Mohammad Shafri et al
Brunei International Medical Journal
2026;22:110-121

Brunei International Medical Journal

Original Article

Open Access

Health Literacy and Habits in Cardiac Rehabilitation Patients: Experience of a Tertiary Centre in Brunei Darussalam

Shahnezza Yulniqmah **Mohammad Shafri**[1*], Muhammad Nurhasanuddin **Abdullah Kelali**[2], **Jong** Seng Khiong[3], Hanif **Abdul Rahman**[1]

Abstract

Introduction: Cardiovascular disease (CVD) is a major cause of global mortality, including Brunei Darussalam. Health literacy plays an important role in the management of CVD. It is not clear how much patients could understand, judge and apply CVD knowledge in the management of their condition after completion of a cardiac rehabilitation programme at the Raja Isteri Pengiran Anak Saleha Hospital, a tertiary referral centre in Brunei Darussalam. **Materials and Methods:** This was a cross-sectional study of cardiac rehabilitation patients who completed Phase II of the programme over a four-month period. Patients were recruited through convenience sampling methods. A validated questionnaire was used to assess participants' knowledge, attitude and practice (KAP) on CVD. The data were computed using R v.3.4.4. and analysed using descriptive and inferential statistics. A $p<0.05$ was considered to be statistically significant. **Results:** Of the total (n=120) participants recruited, 89.2% were males. 90.0% were below 70 years of age and 82.5% were Malay. 54.2% achieved the highest level of education at secondary school. Hypercholesterolemia and hypertension were prevalent; accounting for 71.7% and 70.0% respectively, while obesity and diabetes mellitus accounted for 47.5% and 39.7% respectively. The mean (standard deviation) scores for knowledge, attitude and practice were 66.86 (3.71) out of 75, 57.83 (4.47) out of 65, and 33.11 (3.65) out of 44, respectively. There was a significant difference in the CVD knowledge scores between different levels of education ($p=0.024$). **Conclusions:** There is a good level of CVD knowledge, attitude and practice in cardiac rehabilitation patients post-Phase II of the programme. Delivery of education sessions in Phase II of the programme in consideration of the varied educational backgrounds of the participants may help ensure everyone can benefit equally.

Keywords: Cardiac rehabilitation; Cardiovascular diseases; Cardiovascular risk factors; Cardiovascular disease prevention.

Author Details:
1 PAPRSB Institute of Health Sciences, Universiti Brunei Darussalam, Jalan Tungku Link, BE1410, Brunei Darussalam
2 Geriatrics and Palliative Care Unit, Raja Isteri Pengiran Anak Saleha Hospital, Bandar Seri Begawan, BA1710, Brunei Darussalam
3 Cardiac Rehabilitation, Raja Isteri Pengiran Anak Saleha Hospital, Bandar Seri Begawan, BA1710, Brunei Darussalam

***Correspondence:**
Shahnezza Yulniqmah **Mohammad Shafri**
shahnezza.shari@hotmail.com

INTRODUCTION

Non-communicable diseases (NCDs) account for almost three-quarters of global deaths each year; CVD being heavily attributed to these deaths.[1] As of 2019, NCDs accounted for the top five leading causes of mortality in Brunei Darussalam[2] (**Figure 1**), with heart diseases consistently being the second leading cause of death over the last decade[3] (**Figure 2**). The risk of developing CVD increases in the presence of other NCDs, particularly hypercholesterolemia, diabetes mellitus, hypertension and obesity, especially truncal obesity, which may ensue from an unhealthy lifestyle such as being sedentary and eating a poor diet.[4]

Health literacy has an important role in the prevention and management of CVD.[5] Nielson-Bohlman (2004) defined health literacy as the ability to obtain, understand, judge and apply health information in making decisions related to one's health.[5] A recent study has shown that CVD patients with inadequate health literacy were associated with more frequent doctor visits, increased rehospitalisation and a delay in getting needed health care, highlighting its significant role in the management of CVD.[6]

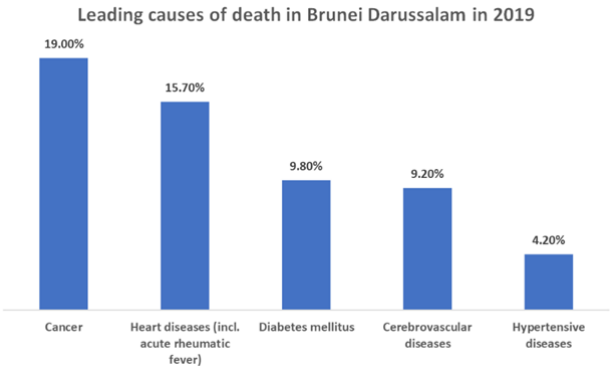

Fig. 1: Leading causes of death in Brunei Darussalam (2019): Distribution by percentage of total mortality cases. Source: Country Fact Sheet, Public Health at a Glance, Brunei Darussalam (World Health Organisation, 2020).

Cardiac rehabilitation (CR) is a comprehensive programme that has become an essential part of modern cardiology. Guidelines vary in terms of indications for CR. However, it is recommended for individuals with CVD, heart failure, undergoing re-vascularisation, and with stable coronary artery disease as evidenced by robust meta-analysis evidence of about 20% reductions in

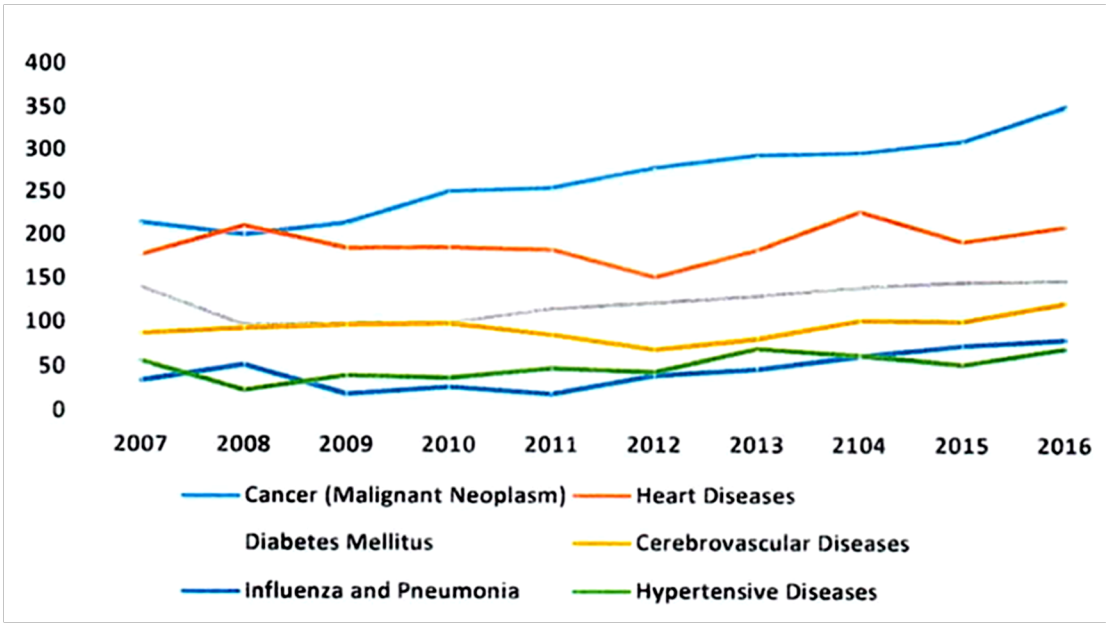

Fig. 2: Trends in leading causes of death in Brunei Darussalam (2007-2016). Source: Empowering Health Promotion, A Review on Finance Mechanism and Governance Entity (Department of Policy and Planning, Ministry of Health, 2018).

CVD mortality and re-hospitalisation attributed to participation in CR programme.[7] The benefits of the programme are also established in valve disease, transplant and atrial fibrillation.[7] In addition to optimising exercise capacity in these individuals, CR programmes focuses on empowering these individuals to make lifestyle modifications through education sessions with the aim to prevent disease progression and maintain a good quality of life .[8] When an educational component is included in the CR programme besides the usual supervised exercise components, cardiac mortality can reduce by 26-36% and total mortality by 13-26%.[9]

Although it is generally accepted that knowledge is important for people to identify CVD risk factors, there is evidence that behavioural change may not ensue if there is lack of self-efficacy to apply it and lack of ability to judge one's own susceptibility to developing CVD in relation to their lifestyle habits – which could be measured as the individual's attitude.[8,10] An evaluation study of the comprehensive CR programme at the Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital showed significant improvements in the control of total cholesterol, fasting blood sugar and waist circumference among patients upon completion of the eight weeks Phase II programme which includes supervised exercise sessions and education intervention, but unfortunately were not maintained at follow-up review towards the end of Phase III of the programme where patients self-maintain their condition for 18 months.[11]

No studies have been conducted with the objective to evaluate health literacy on CVD of CR patients at RIPAS Hospital. The aim of this study is to assess CVD health literacy of CR patients at RIPAS hospital who have completed Phase II programme, with the focus on evaluating their level of CVD knowledge, attitude towards CVD prevention and application of preventive measures. The findings of the study may reveal particular themes surrounding CVD management the patients find difficult to understand, commit to or apply beyond health care settings.

MATERIALS AND METHODS

Study design and target population

The study was a cross-sectional paper-based study conducted over a four-month period between December 2019 and March 2020 at the cardiac rehabilitation centre of RIPAS Hospital. Participants were recruited through a convenience sampling method. An invitation was sent through the mobile application, WhatsApp, to patients who have completed the programme or is in Phase III (supervised self-maintenance) between 2005 and 2017.

The CR participants are categorised into either high-risk or low-risk. High risk participants are those with heart failure (HF) with ejection fraction (EF) <50% and are enrolled in to the HF CR programme, where they complete four months of Phase II (education and supervised exercise sessions).[11] Meanwhile, low-risk participants include, but are not limited to, those admitted to coronary care unit secondary to events related to ischaemic heart disease - such as undergoing an angioplasty or a coronary artery bypass surgery – as well as valvular heart disease and pericarditis. These participants would complete only two months of Phase II (education and supervised exercise sessions) of the CR programme.[11] The education sessions involve a multidisciplinary team of cardiologists, physiotherapists, clinical psychologists, dietitians, pharmacists, smoking cessation counsellors and diabetic nurse educators to address issues relevant to CVD. These include medication counselling, heart healthy diet recommendation, physical activity and lifestyle adjustments, smoking cessation counselling and psychological support.[12] (**Table I**)

Eligible cardiac patients who were interested attended the briefing at the CR centre and before recruiting them as participants of the study, explanations were provided, and written consents were obtained. Cardiac

Table I: Overview of the cardiac rehabilitation programme at the RIPAS Hospital. Source: Brunei Darussalam National Heart Failure Guidelines 2023, Cardiac Society Brunei Darussalam

Phases of the CR programme	Phase Description	CR Programme Content	Phase Duration	
			Low-risk Participants	High-risk participants
Phase I	CCU admission	Understanding the disease Understanding risk factors Lifestyle changes to improve heart health Supervised exercise and advice Psychosocial support	Depending on individual admission	Depending on individual admission
Phase II	Education and supervised exercise sessions		8 weeks	16 weeks
Phase III	Supervised self-maintenance		18 months	18 months

patients below the 18 years of age and who did not speak, read or write English and Malay were excluded. The questionnaire took 10-15 minutes to complete and was returned to the researcher once completed.

Research Instrument

The study used a CVD knowledge, attitude and practice (KAP) questionnaire created at the International Islamic University Malaysia.[10] The questionnaire consisted of four sections in the following order: sociodemographic data, knowledge on CVD, attitude towards CVD preventative measures and practices in the prevention of CVD. With permission from the questionnaire developer, section 1 (sociodemographic data) was adapted to suit the context of the study. Section 2 consists of 19 CVD knowledge questions in the true/false/do not know format. Section 3 consists of 13 attitude questions related to CVD. The participants were given 5 choices from one to five which corresponds to five degrees of agreement from one being "*Strongly agree*" to five being "*Strongly disagree*". Section 4 consists of 11 practice questions to which the participants respond based on how frequently they perform the activities. The choices given were from one to four where one means "*Almost every day*" (six to seven times per week), two means "*Frequent*" (more than two times per week), three means "*Seldom*" (two times or less per week) and four means "*Never*". The mean scores were used to estimate the level of CVD knowledge, attitude and practice of patients who have completed Phase II of the CR programme. Higher scores infer good understanding, judgement and application of CVD information and vice versa.

Data Analysis

All analysis was computed using R v.3.4.4. Frequency and percentage for categorical variables and mean with standard deviation for numerical variables were used for the descriptive statistics of the data in the study. Normal approximation of 95% confidence interval was used to estimate knowledge, attitude and practice of patients post Phase II of the CR programme at RIPAS Hospital. Independent-*t*-test was used to compare knowledge scores between different education levels and nonparametric Mann-Whitney U test was used to compare differences in knowledge scores between genders and races.

Ethical Approval

The study protocol was reviewed and approved by the Medical and Health Research and Ethics Committee (MHREC), Ministry of Health, Brunei Darussalam, and the Institute of Health Sciences Research Ethics Committee (IHSREC) of Pengiran Anak Puteri Pengiran Anak Rasidah Sa'adatul Bolkiah (PAPARSB).

RESULTS

Sociodemographic characteristics and co-morbidities of the participants

The study recruited 120 participants; 107 (89.2%) were males and 13 (10.8%) females. Of this, 12 (10.0%) of the participants recruited were 70 years old and above, whereas 108 (90.0%) of them were aged below 70 years old, with the youngest participants being in their 30s. Most of the participants recruited were Malay (82.5%). Over half of the participants (54.2%) achieved the highest level of education at secondary school and 63 (52.5%) of them are still working. Half of the participants (50%) have a family history of CVD. The prevalence of hypercholesterolemia and hypertension were highest among the participants, accounting for 71.7% and 70.0% of the participants respectively. Meanwhile, obesity and diabetes mellitus accounted for 47.5% and 39.7% of the participants respectively. **Table II** represents the sociodemographic characteristics and comorbid conditions of the study participants.

Table II: Sociodemographic characteristic and co-morbidities of the study participants.

Sociodemographic characteristics	n (%)
Gender	
Male	107 (89.2)
Female	13 (10.8)
Ethnicity	
Malay	99 (82.5%)
Non-Malay	21 (17.5%)
Level of education*	
Lower	72 (60.0)
Higher	48 (40.0)
Occupational status	
Working	63 (52.5)
Not working	57 (47.5)
Co-morbidities	86 (71.7)
Hypercholesterolaemia	
Hypertension	84 (70.0)
Obesity	57 (47.5)
Diabetes mellitus	48 (39.7)

n = number of participants; % = percentage; *The level of education was categorised into lower education - which include no formal education, primary school and secondary school - and higher education which include Diploma, Bachelor's degree and Postgraduate (Master/PhD)

Most of the participants has a history ischaemic heart disease (85.8%). 13 of these participants had complications that resulted in a reduced EF of < 50% and hence, were categorised as high-risk and have completed four months of Phase II (supervised exercise and education intervention). Meanwhile, 3 of them progressed to having heart failure after completing the programme and hence, were recruited as low-risk patients where they had completed two months of Phase II. Therefore, there were a total of 16 participants (13.3%) with heart failure with a reduced EF <50% at the time of data collection. Those who had valvular heart disorders, stroke and others (including congenital heart defects and pericarditis) were also enrolled as low -risk patients and accounted for 8.3%, 0.03% and 0.03% of the participants of the study, respectively. At the time of data collection, 15 (12.5%) participants were in Phase III while the rest have completed Phase III of the programme and were no longer under close supervision.

Knowledge of CVD and its risk factors

The mean (SD) knowledge score obtained from this study was 66.86 (3.71) from the full scores of 75.00. The mean knowledge score of the study population is as low as 66.19 and as high as 67.53 (95% CI: 66.19, 67.53). Most of the knowledge questions were answered correctly by the participants. The majority of the patients is aware of the involvement of obstructed blood vessels in CVD (82.5%), it being the second leading cause of death in Brunei Darussalam (80.8%), that it does not only occur in women (95.8%) or only in young people (92.5%), and of the importance of controlling high-fat food (80.8%) and adequate exercise (94.2%) to prevent CVD. However, most of the participants (85.8%) were incorrect or unsure on whether light walking can prevent cardiovascular disease and over half (56.7%) were incorrect or unsure on whether most cardiovascular disease cases are hereditary. **Figure 3** summarises the responses to each statement regarding CVD.

Most of the participants were able to correctly identify hypertension (94.2%), heart attack (94.2%), stroke (70.0%) as risk factors for CVD. However, over a third of the participants (35.8%) were unable to correctly identify diabetes mellitus as a significant CVD risk factor. **Figure 4** summarises the participants' responses in the identification of diseases as a significant CVD

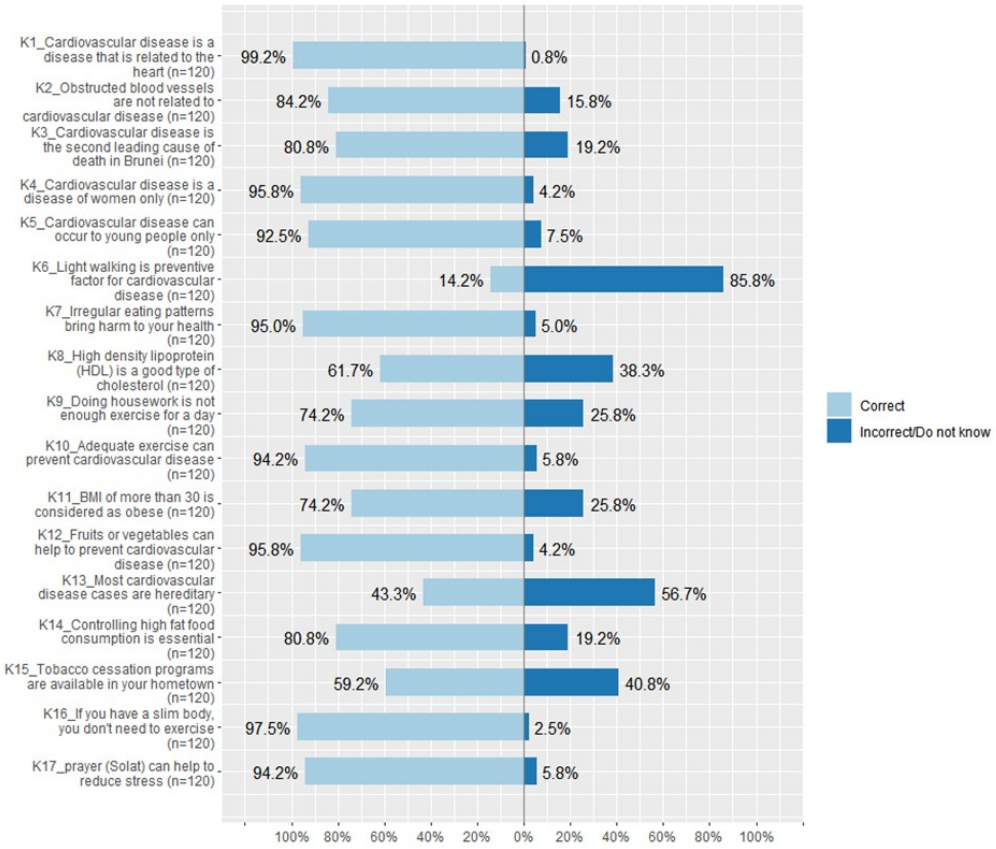

Fig. 3: Distribution of participants' responses to statements regarding knowledge of cardiovascular disease. (Note: The following are correct statements – K1, K3, K7, K8, K9, K10, K11, K12, K14, K15 and K17).

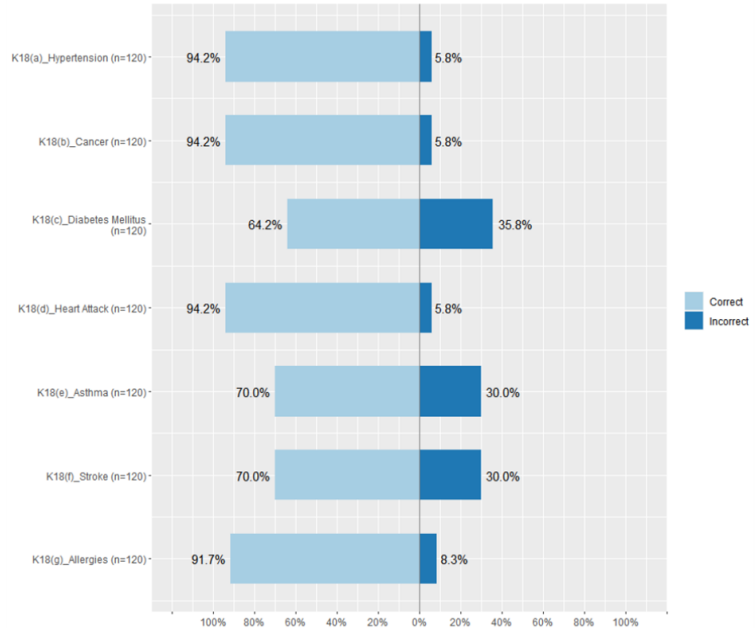

Fig. 4: Distribution of participants' responses in the identification of diseases as a significant CVD risk factor. Note: The correct CVD risk factors are hypertension, diabetes mellitus, heart attack and stroke.

risk factors (**Figure 5**).

Attitude towards prevention of cardiovascular disease (CVD)

The mean (standard deviation [SD]) attitude score obtained from the sample was 57.83 (4.47) from the full score of 65.00. The mean attitude score of the study population is as low as 57.03 as and as high as 58.64 (95% CI: 57.03, 58.64). It can be concluded from **Figure 6** that the vast majority of the participants had a a positive attitude towards the CVD prevention measures, with 100% of the participants agreeing that they should be doing exercise and incorporating fruits and vegetables in their diet. Although, it is observed that a third (31.7%) of the participants still chooses to buy fast food when going out with friends and family.

Practice towards prevention of cardiovascular disease (CVD)

The mean (standard deviation [SD] practice score

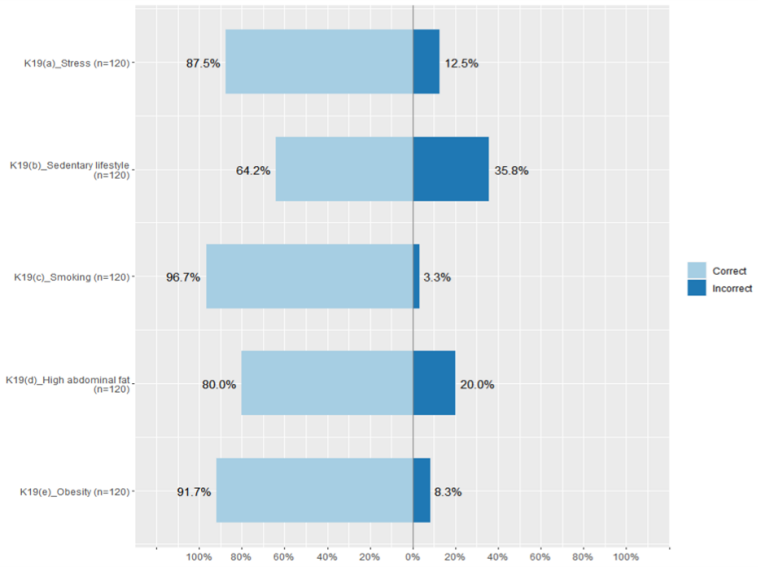

Fig. 5: Distribution of participants' responses in the CVD risk conditions. Note: The correct conditions are all of the listed items.

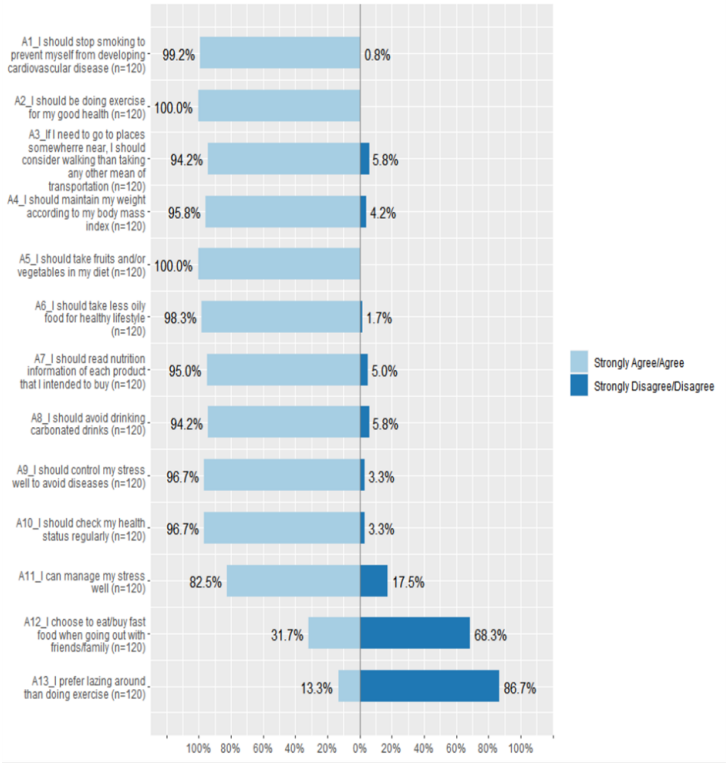

Fig. 6: Distribution of participants' responses to statements on the attitudes surrounding CVD preventative measures.
Note: Agreement to statements A1-A11 and disagreements to statements A12 and A13 indicate good attitude towards CVD prevention.

obtained from the sample was 33.11 (3.65) from the full score of 44.00 (**Figure 7**). The mean practice score of the study population is as low as 32.45 and as high as 33.77 (95% CI: 32.45, 33.77). **Figure 7** shows the participants' practice surrounding CVD prevention. Most of the participants adopt positive practices such as

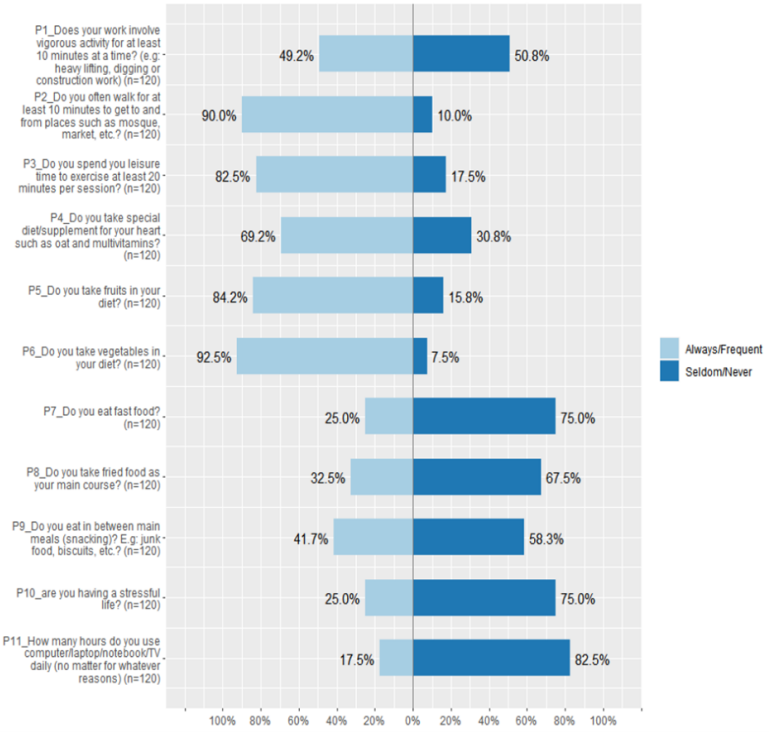

Fig. 7: Distribution of participants' responses to practices surrounding CVD prevention.
Note: Statements P1-P6 are the positive practices whereas statements P7-P11 are the negative practices.

Table III: Comparing knowledge scores between different genders, races and academic levels (n=120).

Variables		n (%)	K-score	t-Statistic (df)	*P*-value
			Mean (SD)		
Gender	Male	107 (89.2)	66.95 (3.64)	-	0.546[b]
	Female	13 (10.8)	66.08 (4.39)		
Ethnicity	Malay	99 (82.5)	66.83 (3.53)	-	0.573[b]
	Non-Malay	21 (178.5)	67.00 (4.58)		
Level of education	Lower	72 (60.0)	66.24 (3.96)	-2.288 (118)	**0.024**[a]
	Higher	48 (40.0)	67.79 (3.11)		

walking more than 10 minutes to places (90.0%), exercising at least 20 minutes in their leisure time (90%), taking a heart-conscious diet (70.0%) and eating vegetables (92.5%) and fruits (84.2%) in their in their day to day life while negative practices for cardiovascular health such as spending many hours on the television were seldom or never adopted. However, it can be observed that almost half of the participants (41.7%) still snack on junk food frequently in their everyday life and over a third (32.5%) will have fried food as a main course.

An independent sample *t* test or Mann-Whitney U test was carried out to determine the *P*-value of each variable tested against knowledge. There was a significant difference ($p<0.05$) in knowledge of CVD between different academic levels. Meanwhile, there was no significant difference in CVD knowledge across the different genders and ethnicities. **Table III** summarises the association of gender, ethnicity, and academic level with CVD knowledge.

DISCUSSION

The KAP regarding CVD of patients enrolled in the cardiac rehabilitation programme at the Raja Isteri Pengiran Anak Saleha (RIPAS) Hospital between 2005 and 2017 was determined from the information obtained from this study. Knowledge on CVD was found to be generally good among the participants, however there was inadequate understanding of light walking in the prevention of CVD and on the contribution of inheritance in CVD, as observed by the number of incorrect responses to these aspects of CVD. Overall, there was a positive attitude among the participants with most participants agreeing that exercising, stopping smoking, managing stress, and being conscious with their diet and general health all play a positive role in preventing CVD. However, the study does highlight that about a third of the participants would choose fast food when going out with family and friends which would not be an ideal attitude to have in the effort to maintain a good cardiovascular health. Meanwhile, practice surrounding CVD prevention was also largely satisfactory among the participants, especially on exercise, intake of fruits and vegetables and incorporation of heart-friendly food and supplements into their diet. However, it can be noted that a proportion of the participants would frequently or always eat fast food (25%), snack on junk food (41.7%), have fried food as a main meal (32.5%) and has a stressful life (25%), which would promote CVD. The KAP of the post-phase II cardiac rehabilitation patients in Brunei Darussalam will be further discussed in the following sections.

Knowledge on CVD: The study has shown good understanding amongst the participants on various aspects of CVD such as the involvement of obstructed arteries in the disease process, its significant co-morbidities and risk factors. A study done in India reported a similar finding whereby coronary artery disease patients had significantly higher knowledge of their disease upon completion of the comprehensive CR programme compared to before they were enrolled in the programme.[13] The finding of good understanding of the relation of obstructed blood vessels with CVD amongst the participants from this study is in contrast to the findings from the Malaysian study done in Kuantan,[14] however their study participants were patients attending outpatient clinic rather than cardiac participants who have been enrolled into a cardiac rehabilitation programme which likely explains this lower understanding of the disease process amongst the Malaysian participants. Furthermore, the participants had good understanding of the importance of diet, exercise and stress management on cardiovascular health. Having knowledge regarding cardiovascular diseases helps patients have more control over their health and it can facilitate self-management

towards the prevention of disease-recurrence.[15] This is in line with a study done in Singapore which reported that patients who attended at least 10 sessions of comprehensive CR reported higher levels of physical and mental quality of life and lower levels of depression in the period post-cardiac rehabilitation.[16]

Meanwhile, it is observed that only a small proportions of the participants knew that light walking would not prevent CVD, although adequate exercise is generally understood to prevent CVD by the majority of the participants (**Figure 3**). The potential lack of understanding on the types of exercise and the intensities at which it would be effective in the prevention of CVD may lead to the suboptimal practice of physical exercise during self-maintenance which may explain the gain in waist circumference observed in the previous study on low-risk cardiac rehabilitation patients at RIPAS hospital.[11] Furthermore, half of the participants have a family history of CVD and it is observed that over half of the participants believed that most cardiovascular diseases are hereditary which is false; although conditions like familial hypercholesterolaemia contribute to CVD, poor lifestyle choices are a much more frequent contributor to the disease. This highlights the need to address this misconception in the education sessions of the programme as this belief may diminish motivation and effort to make lifestyle changes and efforts against CVD. In terms of significant co-morbidities in CVD, there was a much lower understanding of diabetes as a CVD risk factor compared to hypertension (**Figure 4**). This highlights the possible need to further improve patients' understanding of diabetes as a CVD risk factor, especially since diabetes mellitus has been the third leading cause of mortality in Brunei Darussalam for five consecutive years.[3] All of the conditions were identified as CVD risk factors by the majority of the participants (**Figure 5**), most especially smoking (96.7%). Despite this, 40.8% of the participants were unaware of the availability of tobacco cessation programmes.

Attitude on CVD prevention: It can be concluded that there is a positive attitude pertaining to CVD prevention among cardiac rehabilitation patients. Most of the participants agreed that they should stop smoking to prevent CVD. Good knowledge on smoking being a CVD risk factor (**Figure 5**) combined with a positive attitude regarding smoking cessation to prevent CVD justifies further efforts to promote existing tobacco cessation programmes around the country in the education sessions of the cardiac rehabilitation programme. Similarly, all participants agreed that they should do exercise for their health and it was largely understood that adequate exercise can prevent CVD (**Figure 3**), highlighting the need to address the potential issue of inadequate understanding of the types of exercise that would be effective in maintaining good cardiovascular health. However, it can be acknowledged from their responses on being lazy (question A13) and preferring to walk to nearby destinations rather than taking a vehicle (question A3) that the participants understand, at the very least, that they should be mobile rather than stationary. Efforts to further expand their knowledge on this might be worthwhile to promote maintenance of their cardiovascular health in the long run.

Furthermore, most participants generally agreed that oily foods should be limited in a healthy diet. However, almost a third of the participants would choose to eat fast food when going out with friends or family (**Figure 6**). Riegel *et al.* (2018) asserts that self-care in the prevention of CVD is not only an individual-level behaviour but is also influenced by family support and the availability of a conducive environment.[15] Furthermore, the wider availability of fast-food chains in Brunei Darussalam compared to heart-healthy restaurants may encourage this preference for fast-food as they are easily accessible. This finding may also suggests minimal influence of family on the participants' self-care beyond health care settings, which have been identified as an important barrier to adequate self-care especially in heart failure patients.[17]

Practice on CVD prevention: Overall, this study shows good practice on CVD prevention among the participants. The study found that most participants would exercise at least 20 minutes in their leisure time either frequently (more than two times per week) or always (six to seven times per week). Similarly with diet, particularly on vegetable and fruit intake. Furthermore, more than half of the participants were found to adopt a diet that is cardiac health conscious. This is inconsistent with the findings of the Malaysian study conducted in Kuantan where only fewer than half of the participants adopted a special diet for the heart.[14] Again, this gap in practice is likely due to the difference in cardiac history between the participants of the two studies. The current study recruited participants who has a positive cardiac history, making them more likely adopt a heart-healthy diet.

Meanwhile, it is highlighted that almost half of the participants would eat fried food as their main course and snack in between meals frequently (more than two times per week) or always (six to seven times per week). As mentioned earlier, a suboptimal environment within the country to support a healthy diet in these patients and the lack of positive influence from imme-

diate family and friends to help de-normalise fried food intake and snacking may explain these continued poor practices, despite the good understanding that controlling consumption of high-fat food is essential (**Figure 3**). Dieticians may further explore further with patients in the education sessions of the programme healthy alternatives to cooking ingredients to help reduce intake of fried food at home.

Furthermore, it is observed that a quarter of the participants reported having a stressful life, and a smaller number had a negative attitude about being able to manage their stress well (**Figure 6**). Moreover, there are a few participants who did not know that stress is a CVD risk factor (**Figure 5**). Apart from diet and smoking, conditions such as frequent emotional upsets and chronic stress can increase the risk of cardiovascular disease.[7] This study suggests that there is room to further improve participants' understanding of the negative role of stress in CVD and enlighten them about strategies to identify and deal with stressful situations. Notably, most participants were aware that praying can contribute to stress reduction (**Figure 3**). A study have shown that the Islamic prayer has an influential role in attaining peace of the mind and body through modulation of the stress response even at the gene level.[18] While another study reported a decrease in systolic blood pressure and heart rate with meditation.[19] Increasing efforts to emphasise the detrimental effects of stress on cardiovascular health and potential ways to de-stress in the education sessions of the programme may help improve patients' attitude on managing stress and encourage practices to reduce stress.

Association of genders, ethnicity and education levels with knowledge of CVD: There was a significant difference found in the mean knowledge score between participants with different levels of education ($p<0.05$). Participants with lower education had lower mean CVD knowledge score (66.24) compared to participants with higher education (67.79). One factor that significantly contributes to the adequacy of health literacy is having literacy skills such as reading, listening, speaking, numeracy and speech comprehension for individuals to understand health information.[5] The significant difference in knowledge scores between participants with lower education and participants with higher education may be due to a gap in literacy skills whereby individuals with higher education are likely more advanced in these skills hence able to grasp the content of the education sessions more. Although the difference in mean knowledge scores was small, taking into consideration the varying levels of education amongst CR participants may help ensure everyone can benefit equally from the education sessions. Furthermore, assessments of the participant's ability to apply literacy skills in health contexts using assessment tools such as the Rapid Estimate of Adult Literacy in Medicine[20] and the Test of Functional Health Literacy in Adults[21] may also aid in tailoring education sessions to further strengthen its delivery for all participants with various education backgrounds.

Limitations: The study has several limitations. The unbalanced number of male and female study participants may have yielded results that are more likely to represent CVD health literacy of male cardiac rehabilitation patients and therefore may not give a reliable insight into the CVD health literacy of female cardiac rehabilitation patients. Moreover, the small sample size of female participants might also have masked the difference in CVD health literacy between genders in the study population. Furthermore, engagement in other educational activities in the period from completion of Phase II of the cardiac rehabilitation programme at RIPAS hospital to the time of data collection is beyond researcher control and might have influenced the results. Additionally, the use of a KAP questionnaire created for a different study population[14] to estimate the participants' CVD health literacy based on their ability to understand, judge and apply CVD information can only provide limited insight. The development of a validated CVD-specific health literacy tool that includes assessment of CVD-specific management skills such as the ability to self-measure blood pressure may provide a more comprehensive insight into the CVD health literacy of the current study's participants.

CONCLUSION

In conclusion, CR participants had good CVD health literacy in terms of their ability to understand, judge and apply CVD information in the management of their condition. However, there were particular areas surrounding CVD that the participants were found to have limited comprehension on, such as the types of impactful exercises for their cardiovascular health, the contribution of genetics versus poor lifestyle decisions in CVD, the significance of diabetes mellitus and stress in increasing CVD risk and the availability of smoking cessation programmes within Brunei Darussalam. Considering patients' abilities to apply literacy skills in health contexts may facilitate efforts to improve the delivery of CVD information whereby all participants enrolled into the CR programme could equally understand. The study also highlights the possible need to

address the potential barriers to adhere to lifestyle changes at community level such as increasing the availability and accessibility of heart healthy food options. Moreover, social circumstances play a significant role in CVD management hence involving family members of the participants in their health journey can enhance the sustainability of lifestyle changes by fostering a supportive environment and reinforcing positive attitude and behavioural patterns.

Take Home Message

- Cardiac rehabilitation patients in this study demonstrated good overall knowledge, attitude, and practice regarding CVD prevention post-Phase II.
- Higher education level was associated with significantly better CVD knowledge scores, suggesting a need to tailor educational sessions to patients' varying literacy skills.
- Key knowledge gaps existed including the role of light walking in CVD prevention, the hereditary contribution to CVD, and diabetes mellitus as a risk factor.
- Despite positive attitudes, nearly half of participants frequently snacked on junk food, and a third continued consuming fried food as a main course, indicating a gap between attitudes and practices.

Abbreviations

CVD	Cardiovascular disease
KAP	Knowledge, attitude and practice
NCDs	Non–communicable diseases
CR	Cardiac rehabilitation
HF	Heart failure
EF	Ejection fraction

Declarations

The authors declare no conflicts of interest, and no external funding was received for the research, authorship, and/or publication of this article.

Ethical Consideration

The study protocol was reviewed and approved by the Medical and Health Research and Ethics Committee (MHREC), Ministry of Health, Brunei Darussalam, and Ethics Committee of PAPARSB Institute of Health Sciences (IHSREC).

Acknowledgement

This study was not funded by any organisation but was undertaken by the principal investigator as part of her Bachelor of Health Sciences (Medicine) at Universiti Brunei Darussalam under the Scholarship granted by Brunei's Ministry of Education. The author would like to thank the clinical supervisors and academic supervisors on their contribution to this study, as well as to the nurses involved. The author would also like to express her gratitude towards the developer of the questionnaire used in this study for granting permission to use their questionnaire in this study.

References

1. World Health Organisation. Noncommunicable diseases [Fact sheet]. 2025. Available from https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases (Accessed on 25 September 2025).
2. World Health Organization. Health Data at a Glance: Asia/Pacific 2020 Measuring Progress Towards Universal Health Coverage. 2021. Available from: https://www.oecd.org.content/dam/oecd/en/publications/reports/2020/11/health-at-a-glance-asia-pacific-2020_a34fcfc8/26b007cd-en.pdf (Accessed on 25 September 2025).
3. Haji Morsidi, H. N. Empowering Health Promotion, A Review on Finance mechanism and Government Entity. 2018. Ministry of Health, Brunei Darussalam. Available from: https://www.jpa.gov.bn/Shared%20Documents/Kertas%20Kerja%20Projek%20Perkhidmatan%20Awam/Empowering%20Health%20Promotion.pdf (Accessed on 25 September 2025)
4. De Backer G. Prevention of cardiovascular disease: recent achievements and remaining challenges. 2017. European Society of Cardiology. Available from https:/www.escardio.org/communities/councils/cardiology-practice/scientific-documents-and-publications/ejournal/volume-15/prevention-of-cardiovascular-disease-recent-achievements-and-remaining-challeng/ (Accessed on 25 September 2025).
5. Magnani JW, Mujahid MS, Aronow HD, Cené CW, Dickson VV, Havranek E, et al. Health Literacy and Cardiovascular Disease: Fundamental Relevance to Primary and Secondary Prevention: A Scientific Statement From the American Heart Association. Circulation. 2018;138:e48-e74.
6. Diederichs C, Jordan S, Domanska O, Neuhauser H. Health literacy in men and women with cardiovascular diseases and its association with the use of health care services - Results from the population-based GEDA2014/2015-EHIS survey in Germany. PLoS One. 2018;13:e0208303.
7. Supervia M, Turk-Adawi K, Lopez-Jimenez F, Pesah E, Ding R, Britto RR, et al. Nature of Cardiac Rehabilitation Around the Globe. EClinicalMedicine. 2019 Jul 4;13:46-56.
8. Mampuya WM. Cardiac rehabilitation past, present and future: an overview. Cardiovasc Diagn Ther.2012;2:38–49.
9. Buckley JP, Furze G, Doherty P, Speck L, Connolly S, Hinton S, et al. BACPR scientific statement: British standards and core components for cardiovascular disease prevention and rehabilitation. Heart. 2013;99:1069-71.
10. Burger A, Pretorius R, Fourie C MT, Schutte AE. The relationship between cardiovascular risk factors and knowledge of cardiovascular disease in African men in the North-West Province. Health SA Gesondheid. 2016;21:364–71.
11. Jong S, Lai D, Chong C, Ong S, Chong C. Comprehensive cardiac rehabilitation programme improves quality of life and exercise tolerance in low risk cardiac patients. Brunei Int Med J. 2018;14:17–27.
12. Cardiac Society of Brunei Darussalam. Brunei Darussalam National Heart Failure Guidelines 2023. Available from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://moh.gov.bn/wp-content/uploads/2024/10/Brunei-Darussalam-National-Heart-Failure-Guidelines-2023.pdf.
13. Kunjan K, Thukar JS, Viayvergiya R, Rohit MK, Kohli A, Oh P, et al. Effectiveness of cardiac rehabilitation in patients with myocardial infarction and percutaneous coronary intervention at a tertiary care hospital. Int J Noncommun Dis. 2018;3:104–110.
14. Mohammad NB, Rahman NAA, Haque M. Knowledge, attitude, and practice regarding the risk of cardiovascular diseases in patients attending outpatient clinic in Kuantan, Malaysia. J Pharm Bioallied Sci. 2018;10:7-14.
15. Riegel B, Moser DK, Buck HG, Dickson VV, Dunbar SB, Lee CS, et al: American Heart Association Council on Cardiovascular and Stroke Nursing; Council on Peripheral Vascular Disease; and Council on Quality of Care and Outcomes Research. Self-care for the prevention and management of cardiovascular disease and stroke: A scientific statement for healthcare professionals from the American heart association. J Am Heart Assoc. 2017;6:e006997.
16. Choo CC, Chew PKH, Lai SM, Soo SC, Ho CS, Ho RC, et al. Effect of cardiac rehabilitation on quality of life, depression and anxiety in Asian patients. Int J Environ Res Public Health. 2018;15:1095.
17. Fry M, McLachlan S, Purdy S, Sanders T, Kadam UT, Chew-Graham CA. The implications of living with heart failure; The impact on everyday life, family support, co-morbidities and access to healthcare: A secondary qualitative analysis. BMC Fam Pract. 2016 Sep 26;17:139.
18. Sobhani V, Manshadi Mokari E, Aghajani J, Hatef B. Islamic praying changes stress-related hormones and genes. J Med Life. 2022 Apr;15:483-8.

19.Lee MS, Kim BG, Huh HJ, Ryu H, Lee HS, Chung HT. Effect of Qi -Training on Blood Pressure, Heart Rate and Respiration Rate. Clin Physiol. 2000;20:173-6.
20.Davis TC, Long SW, Jackson RH, Mayeaux EJ, George RB, Murphy PW, et al. Rapid estimate of adult literacy in medicine: a shortened screening instrument. Fam Med. 1993;25:391-5.
21.Parker, R. M., Baker, D. W., Williams, M. V & Nurss, J. R. The Test of Functional Health Literacy in Adults: A New Instrument for Measuring Patients' Literacy Skills.