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Population awareness of cardiovascular disease risk factors and health care seeking behavior in the UAE

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ABSTRACT

Objectives: We aimed to determine the awareness, knowledge, and attitude of people residing in Dubai, United Arab Emirates, regarding cardiovascular disease (CVD) risk factors. Our aim was to further identify prospects to increase awareness of modifiable CVD risk factors and influence behavior.

Methods: This observational study was conducted in Dubai: a global city in the United Arab Emirates. Participants were selected using simple randomization approach in primary health care centers, and a questionnaire was implemented based on literature review.

Results: Out of 1020 individuals approached, 738 agreed to participate in the study (response rate of 72%).The majority of participants surveyed had good knowledge and attitude toward CVD (528, 71.5% and 445, 60% respectively); yet, poor/fair practice related to CVD risk factors (553, 75%). Predictive Margins of Knowledge Scores were significant for age ($p<.01$), academic level ($p<.0001$), and nationality ($p<.0001$) (Table 5). Participants aging 40-49, non-UAE subjects, and university/Postgraduate academic level scored better on the knowledge. Demographics predictor for practice score was highly significant for age ($p=.0001$) and BMI ($p=.0001$). Those aging ≥50 and obese participants scored higher on practice toward CVD risk factors. Knowledge score was significant predictor of practice and attitude toward CVD risk factors ($p=.0001$, $p<.0001$)

Conclusions: Although more than half of the current study participants had high knowledge and attitude toward CVD, their behaviors were not satisfactory. It is necessary to establish more effective educational interventions intended to promote positive health behaviors. Public health providers need to explain to the public that knowledge and proper actions regarding the reduction of risk factors are associated with reduced CVD and mortality.

1. Background

Cardiovascular disease (CVD) is the number one leading cause of death globally [1]. Unfortunately, it is also a significant cause of death in the UAE, contributing to 28 percent of total deaths in the country [2]. Major risk factors of CVD include high blood pressure, cigarette smoking, high cholesterol level, diabetes, obesity, and physical inactivity [3]. Other risk factors of CVD include stress, sex hormone intake, birth control pills, and alcohol. Other factors such as age, gender, and genetics are also considered non-modifiable risk factors [4]. There are, however, disparities in the prevalence of and mortality from CVD related to socioeconomic status, race, and nationality.[5] Those with lower income levels face a higher possibility of having at least one CVD risk factor.[6, 7]

Increasing the knowledge relevant for CVD-related health is of great importance because of the high prevalence of CVD and widespread CVD-related disparities in this region of the world. Cardiovascular disease-related knowledge (e.g., risk factors, conditions) and beliefs (e.g., health consequences of CVD) are essential factors that lead individuals to preventive actions.[8] Knowledge itself may initiate changes in health

Abbreviations: BMI, Body mass index; CVD, Cardiovascular disease; FBS, fasting blood sugar; HbA1c, hemoglobin A1c; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; TG, triglycerides; UAE, United Arab Emirates.

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behaviors while not directly predicting the health behaviors themselves.[9] At the same time, beliefs may promote a healthy lifestyle or act as barriers to preventive actions.[9] Awareness of chronic diseases, including CVDs and their risk factors, can be a precondition for success in preventing and controlling these diseases [10, 11]. This knowledge will inform individuals on healthy attitudes to adopt [12, 13] and to be proactive in reducing their own lifetime risk by plummeting their exposure to modifiable risk factors for CVD [9, 14].

The UAE is experiencing an economic transition since the discovery of oil over five decades ago, and as a consequence, there has been a change in lifestyle among the UAE population that has resulted in an increase in CVD risk factors and worsening outcomes. This research aims to assess the population's knowledge, attitude, and practice regarding CVD risk factors. We also wanted to identify the significant contributing factors of CVD, and determine the most common modifiable risk factor of CVD in the UAE population. By assessing the population awareness, we hope that we will have accurate solid data representing the UAE that will allow us to be able to develop strategies to overcome the most significant risk factor in our region, aiming to reduce CVD mortality.

2. Methods

2.1. Study Design

This descriptive cross-sectional study was conducted among participants above 30 years, of both genders, who were attending primary health care center (PHC) in Dubai Health Authority from September 2020 until February 2021.

2.2. Study Participants and Procedure

Participants living in the UAE that were willing to provide a written informed consent were selected for the study. The participants were selected using simple randomization approach in PHC. The participants were assured of the confidentiality of the information provided and protection of their privacy rights, mandated by the research ethics guidelines of the human research ethics committees. The inclusion criteria mandated participants to be 30 years of age and above, not to be a health care provider, willing to participate in the survey, sign informed consent, have appropriate cognitive skills, and read and understand in English or Arabic (e.g., the local language). Both UAE citizens (nationals) and expatriates were included in the study. Participants that had poor mental health and were unable to meet any of the above criteria were excluded from the study. We calculated the sample size using an online calculator (http://www.raosoft.com/samplesize.html) with a confidence interval of 99%, a margin of error of 5%, and response distribution of 50% for the population of 504,000 individuals (total number of individuals older than 30 years attending PHC in Dubai Health Authority per year). An additional 40% sample was added as a non-response rate, and the final sample size of 630 respondents was calculated.

2.3. Survey Design (Evaluation tools)

A structured questionnaire was designed and developed by a multidisciplinary team that reviewed the literature from relevant studies [9-11]. The evaluation tool was then pre-tested among 20 adults to assess ease of understanding and time required for completion. Our bilingual questionnaire in Arabic and English is represented in APPX I. The survey instrument consisted of 46 items. The first part of the questionnaire collected sociodemographic data: age, nationality, marital status, employment status, academic level, monthly income, and health-related history (e.g., Smoking status, diabetes, hypertension, High cholesterol, Ischemic heart disease diseases, and Family history of cardiovascular disease. The remaining sections of the questionnaire focused on knowledge, attitude, and practice toward CVD. The questionnaire contained sixteen questions regarding CVD risk factors, nine regarding attitude, and 11 regarding practice. Each of these questions was equally scored (one point for each correct answer and zero otherwise). These points were then summed across all the questions. We categorized participants who obtained 11 or more correct responses having "good knowledge"; those with a score between 6 and 10 were classified as having "fair knowledge" while those with a score of 5 and below were classified as having "poor knowledge." Previously published studies [15, 16] have used this categorization approach and assisted us to compare our study findings.

Fasting blood sugar, HbA1C, and blood pressure were classified as per NICE guidelines [17]:

- For non-diabetic, normal fasting sugar: <106
- For diabetic, normal fasting sugar: <126
- HbA1C of 6.5 or more is diagnostic for diabetes
- For those with diabetes, target HbA1C is seven or less
- Blood pressure <140/90 mmHg

Minimal desirable values for total cholesterol, LDL, HDL, and triglycerides were classified as per The American Heart Association's [18]:

- Total cholesterol: <200 mg/dL.
- Low density lipoprotein (LDL) cholesterol: <100 mg/dL.
- Triglycerides: <150 mg/dL.
- High density lipoprotein (HDL) cholesterol ≥40 mg/dL.

2.4. Data analysis and statistics

All collected data were entered into STATA version 16.1 (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC.) for statistical analysis. Descriptive statistics were computed for the sociodemographic variables. The overall responses to each item of the survey were recorded as a percentage of the total. The percentage differences in the total responses were determined using the Chi-square test, and statistical significance was recorded for non-parametric data. For all analyses, alpha (α) was set at 0.05. A multiple regression model was fitted to explore the possible predictors of knowledge, attitude, and practice.

2.5. Ethics statement

The study was approved by the institutional review boards of Dubai Health Authority Dubai (Approval # DSREC-10/2020_14). All participants gave written informed consent before participation. Aggregate reporting of data assured to enhance confidentiality and accurate reporting by the respondents. The return of the completed survey also guaranteed the anonymity of participation constructs to an administrator, independent and blinded to the study hypothesis. A code linking respondents to their surveys was kept isolated from the investigators.

3. Results

3.1. Sociodemographic characteristics of the subjects

Out of 1020 individuals approached, 738 agreed to participate in the study (response rate of 72%). The majority of our respondents were 35-39 years, UAE national, married, had college or higher degrees or certification, employed/self-employed, low monthly income, and non-smokers (**Table 1**). Majority of our participants did not have any medical history or family history of CVD. The most common medical history among the participants was hypertension (171, 23%) and diabetes (169, 23%). In addition, the most common source of CVD information reported by participants were obtained from TV/Internet/Magazines (506, 69%) (**Table 1**). The biochemical measurements for the participants within one year were mainly average for triglycerides (TG), cholesterol, high-density lipoprotein cholesterol (HDL), fasting blood sugar (FBS),

Table 1
Descriptive demographic and clinical characteristics of participants (n =738). UAE: United Arab Emirates; CVD: Cardiovascular disease; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; TG: Triglycerides; FBG: Fasting Blood Glucose; HbA1c: Glycated hemoglobin. *More than one answer was selected by the participants.

Variable, n(%)					
Age (Years)	**35-39**	**40-49**			**≥50**
	305 (41.5)	227 (31)			202 (27.5)
Nationality	**UAE**	**Non-UAE**			
	411 (56)	322 (44)			
Marital status	**Single**	**Married**			**Divorced or Widowed**
	114 (15.5)	582 (79)			42 (5.5)
Academic level	**Illiterate/ Primary**	**Middle school/High school**			**University/Postgraduate**
	44 (6)	237 (32)			455 (62)
Occupational status	**Employed/self-employed**	**Not Employed**			**Retired**
	477 (65)	213 (29)			42 (6)
Monthly Income (AED)	**Less than 20,000**	**20,000-40,000**			**More than 40,000**
	463 (64)	219 (30)			44 (6)
Smoking status	**Yes**	**No**			**Ex-smoker**
	106 (14)	596 (81)			33 (5)
Medical history	**Diabetes**	**High cholesterol**			**Hypertension**
	169 (23)	134 (18)			171 (23)
	Ischemic heart disease	**None**			
	31 (4)	405 (55)			
Family history of CVD	**Yes**	**No**			
	285 (39)	448 (61)			
Where did you get knowledge on CVD*	**Physician/Nurse**	**TV/Internet/Magazines**			**Family/ friends**
	443 (60)	506 (69)			288 (39)
Biochemical measurements within one year					
TG			**Cholesterol**		
<150	465 (82)		<200		409 (74)
≥150	99 (18)		≥200		146 (26)
LDL			**HDL**		
<100	248 (44)		>40		445 (80)
≥100	316 (56)		≤40		114 (20)
FBS for diabetic			**HbA1C for diabetic**		
<126	89 (61)		**≤7**		95 (63)
≥126	57 (39)		**>7**		57 (37)
FBS for Non-diabetic			**HbA1C for**		
<106	358 (86)		**Non-diabetic**		417 (95)
≥106	56 (14)		<6.5		23 (5)
			≥6.5		
Blood pressure			**BMI**		
<140/90	607 (84)		Underweight		8 (1)
≥140/90	113 (16)		Healthy Weight		146 (21)
			Overweight		261 (38)
			Obese |		272 (40)

hemoglobin A1c (HbA1c). However, the low-density lipoprotein cholesterol (LDL) level was high in the mainstream (316, 56%) of participants. Most participants were overweight (261, 38%) or Obese (272, 40%).

3.2. Knowledge of CVD risk factors

The majority of participants surveyed had good knowledge of CVD (528, 71.5%). The only question that the mainstream (527, 71%) answered incorrectly was "Use of contraception can increase risk of heart and blood vessel disease" (Table 2).

3.3. Attitude toward CVD risk factors

The attitude of mainstream toward CVD was Good (445, 60%). The main steam were considering doing more exercise (726, 98%), taking less oily food (707, 96%), and avoid drinking carbonated drinks (656, 89%) (Table 3).

3.4. Practice toward CVD risk factors

Most of our participants reported a poor/fair practice considering CVD (553, 75%) (Table 4). The majority mentioned that their daily activity does not involve vigorous activity (421, 57%); they frequently or consistently eat fast food (475, 66%); and they frequently/always take fried food as a main course (482, 65%). The majority were limiting the amount of salt they were using on food (494, 68%); and were going to the doctor for regular health checkups (523, 71%).

3.5. Association biochemical tests with Knowledge, attitude, and practice (KAP) of CVD risk factors

A multiple linear regression model showed that none of biomedical tests were significantly associated with KAP score.

3.6. Association of age, nationality, and academic levels with knowledge of CVD risk factors

Predictive Margins of Knowledge Scores with 95% CIs were significant for age ($p<.01$), academic level ($p<.0001$), and nationality ($p<.0001$) (Table 5). Participants aging ≥50, non-UAE subjects, and university/Postgraduate academic level scored better on the knowledge score. A multiple linear regression model used to identify whether any biochemical tests might predict the knowledge score was non-significant.

Table 2
Knowledge on cardiovascular disease among the participants (n=738).

Variable n(%)	True	False
Heart and blood vessel disease is the leading cause of death in the world	528 (72)	206 (28)
Adequate exercise can prevent Heart and blood vessel disease	674 (92)	63 (8)
Eating fruits or vegetable is able to prevent from Heart and blood vessel disease	627 (85)	109 (15)
Most Heart and blood vessel disease cases are hereditary	476 (65)	259 (35)
Most Heart and blood vessel disease occur in old people	366 (50)	366 (50)
Controlling high fat food can prevent Heart and blood vessel disease	629 (86)	106 (14)
Stop smoking can prevent Heart and blood vessel disease	640 (87)	94 (13)
Doing housework as an exercise is enough for a day	352 (48)	381 (52)
Cardiovascular disease can occur in young people	608 (83)	121 (17)
Obesity can cause Heart and blood vessel disease	646 (90)	74 (10)
Having diabetes increase the risk of Heart and blood vessel disease	568 (77)	169 (23)
Having high blood pressure increase risk of Heart and blood vessel disease	634 (87)	100 (13)
Having high cholesterol in blood can increase risk of Heart and blood vessel disease	648 (88)	87 (12)
Taking a daily aspirin could reduce the chances of heart attack	398 (54)	336 (46)
High stress in life can cause Heart and blood vessel disease	651 (88)	87 (12)
Use of contraception can increase risk of Heart and blood vessel disease	211 (29)	527 (71)
Knowledge score **Poor: 14 (2)**	**Fair: 196 (26.5)**	**Good: 528 (71.5)**

Table 3
Attitudes towards cardiovascular disease among the participants (n=738). * More than one answer was selected by the participants. The main steam were believing on doing more exercise (726, 98%), taking less oily food (707, 96%), and avoid drinking carbonated drinks (656, 89%).

Variable n(%)	Disagree	Uncertain	Agree
I should be doing exercise to maintain a healthy lifestyle	6 (1)	5 (.7)	726 (98.3)
I should take less oily food and salt for healthy lifestyle	22 (3)	8 (1)	707 (96)
I prefer to play with my laptop instead of doing exercise	78 (10)	42 (6)	616 (84)
I choose to eat or buy fast food when going out with friends	133 (18)	74 (10)	525 (72)
I am willing to reduce the amount that I eat to improve my health	34 (5)	47 (6)	654 (89)
I should avoid drinking carbonated drinks	49 (7)	32 (4)	656 (89)
I believe walking can give benefits to my health	9 (1)	3 (.5)	725 (98.5)
I should take fruit & vegetable in my diet to maintaining my health	10 (1.5)	7 (1)	720 (97.5)
I should control my stress to avoid from getting any disease	14 (2)	18 (2.5)	705 (95.5)
Attitude score	**Poor: 49 (7)**	**Fair: 244 (33)**	**Good: 445 (60)**

Table 4
Practice towards cardiovascular disease among the participants (n=738).

Variable n(%)	Never	Seldom	Frequently	Always
Does your daily activity involve vigorous activity?	96 (13)	325 (44)	220 (30)	94 (13)
Do you walk for at least 10 minutes to get to and from places?	45 (6)	167 (23)	241 (33)	284 (38)
Do you spend time to exercise at least 20 minutes per day?	96 (13)	219 (30)	221 (30)	199 (27)
How often do you take fruits & vegetables in your diet?	13 (2)	143 (20)	331 (45)	243 (33)
How often do you eat fast food?	47 (7)	194 (27)	409 (57)	66 (9)
Do you take fried food as your main course?	50 (7)	203 (28)	366 (50)	116 (15)
Do you like to eat in between main meals? snacking	87 (12)	283 (39)	282 (38)	81 (11)
Do you lead a stressful life?	147 (20)	265 (36)	215 (29)	106 (14)
If you are overweight, have you ever tried to lose weight?	113 (16)	123 (17)	248 (34)	242 (33)
Do you limit the amount of salt you use in your food, so you do not develop health problems?	72 (10)	165 (22)	231 (32)	263 (36)
Do you go to the doctor regularly for health checkups?	42 (6)	172 (23)	222 (30)	301 (41)
Practice:		**Poor: 23 (3)**	**Fair: 530 (72)**	**Good: 185 (25)**

3.7. Association of academic levels with attitude toward risk factors of CVD

A multi-linear regression model was fitted to predict the attitude score by age, marital status, nationality, employment, academic level, monthly income, smoking status was statistically significant (p=.02). However, there were no significant predictors of the attitude score by the variables individually. The academic level of the subject was the only statistically significant predictor of the attitude score (p=.02) (Table 5). A multiple regression model using all biomedical test outcomes to predict the attitude score was non-significant, demonstrating that the results of tests or the knowledge of abnormal tests did not affect the attitude score.

3.8. Association of age and BMI with practice toward CVD disease risk factors

A multiple linear regression model used to identify whether any subject demographics or health characteristics might predict the practice score was highly significant for age (p=.0001) and BMI (p=.0001) (Table 5). Those aging ≥50 and obese scored higher on practice toward CVD risk factors.

3.9. Association of knowledge on CVD risk factors with attitude and practice

The predictive margins of the knowledge score by practice and attitude as well as the attitude score by practice Scores with 95% CIs were significant (p=.0001, p<.0001, p<.0001) (Fig. 1).

4. Discussion

The UAE has one of the highest age-standardized death rates for CVD, at 204 and 309 per 100,000 [19, 20]. According to the Global Health Observatory, the UAE has the second-highest cardiovascular mortality rate, after Saudi Arabia, higher than the rate found in Gulf Cooperation Council countries and high-income countries such as Germany, the

Table 5
Factors associated with knowledge, attitude, and practice on cardiovascular disease in UAE (n=738). *$p < 0.05$, only significant results are presented. UAE: United Arab Emirates, BMI: Body Mass Index.

	Knowledge n (%)			P VALUE
	Poor	Fair	Good	
Nationality				.0001
UAE	11 (3)	131 (32)	270 (66)	
non-UAE	4 (1)	65 (20)	258 (79)	
Age group				.01
35-39	7 (2)	95 (31)	203 (67)	
40-49	2 (1)	51 (22)	174 (77)	
≥50	5 (2)	48 (24)	149 (74)	
Academic level				.0001
Illiterate/ primary	2 (5)	14 (32)	28 (64)	
Middle school/high school	8 (3)	81 (34)	148 (62)	
University/postgraduate	4 (1)	101 (22)	350 (77)	
	Attitude n (%)			
	Poor	**Fair**	**Good**	
Academic level				.02
Illiterate/ primary	2 (4)	18 (40)	25 (56)	
Middle school/high school	22 (9)	80 (33)	136 (57)	
University/postgraduate	25 (5)	144 (31)	287 (63)	
	Practice n (%)			
	Poor	**Fair**	**Good**	
Age group				.0001
35-39	11 (4)	241 (79)	53 (17)	
40-49	9 (4)	156 (69)	62 (27)	
≥50	3 (1)	130 (64)	69 (34)	
BMI				.0001
Underweight	0	6 (75)	2 (25)	
Healthy weight	9 (6)	110 (75)	27 (18)	
Overweight	7 (3)	185 (71)	69 (26)	
Obese	4 (1)	187 (69)	81 (30)	

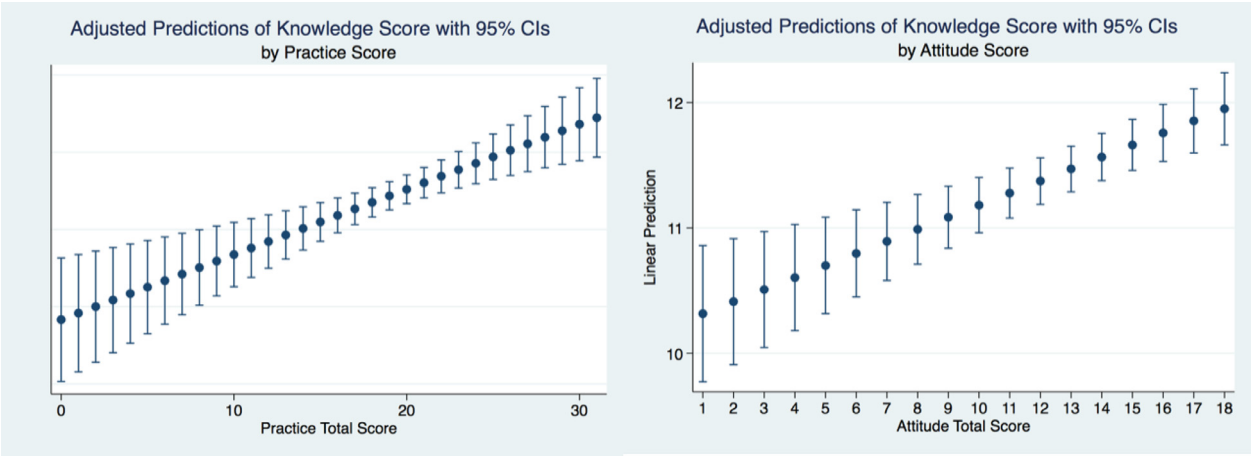

Fig. 1. Predictive Margins of knowledge score by practice and attitude were significant (p=.0001, p<.0001).

USA, and Sweden. [4] The results are also consistent with a Ministry of Health and Prevention report published in 2015, which revealed that CVD is the leading cause of death in the UAE, responsible for 29.89% of all deaths.[19, 21] Various UAE government bodies have invested in several health promotional campaigns to increase community awareness, alter the UAE residents' attitudes toward healthy lifestyles, and facilitate the adoption of healthy practices [21]. Our results, however, reveal that these public health initiatives have not been entirely successful in targeting all sections of the population, especially the youth, UAE nationals, and those with lower educational attainment.

In this large community-based study, we have found that population knowledge regarding CVD was good in more than half (445, 60%) of the participants. Participants aging 40-49, non-UAE subjects, and those with University/Postgraduate academic levels had better knowledge of CVD risk factors. There is evidence to support this observation [25, 26], and this could be explained by the fact that the more literate group, the greater exposure to CVD health-related knowledge. The higher knowledge in middle-aged participants has been also reported in previous studies in the region [25, 26]. Despite the high level of knowledge and attitude, the majority of our participants expressed that they "prefer to play with a laptop instead of doing exercise" (616, 84%); and choose to eat or buy fast food when going out with friends (525, 72%); however (**Table 3**). This trend of sedentary lifestyle is common in Middle East population and is alarming. According to a report, the Middle East has one of the worst physical activity profiles globally [27] and physical inactivity along with unhealthy diet are the most prevalent CVD risk factors in almost all countries in this region [27].

Based on our results, higher educated individuals have significantly higher knowledge and better attitude toward CVD risk factors (**Table 5**), yet, this knowledge was not affecting on practice. The association of higher education with better knowledge score has been reported in other studies in the region [25, 26]. It seems reasonable to expect higher CVD knowledge scores in higher educated individuals, since more education can result in more exposure to information about diseases. Similar to some previous studies, which reported a significant association between age and CVD knowledge [25, 28]; the current study showed that participants aged 40-49 years old were more knowledgeable about CVD risk factors compared to others. This is in line with other studies, which reported significant difference in CVD knowledge among different age groups [25]. This might be due to middle-aged people usually are more keen on getting medical care and having more intention to access physicians and knowing about CVD. Our study did not find a significant difference among females and males regarding CVD KAP, which is consistent with other studies conducted in different populations [25, 28].

We also observed a tendency for people to be overweight (mean BMI of 28.7 kg/ m^2) in our study population. More than half (421, 57%) of our study participants were physically inactive, a finding which is alarming and higher than the 33% reported in Iran [25] and the 43% reported in Saudi Arabia [29]. Interestingly, those participants with higher BMI had significantly better practice score than others (**Table 5**). We found that practice among our participants is significantly different among different age groups. Those aging 50 or more were scoring better in practice. In the UAE, we have accustomed several programs to public to adopt a healthier lifestyle by engaging in healthier behaviors, such as taking up more regular exercise and making healthier food choices. However, it remains unclear if such messages are reaching to the concerned or not. Awareness and knowledge are related to risk perceptions, which are the fundamental prerequisite for adopting a healthy lifestyle and motivating behavioral changes.[22-24]

Our population-based survey documents the current level of knowledge regarding CVD risk factors among the UAE population. The data from this study can form the foundation in developing various health promotion programs utilizing available resources. Timely health promotion and prevention efforts can significantly impact the quality of life than therapeutic interventions alone commenced at a more advanced age. Modifiable risk factors are the keystone in the prevention of CVD. As evident from our data, it is essential to target the youth and not just the old and middle-aged population. If young people have good knowledge of CVD risk factors, they should be expected to embrace primary preventive measures throughout the lifespan. The importance of preventive factors such as diet and physical activity needs to be emphasized more. However, health education efforts need to focus on attitude change because patients with CVD who have positive health attitudes are more likely to exercise and manage their weight than those who do not. [24] These findings have implications for policymakers in their considerations of strategies in the fight against CVD. While participants had a moderate-to-good knowledge of risk factors, this paradoxically occurred in the context of reported unhealthy diets and lifestyles, potentially increasing the populations' risk for CVDs. Hence, it is necessary to establish more effective educational interventions intended to promote positive health behaviors. Public health providers need to explain to the public that knowledge and proper actions regarding the reduction of risk factors are associated with reduced CVD and mortality.

5. Conclusion

Concerning CVD risk factors, participants had an overall good mean knowledge score; around two-thirds of the population could identify smoking, unhealthy diet (low in fruits, vegetables and high in salt and saturated fats), stress, high blood pressure, obesity, and lack of exercise as potential risk factors for CVD. However, although more than half of the current study participants had high knowledge and attitude about CVD, their behaviors is not satisfactory.

5.1. Limitations of the study

This study presents several limitations that need to be mentioned. As it is a cross-sectional study, it does not allow the establishment of cause and effect relationship. All variables analyzed were self-reported by the interviewees. Due to many independent variables included in the statistical analysis, there may have been multiple comparison biases. Comparison of knowledge about CVD among different populations is challenging because the studies are carried out with different designs and measurement tools. There are no standardized, validated questionnaires to compare results from different cultural backgrounds. There is potential for bias within the reporting of the results. For example, since participants were based on a convenience sample, patients interested in the CVD-related issues might be more likely to have agreed to participate. Data were obtained from participants in Dubai, so this cannot be generalized to other regions of the country or the world. Because this was a population-based study investigating a very prevalent yet minimally explored subject in both the UAE and global population, we believe that the results obtained are valid.

Concerning CVD risk factors, participants had an overall good mean knowledge score; around two-thirds of the population could identify smoking, unhealthy diet (low in fruits, vegetables and high in salt and saturated fats), stress, high blood pressure, obesity, and lack of exercise as potential risk factors for CVD. However, although more than half of the current study participants had high knowledge and attitude about CVD, their behaviors is not satisfactory. Hence, it is necessary to establish more effective educational interventions intended to promote positive health behaviors. Public health providers need to explain to the public that knowledge and proper actions regarding the reduction of risk factors are associated with reduced CVD and mortality.

Ethics approval and consent to participate

The study was approved by the Human Research Ethics Committee of the Dubai Health Authority. Written consent for publication of data collected in this study was obtained from all participants. All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

NA

Availability of data and materials

The author will gladly provide any supporting information upon request.

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Availability of data and material

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

Authors' contributions

MNK and MA designed the study and prepared the process evaluation framework; FRC and MA analyzed the data and prepared the first draft of the manuscript. THA, FAA, AA, FMA, FSM, MYB contributed to data collection and coding. MNK, FRC, and MA contributed to data interpretation. All authors critically reviewed the manuscript, contributed to interpretation, and approved the submitted version. The author (s) read and approved the final manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ajpc.2021.100255.

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