Original Article

Gender Differences in Knowledge, Attitudes and Practices towards Cardiovascular Disease and its Treatment among Asian Patients

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Abstract

Introduction: Knowledge, attitudes and practices (KAP) impact on cardiac disease outcomes, with noted cultural and gender differences. In this Asian cohort, we aimed to analyse the KAP of patients towards cardiac diseases and pertinent factors that influence such behaviour, focusing on gender differences. Materials and Methods: A cross-sectional survey was performed among consecutive outpatients from a cardiac clinic over 2 months in 2014. Results: Of 1406 patients approached, 1000 (71.1%) responded (mean age 57.0 ± 12.7 years, 713 [71.3%] males). There was significant correlation between knowledge and attitude scores (r = 0.224, *P* <0.001), and knowledge and practice scores (r = 0.114, *P* <0.001). There was no correlation between attitude and practice scores. Multivariate predictors of higher knowledge scores included female sex, higher education, higher attitude and practice scores and prior coronary artery disease. Multivariate predictors of higher attitude scores included higher education, higher knowledge scores and non-Indian ethnicity. Multivariate predictors of higher practice scores included male sex, Indian ethnicity, older age, higher knowledge score and hypertension. Males had lower knowledge scores (85.8 ± 8.0% vs 88.0 ± 8.2%, *P* <0.001), lower attitude scores (91.4 ± 9.4% vs 93.2 ± 8.3%, *P* = 0.005) and higher practice scores (58.4 ± 18.7% vs 55.1 ± 19.3%, *P* = 0.013) than females. Conclusion: In our Asian cohort, knowledge of cardiovascular health plays a significant role in influencing attitudes and practices. There exists significant gender differences in KAP. Adopting gender-specific strategies for future public health campaigns could address the above gender differences.

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Key words: Health behaviour, Health promotion, Public health

Introduction

Cardiac disease (CD) imposes a significant health burden worldwide in both men and women.[1] Various factors such as demographics and socioeconomic status have been shown to influence knowledge, attitudes and practices (KAPs) towards CD.[2-4] The understanding of KAP and its predictors are important as these have been shown to affect cardiovascular outcomes.[5] Associations between lower knowledge scores and higher risk of stroke and myocardial infarction have been reported.[6]

Gender differences, in particular, have been shown to be an important factor affecting cardiovascular KAP.[7] Few studies compared KAP between the male and female gender. One such study from Kuwait showed that knowledge about cardiovascular diseases was significantly higher among females compared to males.[6] Beyond gender, cardiovascular KAPs of a population may be affected by different cultures and locales. Previous studies have shown varying results reported from different countries.[8-10] Singapore is a multiethnic developed Asian city-state comprising 5.47 million people (74% Chinese, 13% Malay, and 9% Indian).[11] A previous study had examined knowledge of symptoms of heart attack and stroke in this country[12] but further studies are lacking.

In our Asian cohort, we aimed to analyse the KAP of patients towards CD and the pertinent factors that influence

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such behaviour, in particular focusing on gender differences. This may potentially identify areas for development of more effective public health strategies.

Materials and Methods

We performed a cross-sectional survey on consecutive subjects attending the outpatient cardiac clinics at our institution for a period of 2 months from June to July 2014. Informed consent was obtained. A self-administered pen-and-paper questionnaire was distributed to the participants and completed questionnaires were collected at a central collection point in the clinics. An on-site investigator was available to answer any queries. Subjects who were unable to understand the questionnaire or declined to give consent were excluded. Ethics approval for the study was obtained from the Institutional Review Board.

Questionnaire

We developed the questionnaire to assess the KAPs of patients towards CD. The questionnaire was based on questionnaires on similar topics used in previous studies[7,13] and models of health behaviour.[14,15] The questionnaire was pilot-tested among patients with similar profiles to our target population and further refined to ensure that all the questions were easily understood and interpreted uniformly. The questionnaire gathered information regarding basic demographics such as age, sex, ethnicity, education level and housing type. The patient's KAP towards CD were also assessed. Questions on knowledge tested the patient's general knowledge towards healthy lifestyle choices, CD and its treatment. Questions on attitudes assessed patient's perception towards the above and questions on practices evaluated the actual compliance of the patients to these factors. Questions to ascertain the impact of financial concerns as well as knowledge of financial assistance schemes (Medisave, Medishield, Medifund, Community Health Assist Scheme [CHAS], and Chronic Disease Management Programme [CDMP]) were also included. Medisave is a government-mandated compulsory individual healthcare savings scheme; Medishield is a national healthcare insurance programme; Medifund is an endowment fund to help the needy with medical expenses; CHAS and CDMP are primary healthcare programmes to help subsidise the management of chronic diseases.

Patients were requested to rate their agreement with the statements in the questionnaire on a 4-point Likert scale or choose relevant option(s) from a list. The questionnaire was available in both English and Chinese.

Clinical information from the questionnaire was supplemented from the patients' hospital medical records including clinical characteristics and risk factors, physical examination findings and laboratory test results.

Statistical Analysis

To determine the sample size, we assumed that responses within each group were normally distributed with a standard deviation of 7%. To detect a true difference in means between groups of 2%, we required 259 participants per group to achieve power of 0.9 and $P = 0.05$.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) 22.0 for Windows (SPSS Inc, Chicago, IL). The demographic and risk factor profile of the study population was characterised using descriptive statistics. To determine the KAP scores for each individual, responses were scored 1 point for a desired response and 0 for an undesired response. For instance, in response to a question which participants should agree to, "strongly agree" and "agree" were scored 1 while "strongly disagree" and "disagree" were scored 0. A total of 20 knowledge questions, 13 attitude questions and 12 practice questions were included. The scores for each section was then divided by the number of items in its respective section to obtain the final scores as percentages ± standard deviation (SD). Comparison between the 2 groups (male vs female) was performed using student's t-test for parametric data, Mann-Whitney U test for non-parametric data and chi-squared test for categorical data. The relationship between KAP scores was explored using bivariate correlational analyses and multivariate linear regression models.

Results

We approached 1406 patients, of which a total of 1000 (71.1%) (713 males, mean age 57 ± 12 years, 74% Chinese, 5% Malay and 13% Indian) patients consented to participate. These 1000 patients formed the study cohort. The incidence of diabetes, hypertension, hyperlipidaemia and prior coronary artery disease were significantly higher in males. Males were less likely to be either unemployed or homemakers. Males had significant higher body mass index (BMI) and diastolic blood pressure (Table 1).

KAP Scores

Overall Population

The overall KAP scores of our study population towards CD was 86.5 ± 8.1%, 91.9 ± 9.1% and 57.5 ± 18.7% respectively (Table 2). There was a significant correlation between knowledge scores and attitude scores ($r = 0.224$, $P < 0.001$) and knowledge scores and practice scores ($r = 0.114$, $P < 0.001$). There was no significant correlation between attitude and practice scores. Significant multivariate predictors of higher knowledge scores included female sex,

Table 1. Demographics of the Study Population

Demographics	Overall (n = 1000)	Males (n = 713)	Females (n = 287)	*P* Value*
Age	57.0 (12.7)	57.0 (12.7)	57.0 (12.6)	0.998
Ethnicity				0.085
Chinese	740 (74.0%)	517 (72.5%)	223 (77.7%)	
Malay	59 (5.9%)	42 (5.9%)	17 (5.9%)	
Indian	130 (13.0%)	105 (14.7%)	25 (8.7%)	
Others	71 (7.1%)	49 (6.9%)	22 (7.7%)	
Education				0.260
≤Secondary school/ITE	366 (37.3%)	254 (36.2%)	112 (40.0%)	
Polytechnic diploma/GCE A level	287 (29.2%)	202 (28.8%)	85 (30.4%)	
Degree/postgraduate	329 (33.5%)	246 (35.0%)	83 (29.6%)	
Occupation				<0.001
White collar§	388 (50.1%)	268 (49.1%)	120 (52.6%)	
Blue collar‖	131 (16.9%)	118 (21.6%)	13 (5.7%)	
Unemployed/homemaker	255 (32.9%)	160 (29.3%)	95 (41.7%)	
Housing				0.019
≤3-room public apartment¶	105 (11.4%)	66 (10.2%)	39 (14.4%)	
4- to 5-room public apartment¶	455 (49.6%)	339 (52.4%)	116 (42.8%)	
Private property	358 (39.0%)	242 (37.5%)	116 (42.8%)	
Marital status				0.013
Married	828 (85.5%)	608 (87.7%)	220 (80.0%)	
Divorced	31 (3.2%)	18 (2.6%)	13 (4.7%)	
Single	109 (11.3%)	67 (9.7%)	42 (15.2%)	
Smoking				<0.001
No	673 (72.0%)	425 (63.6%)	248 (93.9%)	
Ever smoker	262 (28.0%)	246 (36.7%)	16 (6.1%)	
Alcohol				<0.001
No	438 (46.9%)	259 (38.8%)	179 (67.0%)	
Ever drinker	496 (53.1%)	408 (61.2%)	88 (33.0%)	
Clinical characteristics				
Body mass index	25.6 (5.1)	26.2 (4.9)	24.3 (5.3)	<0.001
Systolic blood pressure	131.1 (17.6)	131.8 (17.2)	130 (18.4)	0.145
Diastolic blood pressure	70.7 (10.0)	72.2 (9.8)	67.1 (9.4)	<0.001
Diabetes mellitus	217 (21.7%)	173 (34.3%)	44 (15.3%)	0.002
Hypertension	480 (48.0%)	357 (50.1%)	123 (42.9%)	0.039
Hyperlipidaemia	614 (61.4%)	471 (66.1%)	143 (49.8%)	<0.001
Prior coronary artery disease	415 (41.5%)	353 (49.5%)	62 (21.6%)	<0.001
Prior congestive cardiac failure	38 (3.8%)	32 (4.5%)	6 (2.1%)	0.098
Atrial fibrillation	81 (8.1%)	62 (8.8%)	18 (6.3%)	0.246
Prior cerebrovascular accident	54 (5.4%)	40 (5.6%)	14 (4.9%)	0.758
HbA1C (%)†	6.3 (1.3)	6.4 (1.4)	6.0 (1.0)	0.007
LDL cholesterol (mmol/L)‡	2.7 (1.0)	2.6 (1.0)	3.0 (1.0)	<0.001

GCE: General Certificate of Education; HbA1C: Glycated haemoglobin; ITE: Institute of Technical Education

*Comparing males and females.

†623 patients with missing data (421 males, 202 females).

‡403 patients with missing data (267 males, 136 females).

§Refers to workers who perform job duties in an office setting.

‖Refers to workers who perform labour jobs or work with their hands.

¶Refers to heavily subsidised housing built by the government. Families with gross monthly income in excess of $10,000 are not eligible to directly purchase these subsidised apartments from the Housing and Development Board.

Mean and SD are reported for continuous data and frequency and percentages for categorical data.

Table 2. Scores and Zero-Order Correlation between Scores for Knowledge, Attitudes and Practices towards Cardiovascular Disease

	Overall (n = 1000)	Males (n = 713)	Females (n = 287)	*P* Value*
Knowledge score (%)	86.5 (8.1)	85.8 (8.0)	88.0 (8.2)	<0.001
Attitude score (%)	91.9 (9.1)	91.4 (9.4)	93.2 (8.3)	0.005
Practice score (%)	57.5 (18.7)	58.4 (18.4)	55.1 (19.3)	0.013

Correlation between scores	r	*P* Value	r	*P* Value	r	*P* Value
Knowledge score with attitude score	0.224	<0.001	0.218	<0.001	0.209	<0.001
Attitude score with practice score	0.030	0.359	0.049	0.196	0.004	0.952
Knowledge score with practice score	0.114	<0.001	0.158	<0.001	0.048	0.422

*Between males and females.
KAP scores range from 0% to 100%.

higher level of education, higher attitude and practice scores and prior coronary artery disease. Significant multivariate predictors of higher attitude scores included higher level of education and higher knowledge scores. Indian ethnicity was a significant predictor of lower attitude scores. Significant multivariate predictors of higher practice scores included male sex, higher level of education, older age, higher knowledge score and hypertension (Table 3).

Sex Stratified

Males had significantly lower knowledge scores (85.8 ± 8.0% vs 88.0 ± 8.2%, P <0.001), lower attitude scores (91.4 ± 9.4% vs 93.2 ± 8.3%, P = 0.005) and higher practice scores (58.4 ± 18.7% vs 55.1 ± 19.3%, P = 0.013) than females. In males, there was a significant correlation between knowledge and attitude score (r = 0.218, P <0.001) and knowledge and practice score (r = 0.158, P <0.001). In females, there was a significant correlation between knowledge and attitude score (r = 0.209, P <0.001). There was no significant correlation between attitude and practice scores in both sexes.

Significant multivariate predictors of higher knowledge scores in males included younger age, higher level of education, higher attitude and practice scores, and prior coronary artery disease; while that of females included higher level of education and employment, and higher attitude scores. Significant multivariate predictors of higher attitude scores in males included higher level of education and higher knowledge scores; while that of females included higher knowledge scores. Indian ethnicity and less affluent housing predicted lower attitude scores in females. Significant multivariate predictors of higher practice scores in males included older age, higher knowledge scores, and prior coronary artery disease; while that of females included older age and hypertension. Higher level of employment predicted lower practice scores in females (Table 4).

Specific Behaviours

Regarding compliance to the recommended daily intake of fruit and vegetables, overall 68.0% reported being compliant (66.6% males vs 71.6% females, P = 0.125). A total of 36.5% (38.2% males vs 32.2% females, P = 0.104) of the participants reported exercising ≥3 times per week while 28.7% (26.1% males vs 35.2% females, P = 0.005) exercised <1 time per week. Walking (76.1%), jogging (20.3%) and swimming (10.6%) were the most common modalities. Self-reported compliance to medications was 92.6% (93.6% males vs 80.0% females, P = 0.065). Of those non-compliant to medications, forgetting to take (50.7%), being too busy with work (25.9%) and having too many medications to take (8.8%) were the top 3 reasons. Compliance to follow-up was 85.3% (86.4% males vs 82.7% females, P = 0.169). Of those non-compliant to follow-up, being too busy (45.3%), follow-up visits being too expensive (34.9%) and visits being too troublesome to attend (16.0%) were the top 3 reported reasons.

A total of 33.4% and 19.1% of patients believed that monitoring for hypertension and diabetes mellitus respectively should only be done during clinic visits. Patients chose chest pain (94.4%), shortness of breath (85.9%) and sweating (78.1%) as the 3 most common symptoms of heart attack. A majority of patients were able to distinguish between symptoms suggestive of upper respiratory tract infection and cardiac symptoms. In response to symptoms of a heart attack, 60.3% chose to call the ambulance, 10.8% chose to wait to see if the symptoms get better, 10% would visit the general practitioner, 9.4% would go to the hospital themselves, and 2% would seek advice from family members.

When asked about the affordability of healthcare, 73.3% were worried about the cost of treatment. High cost of medications (43.8%), high cost of consultation (42.0%) and the lack of government support (13.9%) were cited as

Table 3. Multivariate Linear Regression of Scores for Knowledge, Attitudes and Practice towards Cardiovascular Disease for Overall Cohort

	Knowledge Score			Attitude Score			Practice Score		
	β	95% CI for β	*P* Value	β	95% CI for β	*P* Value	β	95% CI for β	*P* Value
Sex									
Male	-2.797	-3.994 to -1.600	<0.001	-1.418	-2.861 to 0.025	0.054	3.173	0.426 to 5.920	0.024
Ethnicity									
Others	0.648	-1.365 to 2.662	0.528	-1.166	-3.548 to 1.217	0.337	3.803	-0.733 to 8.340	0.100
Indian	0.056	-1.531 to 1.644	0.945	-2.394	-4.293 to -0.496	0.014	3.170	-0.432 to 6.772	0.084
Malay	-0.218	-2.474 to 2.038	0.850	0.178	-2.508 to 2.863	0.897	-2.720	-7.846 to 2.407	0.298
Chinese*	NA								
Age	-0.046	-0.099 to 0.006	0.086	-0.010	-0.073 to 0.053	0.763	0.488	0.373 to 0.303	<0.001
Education									
Polytechnic diploma/GCE A level	1.708	0.414 to 3.003	0.010	0.899	-0.647 to 2.445	0.254	1.914	-1.029 to 4.857	0.202
Degree/postgraduate	3.584	2.241 to 4.926	<0.001	2.665	1.044 to 4.286	0.001	3.222	0.129 to 6.314	0.041
≤Secondary school/ITE*	NA								
Occupation									
Blue collar	0.369	-1.275 to 2.014	0.659	-1.221	-3.190 to 0.748	0.224	-1.457	-5.195 to 2.280	0.444
White collar	0.741	-0.418 to 1.901	0.210	-0.704	-2.091 to 0.684	0.320	-1.590	-4.223 to 1.043	0.236
Unemployed/homemaker*	NA								
Housing									
≤3-room public apartment	-1.177	-3.022 to 0.668	0.211	0.337	-1.856 to 2.529	0.910	1.414	-2.759 to 5.586	0.506
4- to 5-room public apartment	-0.185	-1.305 to 0.935	0.746	0.512	-0.828 to 1.851	0.453	-1.771	-4.312 to 0.770	0.172
Private property*	NA								
Marital status									
Married	0.232	-1.454 to 1.918	0.787	0.575	-1.448 to 2.598	0.577	-0.549	-4.383 to 3.284	0.779
Divorced	-2.221	-5.541 to 1.099	0.190	2.821	-1.100 to 6.742	0.158	-3.190	-10.746 to 4.367	0.408
Single*	NA								
Knowledge score	NA			0.215	0.135 to 0.294	<0.001	0.266	0.113 to 0.419	0.001
Attitude score	0.148	0.092 to 0.204	<0.001	NA			0.028	-0.101 to 0.157	0.667
Practice score	0.051	0.022 to 0.081	0.001	0.009	-0.026 to 0.044	0.619			
Body mass index	-0.005	-0.109 to 0.099	0.930	0.091	-0.033 to 0.215	0.152	-0.096	-0.332 to 0.140	0.425
Diabetes mellitus	0.257	-1.110 to 1.624	0.712	0.851	-0.777 to 2.479	0.305	2.091	-0.998 to 5.181	0.184
Hypertension	0.301	-0.831 to 1.433	0.602	-0.203	-1.560 to 1.153	0.768	2.895	0.330 to 5.459	0.027
Hyperlipidaemia	-0.237	-1.456 to 0.982	0.702	0.264	-1.195 to 1.723	0.723	0.316	-2.457 to 3.008	0.823
Prior coronary artery disease	1.321	0.135 to 2.507	0.029	-0.820	-2.239 to 0.598	0.257	2.454	-0.241 to 5.149	0.074

CI: Confidence interval; GCE: General Certificate of Education; ITE: Institute of Technical Education; NA: Not applicable
*Reference group.

Table 4. Sex Stratified Significant Multivariate Predictors of Knowledge, Attitude and Practice Scores

	Knowledge Score				**Attitude Score**				**Practice Score**		
Predictor	β	95% CI	*P* Value	Predictor	β	95% CI	*P* Value	Predictor	β	95% CI	*P* Value
Males											
Age	-0.062	-0.120 to -0.004	0.036	Degree/postgraduate	2.743	0.784 to 4.703	0.006	Age	0.452	0.326 to 0.579	<0.001
Polytechnic diploma/ GCE A level	1.849	0.334 to 3.364	0.017	Knowledge score	0.227	0.129 to 0.325	<0.001	Knowledge score	0.338	0.161 to 0.516	<0.001
Degree/ postgraduate	3.539	1.989 to 5.088	<0.001					Prior coronary artery disease	3.335	0.326 to 6.344	0.030
Attitude score	0.145	0.082 to 0.207	<0.001								
Practice score	0.067	0.032 to 0.102	<0.001								
Prior coronary artery disease	1.354	0.018 to 2.689	0.047								
Females											
Degree/ postgraduate	4.959	2.359 to 7.558	<0.001	Indian	-4.437	-8.001 to -0.874	0.015	Age	0.490	0.269 to 0.712	<0.001
White collar	2.142	0.055 to 4.229	0.044	≤3 room public apartment	-3.324	-6.630 to -0.018	0.049	White collar	-4.890	-9.750 to -0.030	0.049
Attitude score	0.137	0.015 to 0.259	0.028	Knowledge score	0.144	0.015 to 0.273	0.028	Hypertension	6.643	1.471 to 11.816	0.012

CI: Confidence interval; GCE: General Certificate of Education

the 3 most common reasons. Awareness of support schemes was as follows: medical social worker (67.2%), Medisave (81.9%), Medishield (79.5%), Medifund (80.5%), CHAS (62.3%) and CDMP (41.2%).

Discussion

In our cohort, there was high knowledge and attitude scores and relatively lower practice scores. There were also significant correlations between knowledge and attitude/practice scores with noted gender differences.

The high knowledge and attitudes scores in our cohort could be attributed to Singapore being a developed city state with high literacy rates.[16] Most patients were able to identify behavioural cardiovascular risk factors such as smoking, unhealthy diet and lack of exercise. Prior studies in developing countries with poor education levels[17-19] have shown lower levels of knowledge as compared to those developed countries.[10,20] In Nepal, there was limited knowledge of cardiovascular health with 60% being unable to identify any heart attack symptoms.[7] In contrast, the majority of Vietnamese Americans were able to spontaneously mention chest pain as a symptom of heart attack and 85% knew that they should immediately activate the emergency services should they suspect a heart attack.[9]

We found a significant correlation between knowledge and attitudes/practice scores in our study. Knowledge forms the basis of a good foundation to better attitudes and practices and this has been shown in models of behavioural change. The Health Belief Model states that the likelihood of taking action to prevent illnesses depends on factors such as perceived susceptibility, disease severity, and the benefits and barriers of behaviour change.[14] As a result, having better knowledge would then alter the balance of the model constructs, leading to better attitudes and practices. Studies have shown that improving patients' health literacy can empower them to improve their health outcomes.[21] In Malaysian women, there was significant correlation between KAP scores which were independent of other sociodemographic factors.[22]

However, the correlation did not translate proportionally to good practice scores in our study. As discussed above, knowledge does impact practices; however, this relationship may also be influenced by many other factors. A study among patients with cardiovascular diseases and risk factors found that those at moderate risk had better perceptions towards exercise and weight loss as compared to those with established cardiovascular disease but this did not translate into actual practice.[3] Another study on influenza also demonstrated poor practice scores despite high knowledge scores and good correlation between knowledge and practice scores.[13] A potential explanation exists in health behaviour theories such as the social cognitive theory and the theory of reasoned action.[15] There are many factors influencing a person's health behaviour, and knowledge and attitude are only 2 components in the pathway. For example, in the social cognitive theory, constructs and other personal and environmental determinants also play crucial roles. Valente et al also suggested that each behaviour change model utilises different order of KAP with each individuals fitting into each model differently;[23] specific interventions may be required to be tailored to the individual. Thus, although it would be worthwhile to focus on public health interventions to improve the knowledge of the population, the limitations of such measures should be recognised.

Socioeconomic Influences

Socioeconomic status (SES) plays an important part in the long-term outcome of patients with CD.[24] People of lower SES are known to be at higher risk of CD, especially in high-income countries.[25] Traditionally, education level, employment level and housing type have been used a proxy for SES as in our study.[26] In the overall cohort, higher education levels resulted in higher knowledge and attitude scores. In females, higher level of employment resulted in higher knowledge scores while less affluent level of housing resulted in lower attitude scores. This is consistent with other studies that also showed links between lower SES and poorer KAP scores.[8,10,22,27] In Iran, participants with higher education levels had significantly better knowledge towards CD when compared to those with lower education levels.[27] In a study of Canadian residents, higher income was associated with better knowledge of cardiovascular risk factors such as smoking, elevated cholesterol and lack of exercise.[10] Emphasis needs to be placed on reaching out to this section of the population. Unexpectedly, higher level of employment in females in our study resulted in lower practice scores and could possibly be explained by lack of time to focus on health needs.

Gender Influences

Current literature lacks data on gender differences on cardiovascular KAPs. In our cohort, females had significantly higher knowledge and attitude scores but lower practice scores as compared to males. A significantly greater proportion of females did little/no exercise and there was a trend towards lower compliance to medications and follow-up.

The higher knowledge and attitude scores found in our study is consistent with results from prior studies.[27] An Iranian study showed higher mean knowledge scores in women compared to men.[27] One possible explanation for the higher knowledge and attitude scores is that women

are more proactive in seeking health information. A study conducted in Finland looking into the gender differences in health information-seeking behaviour concluded that women were more interested in and reported more active seeking of health-related information.[28] Furthermore, women also received more health-related information from family members as compared to men. This exposure to health information has been shown to result in better knowledge.[29] Hence, in order to improve gender equity in health, men need to be engaged and empowered to utilise the information widely available from various sources. Public health interventions could also be modified to be more gender specific. This conclusion is largely congruent with the result of an analysis of 5 internationally recognised health promotion frameworks which emphasised that gender has never been properly integrated as a factor critical to successful health promotion.[30] Another explanation for higher knowledge and attitude scores among women is that in our local setting, a woman's traditional responsibility to the family involves taking care of the non-financial household matters, and this may extend to include acquiring health-related knowledge and acting as a primary custodian of the family's health.[31,32] The lower practice scores in Asian women could potentially be a result of her prioritising her role as primary caregiver over her health needs, thus, acting as a barrier towards behavioural change.

The higher practice scores in males is also congruent with other studies. In a study of patients postmyocardial infarction, it was found that women were less likely than men to participate in cardiac rehabilitation.[33] The higher practice scores in males could be explained by the fact that males had higher burden of both modifiable and non-modifiable cardiovascular risk factors. In a study of the general population of Seychelles, individuals who were aware that they had hypertension made greater efforts to reduce salt intake and visit a doctor.[4] In another study comparing the health-related behaviour among those with cardiovascular diseases and risk factors, participants with established cardiovascular disease reported higher levels of exercise and better maintenance of desired weight.[3] This finding could be explained by the Health Belief Model whereby individuals who are aware of their cardiovascular risk factors have higher perceived threat, leading to increased likelihood of engaging in cardiovascular health-promoting behaviour.[14] In our study, a prior history of coronary artery disease was a significant predictor of knowledge and practice scores in males, further supporting this explanation.

This study has important public health implications. Public health campaigns targeting the various subsets of at-risk patients to improve their knowledge are important tools. These campaigns need to be pitched at the correct level. Of note, a substantial group of patients were not aware of support schemes like the CHAS and CDMP despite governmental publicity via television commercials, advertisements and posters. This highlights the important role healthcare staff have to play in making aware to the patient the availability of such schemes. For the general public, beyond the routine publicity, novel ways to reach out should be considered (eg. publicity at common areas like food centres, supermarkets). Efforts to bridge the gap between knowledge and actual practice is another area of work. Individual-level patient education by dedicated personnel (eg. nurse educators) is one possible solution.

Limitations

Males were unintentionally represented in higher proportions (71.3%) in our study, reflecting the higher CD burden in males.[1] There exists the potential of bias from the phenomenon of social desirability, whereby individuals become unwilling to admit socially unacceptable KAP in order to leave a more positive impression.[34,35] This is inherent in most similar studies. The impact of KAPs on CD outcomes were not assessed in this cross-sectional survey and will be the subject of future studies. This study was also limited by the availability of only English and Chinese versions of the questionnaire. Therefore, there was likely a selection bias in terms of ethnicity and SES, which may affect the applicability of the results to these subgroups. For example, although Malays comprised 15% of the overall population in the 2014 census, they made up only 5.9% of our study population. Future studies will include Malay and Tamil versions of the questionnaires. Similarly, our study reported higher proportions staying in private housing and lower proportions in 1-, 2- and 3-room public flats.[36] This could suggest that the study population was likely represented by more educated patients who could read the self-administered questionnaire. Another limitation is that this study was conducted in the outpatient setting of a tertiary centre for cardiovascular care, limiting its generalisability to the normal healthy population. However, it does highlight potential gaps in the public's KAP as it can be reasonably inferred that the general public would likely have equal, if not lower, levels of these attributes. Further studies in other population groups (eg. polyclinics, inpatients, etc.) would help validate the findings of our study.

Conclusion

In our Asian cohort, knowledge of cardiovascular health plays a significant role in influencing attitudes and practices. There exists significant gender differences in KAPs. Future public health campaigns may potentially focus on improving general knowledge as well as addressing these gender differences to promote healthy behaviour.

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