine cognitive impairment

The optimal cutoff for the FRS to determine cognitive impairment (**30** for males and **18.5** for females) was obtained from the receiver operating characteristic curve of the FRS by gender (AUC male: 0.679, 95% CI = 0.617,0.741), (AUC female: 0.321, 95% CI = 0.259, 0.383) using the Youden index [25]. An FRS score of more than 30% would determine a risk of cognitive impairment from the MoCA-BM cognitive assessment in males with a sensitivity and specificity of 84.4% and 51.2% and an FRS score of more than 18.5% in females would determine a risk of cognitive impairment with a sensitivity and specificity of 76% and 63.1% respectively.

Discussion

The prevalence of cognitive impairment among older persons with chronic illness

The findings of this study which included 289 patients with chronic illness indicated a prevalence rate of approximately 19.7% for cognitive impairment. This finding is consistent with other similar studies in Malaysia in which determined cognitive decline was determined via specific screening tools. In a prospective cohort study performed in 2019 to determine the incidence rate of mild cognitive impairment among older Asian adults, the prevalence rate was found to be approximately 14.6% [26]. The baseline findings from the LRGS TUA study – a large community based cohort study focused on aging and cognitive decline revealed that the prevalence rate of cognitive impairment among the older individuals was 16% [27] whereas another cross-sectional study revealed that the prevalence rate of cognitive impairment was 21.1% among urban, multiethnic dwelling older individuals aged 60 years and above [5]. This highlights the importance of screening for cognitive impairment among the older individuals due to the high prevalence of this condition in the community.

The FRS as a tool to assess the CVD risk burden among older individuals

The FRS is a tool that has been validated not only for the Asian population but also for the Malaysian population and can be used to predict the 10-year CVD risk for

Table 2 Bivariate analysis of sociodemographic data, clinical profiles, and FRS on cognitive function in older chronic patients

Variables	Normal Cognition $n=232$ (%)	Cognitive impairment $n=57$ (%)	X^2 statistic	Z statistic	P value
Age Mean (SD)	69.42 (6.24)			4.784	**< 0.001**[a]
Gender					
Male	129 (55.7)	32 (56.1)	0.005		0.942[b]
Female	103 (44.3)	25 (19.5)			
Ethnicity					
Malay	132 (56.9)	23 (40.4)			
Chinese	80 (34.5)	23 (40.4)			
Indian	20 (8.6)	11 (19.3)	7.641		**0.022**[b]
Education level					
No Formal Education	4 (1.7)	6 (10.5)			
Primary Education	43 (18.5)	26 (45.6)			
Secondary Education	133 (57.3)	22 (38.6)			
Higher Education	52 (22.4)	3 (5.3)	34.365		**< 0.001**[b]
Systolic Blood Pressure Mean (SD)	135.66 (15.11)			3.501	**< 0.001**[a]
Total Cholesterol	4.2897 (1.03)			0.325	0.745[a]
HDL Level	1.2394 (0.31)			0.056	0.956[a]
Presence of diabetes					
With Diabetes	139 (59.9)	46 (80.7)	8.584		**0.003**[b]
Without Diabetes	93 (49.1)	11 (19.3)			
Currently Smoking					
Yes	21 (9.1)	5 (8.8)	0.004		0.947[b]
No	211 (90.9)	52 (91.2)			
On Anti Hypertensives					
Yes	211 (90.9)	53 (93)	0.240		0.624[b]
No	21 (9.1)	4 (7)			
Known Vascular Disease					
Yes	94 (40.5)	35 (61.4)	8.077		**0.004**[b]
No	138 (59.5)	22 (38.6)			
Framingham Risk Score Median (IQR)	28.50 (11.55)			3.786	**< 0.001**[a]

[a] Mann Whitney test [b]Chi square test of independence level of significance *p* value = < 0.05

men and women [14, 28]. In our study, more than 77.2% of the participants had a high FRS. This is similar to the prevalence reported by the Malaysia National Health and Morbidity Survey (NHMS) 2015. A population-based cross-sectional study using the data from 3,375 participants aged 60 years and above from the NHMS 2015 revealed a high FRS prevalence of 72.1% [29]. This result highlights the CVD risk burden among older persons with chronic illness, which can be attributed to individual risk factors such as age, and the high prevalence of diabetes in the Malaysian community [30]. This further reinforces the importance of assessing CVD risk factors that are modifiable among older persons and managing them as early as possible. More studies are ongoing including a national registry for extended CVD risk evaluation in the community through the MyHEBAT study, coined as the Malaysian health and wellbeing assessment nationwide health study [31]. This study is currently being developed to assess the prevalence of CVD and its associated risk factors across Malaysia [31].

Factors associated with cognitive impairment among older persons with chronic illness

This study revealed the significant associated factors associated with cognitive impairment among older persons with chronic illness using individual CVD risk factors. Age, as an individual CVD risk factor increases the odds of having cognitive impairment by more than 10% with increasing age. A recent observational study from the Longitudinal Aging Study Amsterdam (LASA)

Table 3 Logistic regression for factors associated with cognitive impairment among older persons with chronic illness

Variables	Crude OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Age (Years)	1.120 (1.068–1.175)	**< 0.001**	1.101 (1.041–1.163)	**< 0.001**
Ethnicity				
Malay	1.00(ref)		1.00 (ref)	
Chinese	1.650 (0.869–3.133)	0.126	1.235 (0.611–2.497)	0.557
Indian	3.157 (1.337–7.450)	**0.009**	2.480 (0.967–6.359)	0.059
Education level				
No Formal Education	1.00 (ref)		1.00 (ref)	
Primary Education	0.375 (0.072–1.952)	0.244	0.265 (0.029–2.378)	0.235
Secondary Education	0.115 (0.022–0.614)	**0.011**	0.087 (0.008–0.963)	**0.047**
Higher Education	0.031 (0.003–0.380)	**0.007**	0.037 (0.002–0.833)	**0.038**
Systolic Blood Pressure	1.040 (1.019–1.062)	**< 0.001**	1.048 (1.024–1.072)	**< 0.001**
Diabetes				
With Diabetes	2.798 (1.378–5.681)	**0.004**	2.655 (1.194–5.906)	**0.017**
Without Diabetes	1.00 (ref)		1.00 (ref)	
Presence of Vascular Disease				
Yes	2.336 (1.289–4.231)	**0.005**	1.931 (0.969–3.849)	0.061
No	1.00 (ref)			

Table 4 Logistic regression for the FRS with cognitive function among older persons with chronic illness

	Presence of Cognitive Impairment			
Variables (*N* = 289)	Crude OR (95% CI)	*P* value	Adjusted OR	P value
Framingham Risk Score	1.089 (1.035–1.146)	**< 0.001**	1.099 (1.049-1.172)	**< 0.001**

revealed that the associated risk factors for cognitive decline are age dependent [32]. In another study, the prevalence of cognitive decline and dementia increased exponentially where the clinical diagnosis of Alzheimer's dementia increased from 5% of the population at age 65 to more than 40% among those above age 85 [33].

In the present study, more years of education (i.e. more than 6 years of formal education) had a protective effect on cognitive impairment. This study revealed that having secondary education or higher education reduces the odds of developing cognitive impairment by 95.3% or 96.2% respectively. A cross-sectional study performed in 2020 reported similar findings, where nonmodifiable risk factors such as age increased the risk of cognitive impairment and a longer duration of education (OR: 0.765, 95% CI 0.719–0.813) was associated with a decreased risk of cognitive decline [34]. Our study reiterates the importance of screening for cognitive decline among older persons and especially those with fewer years of education (less than 6 years of formal education).

Our study also demonstrated the associations between chronic illnesses such as hypertension and diabetes with cognitive decline. The findings from this study show that higher systolic blood pressure increases the risk of mild cognitive impairment, with an odds ratio of 1.048, 95% CI 1.024–1.072. Diabetic patients are more than two times more likely to have cognitive impairment compared to non diabetic patients. These findings echo those of other studies. A study in 2017 revealed that midlife vascular risk factors such as elevated blood pressure, midlife smoking, known vascular disease, and diabetes are associated with an increased risk of cognitive impairment and dementia [35]. The Whitehall II cohort study revealed that a systolic blood pressure more or equal to 130 mmHg at age 50 and above is associated with an increased risk of dementia independent of CVD [36]. These findings highlight the importance of screening for cognitive impairment among older individuals with chronic illness especially those with diabetes and hypertension as treating to target might have benefits in terms of decelerating cognitive decline.

The association between cardiovascular disease (CVD) risk and cognitive impairment has been well documented but studies often find that the effect size of this relationship is modest. For instance, research has shown that elevated blood pressure is associated with poorer cognitive outcomes but the strength of these associations is relatively small compared to other factors like age or genetics

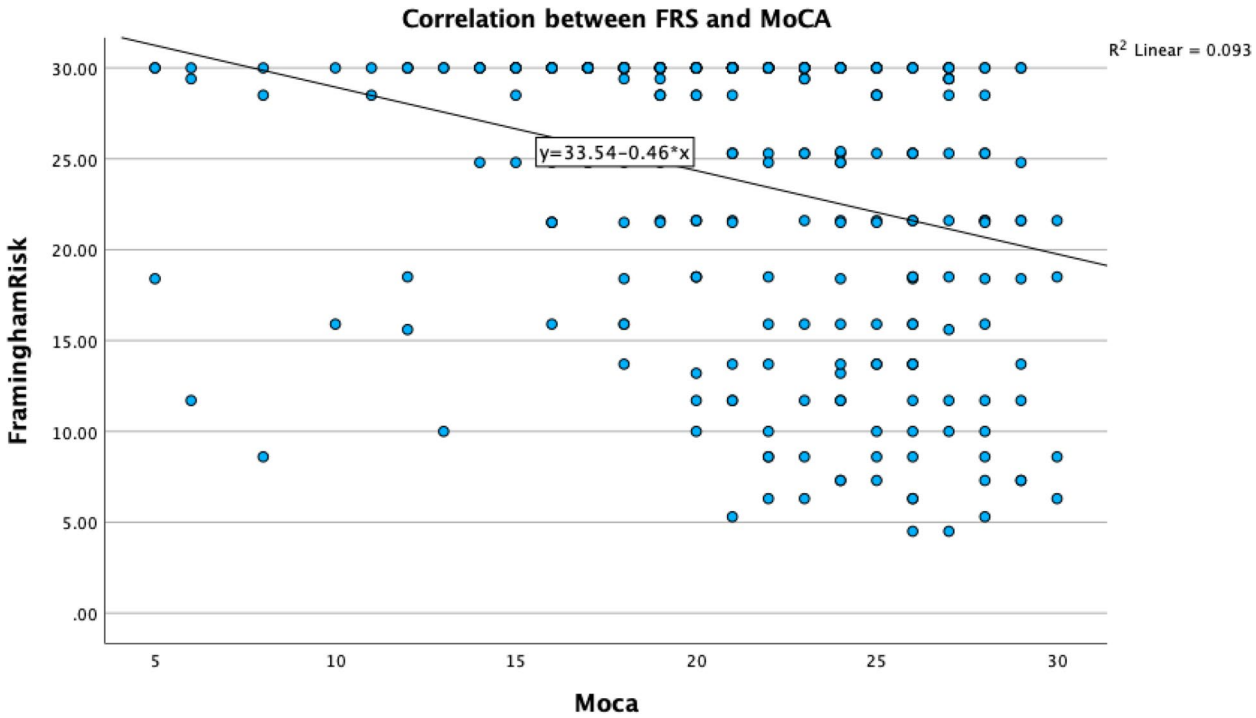

Fig. 2 Correlation graph between the FRS and MoCA

[37]. This modest effect size indicates that while CVD risk factors may raise the likelihood of cognitive impairment, they do not strongly predict individual outcomes.

FRS as a predictor of cognitive impairment

Our study identified the association between the FRS and cognitive impairment. The findings of the present study show that those with mild cognitive impairment have a higher FRS whereas those with high 10-year CVD risk have a higher rate of mild cognitive impairment. This is comparable with studies performed overseas. A longitudinal study performed in Chicago involving 1588 participants followed up for 21 years in the Rush Memory and Aging project concluded that higher FRS predicts a decline in episodic memory, working memory, and perceptual speed [38]. The FRS has the potential to identify patients at increased risk of conversion from mild cognitive impairment to Alzheimer's disease [39]. A study conducted among a Mexican American cohort revealed similar findings that groups with higher FRS presented greater differences in cognitive function [40].

Our study also revealed that the optimal cutoff for the FRS to predict cognitive impairment among older individuals with chronic illness is 30 for males and 18.5 for females. Primary care practitioners can use this cutoff point as an indicator for cognitive impairment screening which can be used to prioritize patient screening in a busy primary care facility. A local study on dementia detection practices among primary care practitioners cited time constraints and inadequate knowledge regarding dementia diagnosis and cognitive evaluation tools among the reasons that cognitive evaluations were not performed [19]. We postulate that using the more familiar FRS for accessing CVD risk provides an opportunity to simultaneously screen for cognitive impairment while addressing the chronic illnesses of older patients in the busy primary care clinic. This can save time for primary care practitioners taking care of older patients with chronic illnesses.

Strengths and limitations

To the best of our knowledge, our study is the first local study performed in Malaysia that can demonstrate the association between FRS and cognitive impairment in a primary care setting. The study sample was limited to patients from one university-based primary care clinic, the findings may not be generalizable to the whole country and the cross-sectional study approach limits the causal effect relationship of the study findings. Access to clinical and demographic data is limited and the study relies on patient interviews and available case notes, supplemented by EMR where it existed. This limits the ability to compare demographic data/ clinical characteristics between the study sample and the clinic population. The

use of the MoCA-BM as the study instrument, and language limitations may have contributed to the differences in cognitive performance among participants of different ethnicities.

Conclusions

There was a high prevalence of cognitive impairment among older persons with chronic illness particularly those with lower education levels, high blood pressure, diabetes, and high FRS. People with high FRS tend to have a higher rate of cognitive impairment as evidenced in our study. The FRS a familiar tool for assessing 10-year CVD risk, has the potential to be used as a tool to screen for cognitive impairment in older individuals with chronic conditions given its correlations with the MoCA cognitive assessment, feasibility of use, and availability in primary care settings. Our study advocates the use of the FRS in general practice for the early identification of cognitive impairment and the management of modifiable risk factors as it can save primary care practitioners much time and 'kill two birds with one stone' by screening for cognitive impairment in older patients as well as routinely managing their chronic illness. We suggest that future studies should involve the general population to validate the findings in a larger, wider population and not limited to the older individuals with chronic diseases.

Abbreviations

CVD	Cardiovascular Disease
FPS	Framingham Point Score
FRS	Framingham Risk Score
IQR	Interquartile Range
KPHCTM	Klinik Primer Hospital Canselor Tuanku Muhriz
MMSE	Mini-Mental State Examination
MoCA	Montreal Cognitive Assessment Test
MoCA-BM	Montreal Cognitive Assessment Test (Bahasa Malaysia version)
NHMS	National Health Morbidity Survey
OMS	Order Management System
SD	Standard Deviation
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12877-024-05505-0.

Supplementary Material 1.

Acknowledgements

We would like to thank SN Zazalina Mohammad, SN Asriah Ishak & SN Halimaton Saadiah who helped with MoCA-BM assessments during the trial.

Authors' contributions

All authors conceived and designed the study. N.B. conducted the study, analyzed the data, and wrote the paper. All authors contributed to the manuscript revisions and approved the final version of the manuscript.

Author's information

N.B. is a post-graduate student in Family Medicine at Universiti Kebangsaan Malaysia.

Funding

This research is self-funded.

Data availability

The dataset used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical approval and consent to participate

This study was conducted in accordance with the guidelines of the Research and Ethics Committee of Universiti Kebangsaan Malaysia with informed consent from all participants. Their participation was voluntary, and the anonymity of each participant was maintained throughout this research process until study publication. Ethical approval was granted from the Ethics Committee of Universiti Kebangsaan Malaysia (JEP-2021–897) and registered with the National Medical Research Registry of Malaysia (NMRR ID 22–00436-TWF). Permission to use MoCA and MoCA-BM versions were obtained from the authors.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 29 March 2024 Accepted: 22 October 2024
Published online: 29 October 2024

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