

# Knowledge of cardiovascular risk factors among female pre-clinical and clinical year medical students at king Abdulaziz university: a cross-sectional survey

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## ABSTRACT

**Background:** The prevalence of cardiovascular diseases (CVD) has been increasing substantially in developing and developed nations during the last decade. Cardiovascular diseases can be prevented by educating the public and providing training opportunities to medical doctors and other healthcare workers, including medical students. **Objective:** This study aimed to assess pre-clinical (third-year) and clinical (fifth- and sixth-years) medical students' knowledge of CVD risk factors and compare the level of knowledge between students in their pre-clinical and clinical years. **Methods:** A cross-sectional survey of the knowledge of CVD risk factors was distributed among female pre-clinical and clinical medical students at King Abdulaziz University, Jeddah between September 2016 and April 2017. The questionnaire was adopted from a study in Croatia. Targets used were based upon the 2016 European guidelines on CVD prevention. Knowledge scores were computed and used to estimate the knowledge score percent. The chi-square test was applied to test for factors associated with knowledge of risk factors for cardiovascular diseases. **Results:** We recruited 259 female medical students: third-year, 109 (42.1%); fifth-year, 75 (29.0%); and sixth-year, 75 (29.0%). Students in the pre-clinical year were more knowledgeable of target low-density lipoprotein levels in diabetic patients than those in other study groups (p-value = 0.030). A significantly higher proportion of fifth- (36%) and sixth-year (38%) students were knowledgeable about arterial blood pressure values in high-risk persons (p-value = 0.001). Sixth-year medical students were more also aware of the rate of mortality due to CVD in KSA (81%) than other groups (p-value = 0.0001). Moreover, sixth-year medical students were more knowledgeable about medication prescription (64%) than fifth-year (48%) and third-year students (45%) (p-value = 0.015). Approximately 36% of sixth-year medical students compared with 22.2% of those of the third year had sufficient knowledge of the risk factors for cerebrovascular and cardiovascular diseases (p-value=0.045). **Conclusion:** Overall, clinical year students had a better understanding of CVD risk factors than those in the pre-clinical year, although they were insufficiently aware of CVD risk factors. Medical education on CVD prevention should therefore be substantially improved at the Faculty of Medicine of King Abdulaziz University.

**Keywords:** Cardiovascular disease, knowledge, medical students, risk factors.

## Introduction

During the last ten years, the incidence of cardiovascular

diseases (CVD) has been increasing substantially in both developing and developed nations. Cardiovascular diseases were estimated to be the leading cause of disability and mortality globally <sup>[1]</sup>, and approximately 294/100,000 deaths due to ischemic and hypertensive heart disease were reported in the Middle East. The high prevalence of key risk factors such as hypertension, diabetes, smoking, being overweight or obese, and low physical activity was also observed among the Gulf community <sup>[2]</sup>. Most of these risk factors are modifiable, implying that the majority of CVDs are preventable <sup>[3, 4]</sup>. In Saudi Arabia, CVDs comprised 46% of all deaths due to non-

### Access this article online

Website: [www.japer.in](http://www.japer.in)

E-ISSN: 2249-3379

**How to cite this article:** Kholoud A. Ghamri, Ranya A. Ghamri, Ebtisam A. Alofi. Knowledge of cardiovascular risk factors among female pre-clinical and clinical year medical students at king Abdulaziz university: a cross-sectional survey. J Adv Pharm Edu Res 2018;8(S2):173-178.

**Source of Support:** Nil, Conflict of Interest: None declared.

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communicable diseases between 2000 and 2012, with the age-standardized death rates being higher in men <sup>[5]</sup>.

One of the important strategies to prevent CVD involves educating the public and providing training opportunities to medical doctors and other healthcare workers, including medical students. However, primary preventive strategies will be ineffective unless there is an enhancement of the knowledge and awareness of CVD risk factors among medical students. Although the Saudi government has reformed its third-year medical curriculum by integrating basic and clinical sciences <sup>[6]</sup>, to date, no studies have been conducted to determine whether these changes improved students' knowledge during their preclinical training years.

We present a questionnaire survey of pre-clinical (third-year) and clinical (fifth- and sixth-years) medical students to assess their knowledge of CVD risk factors, as well as to compare the level of knowledge between students in their pre-clinical and clinical years.

## Methods

This descriptive cross-sectional survey was conducted between September 2016 and April 2017 on medical students in their pre-clinical (third-year) and clinical years (fourth- and fifth-years) at King Abdulaziz University, Jeddah. The Research Ethics Committee at King Abdulaziz University provided an ethical review and approval for the survey, including voluntary participation, informed consent, and confidentiality provisions. Male medical students were excluded from the survey.

An anonymous self-administrated questionnaire was adopted from a study conducted at Croatia <sup>[7]</sup>. However, the targets were based upon the 2012 European guidelines on CD prevention <sup>[8]</sup>. The questionnaire was distributed to medical students in lecture halls. An initial pool of 259 female students were considered for inclusion. Of these, 109 students were in the third year, whereas 150 were in the fifth and sixth years. At the time of recruitment, all third-year students had completed the cardiovascular module during the 2015 academic year.

## Statistical analysis

The Statistical Package for Social Sciences (IBM, SPSS Inc., Armonk, New York, USA), version 22 was used to analyze the data. Knowledge scores were computed such that correct answers were assigned a score of "1," whereas incorrect or missing answers were assigned a score of "0." The total score was computed and used to estimate the knowledge score percent. Students who scored < 60% were considered to have "insufficient knowledge," while those who scored  $\geq$  60% were considered to have "sufficient knowledge". The chi-square test was applied to test for factors associated with knowledge of risk factors for cerebrovascular and cardiovascular diseases.

## Results

A total of 259 female medical students in the third (n = 109; 42.1%), fifth (n = 75; 29%), and sixth (n = 75; 29%) clinical years participated in the study.

Most of the students reported being afraid of having cancer (47.7%), followed by CVD (20.4%), myocardial infarction (13.6%), and acquired immune deficiency syndrome (13.2%) (Figure 1). More than half of the students were aware of their blood pressure values (57.8%), whereas only 12% were aware of their plasma cholesterol concentration. Approximately 1.2% and 3.5% of the students reported previous and current smoking, respectively.

Table 1 summarizes the students' responses to questions on risk factors for cerebrovascular and cardiovascular diseases. The majority of students (90%) responded correctly that high-density lipoprotein (HDL) cholesterol was a protective, anti-atherogenic cholesterol, which if elevated would not increase cardiovascular risk. Similarly, a large proportion of students (87%) correctly identified low-density lipoprotein (LDL) cholesterol as the bad atherogenic cholesterol, which if elevated increased cardiovascular risk (87%). Of note, third-year medical students had excellent knowledge of the effects of different cholesterol types and the cardiovascular system (Table 1). Moreover, when compared with fifth-year students, a greater proportion of third-year students responded correctly to survey questions that assessed their knowledge of the cardiovascular system (94% vs 81%). A similar proportion of third- and sixth-year medical students demonstrated an understanding of the cardiovascular system (94% vs 93%). However, the differences did not reach significance.

Approximately 32% of respondents recognized that a patient with diabetes should have LDL cholesterol level < 2.5 mmol/L and 36% responded correctly that the recommended level for HDL cholesterol in women was > 1.2 mmol/L. In addition, only 42% of participants knew that the recommended level for total plasma cholesterol in persons without coronary heart disease was < 5 mmol/L. Students in the pre-clinical year lacked adequate knowledge of the lipid profile for subjects without coronary heart disease (Table 1). On the other hand, they were more knowledgeable of target LDL levels in diabetic patients than those in the other study groups (p-value = 0.030; Table 1).

Regarding knowledge of arterial blood pressure (ABP), only 28% of surveyed students knew that the recommended blood pressure value for persons at high risk for CVD was < 140/90 mmHg. Approximately 46% of third-year students confused normal ABS to be < 120/80 mmHg. Therefore, the rate of correct responses to the question that assessed students' knowledge of ABP values in high-risk persons was lowest among pre-clinical year students: 16% for third-year versus 38% and 36% for fifth- and sixth-year medical students, respectively (p-value = 0.001).

Sixth-year medical students were more aware of the rate of mortality due to CVD in Saudi Arabia (81%) than other groups

( $p$ -value = 0.0001; Table 1). Moreover, sixth-year medical students were more knowledgeable about medication prescription (64%) than fifth-year (48%) and third-year students (45%) ( $p$ -value = 0.015; Table 1).

Approximately 36% of sixth-year medical students compared with 22.2% of those of the third year had sufficient knowledge of the risk factors for cerebrovascular and cardiovascular diseases ( $p$ -value=0.045; Table 2). On the other hand, students' awareness of blood pressure, plasma cholesterol, and smoking status were not significantly associated with knowledge of risk factors for cerebrovascular and CVD.

## Discussion

This analysis demonstrated poor-to-moderate knowledge of CVD risk factors among female pre-clinical (third-year) and clinical years (fourth- and fifth-year) at King Abdulaziz University, Jeddah. Furthermore, knowledge of some CVD risk factors was significantly better among clinical year than among pre-clinical year students. This finding is consistent with that of other authors who found that medical students in their last year of clinical training were more knowledgeable of CVD risk factors than those in their second year of medical school [9]. Although there is a paucity of data on medical students' knowledge of CVD factors in Saudi Arabia, some studies demonstrated unhealthy nutritional habits among students in Saudi medical colleges [10–12]. In one of the reports, investigators found that up to 91.3% of medical students regularly consumed fast food, which is strongly correlated with high CVD risk [13], suggesting poor CVD awareness among students.

Although clinical-year students performed better on questions that assessed knowledge of cerebrovascular and cardiovascular risk factors, as expected, a significantly lower proportion of these students was less knowledgeable of target LDL levels in diabetic patients than those in the pre-clinical year. These findings suggest insufficient awareness of CVD risk factors and underscore an imperative need for healthcare educators to improve the promotion of CVD prevention during medical education. It is plausible that the curricula of medical students and programs of Saudi medical colleges do not adequately cover awareness of CVD. Current programs for medical education include mandatory courses in family and community medicine, internal medicine, epidemiology, and public health.

A significantly higher proportion of clinical year students was more knowledgeable about target ABP values in high-risk persons. Clinical year students were also more aware of the rate of mortality due to CVD in Saudi Arabia (81%) than those in the pre-clinical year, and had better knowledge of medication prescription. However, the proportion of clinical year students knowledgeable about medication prescription was disappointing (48% and 64% among and fifth- and sixth-year students). Therefore, if final-year undergraduate medical students do not master the prescription of medication in patients with CVD, it is unsurprising that recent reports have

shown suboptimal control of blood glucose and other CVD risk factors in Saudi Arabia [14–17].

A disturbing fact among surveyed students is that approximately two-fifths knew about their blood pressure values and only 12% were aware of their plasma cholesterol levels. Furthermore 1.2% and 3.5% of students reported being ex-smokers and smokers, respectively. Other studies conducted in the Middle East [18] and Western countries also reported smoking among medical students [7, 19, 20]. In the study conducted among medical students in the Nile Delta [18], approximately 5.6% and 1.2% of the respondents reported current and previous smoking respectively. Reiner *et al.* [7] further determined that smoking rates were higher among undergraduate medical students in their final year of training. In the current study, we did not determine the proportion of final and pre-clinical students that smoked, since this was not the objective of our study.

On a hopeful note, most students in this study correctly responded that HDL cholesterol was anti-atherogenic and cardioprotective and that LDL cholesterol was atherogenic and thus a cardiovascular risk. Similarly, in a survey that aimed to investigate CVD factors among students enrolled at a medical school in Croatia, investigators found that students had relatively adequate knowledge of atherogenic dyslipidemia [7], which typically occurs in persons with low HDL or high triglyceride levels [21, 22]. Dyslipidemia is frequently associated with other metabolic disorders, such as diabetes mellitus or obesity, which are increasingly prevalent among the Saudi population, but are, in many cases, underdiagnosed or poorly controlled [23–25].

This study has limitations that should be discussed. First, it was a single-center study that included only female medical students. Consequently, we cannot make relevant conclusions about CVD knowledge among all medical students at King Abdulaziz University. Second, we compared the level of knowledge between third-year students and those in their final year of training. We believe that a better picture of the success of medical training would be depicted if students' levels of knowledge was assessed at the beginning and final year of their medical school training.

## Conclusion

Overall, clinical year students had a better understanding of CVD risk factors than those in the pre-clinical year, although they were insufficiently aware of CVD risk factors. This suggests that medical education on CVD prevention must be substantially improved by the Faculty of Medicine of King Abdulaziz University. Further, the medical school curriculum should include strategies to increase knowledge of CVD risk factors and strategies to prevent or eradicate them. Of note, healthcare educators and medical curriculum developers should consider increasing students' knowledge of the management of CVD risk factors such as dyslipidemia, especially in persons at high risk.

## List of Abbreviations

ABP	Arterial blood pressure
AIDS	Acquired immune deficiency syndrome
CVD	Cardiovascular diseases
HDL	High-density lipoprotein
LDL	Low-density lipoprotein
MI	Myocardial infarction
TB	Tuberculosis

## Acknowledgements

The authors wish to thank the medical students Abdulrahman Hossameldin Ghoneim, Wafaa Ahmed Alkaf, and Dana Abdulrahman Mohanna, who helped to distribute the questionnaires. The authors also wish to thank Dr. Princila Mukoko for editorial assistance and Professor Željko Reiner for providing the authors with the questionnaire.

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**Table 1: Responses of the students to questions on risk factors for cerebrovascular and cardiovascular diseases**

Knowledge Questions (Correct Responses)	Answers	Academic level							
		Third-year		Fifth-year		Sixth-year		Total	
		No.	%	No.	%	No.	%	No.	%
1. Based on your knowledge, what is the leading cause of death in Saudi Arabia? (Road traffic accidents)	Road traffic accidents	47	45 %	40	55%	60	81%	147	58%
	Cancer or some malignant disease	5	5%	7	10%	5	7%	17	7%
	Stroke and similar CVDs	11	10%	5	7%	2	3%	18	7%
	Myocardial infarction and similar CVDs	41	39%	20	27%	7	9%	68	27%
	Cirrhosis and other liver diseases	1	1%	0	0%	0	0%	1	0.5%
	Tuberculosis and other lung diseases	0	0%	1	1%	0	0%	1	0.5%
2. Which is the 'bad' atherogenic cholesterol which if elevated increases cardiovascular risk: (LDL cholesterol)	HDL cholesterol	6	5%	10	14%	5	7%	21	8%
	LDL cholesterol	101	93%	58	79%	64	88%	223	87%
	Triglycerides	2	2%	2	3%	3	4%	7	3%
	None of these	0	0%	3	4%	1	1%	4	2%
3. Which is "protective" antiatherogenic cholesterol which if elevated does not increase cardiovascular risk? (HDL cholesterol)	HDL cholesterol	103	94%	60	81%	69	93%	232	90%
	LDL cholesterol	6	6%	11	15%	2	3%	19	7%
	Triglycerides	0	0%	2	3%	2	3%	4	2%
	none of these	0	0%	1	1%	1	1%	2	1%
4. Based on your knowledge, what is the recommended level for total plasma cholesterol (expressed in mmol/L) in subjects without coronary heart disease? (< 5)	< 5	38	37%	30	44%	31	48%	99	42%
	< 5.2	43	42%	24	35%	21	32%	88	37%
	< 6.5	20	19%	14	20%	11	17%	45	19%
	<7.8	2	2%	1	1%	2	3%	5	2%
5. Based on your knowledge, what is the recommended level for HDL cholesterol in women (expressed in mmol/L)? (> 1.2)	< 0.9	6	6%	5	7%	1	2%	12	5%
	< 0.9	7	7%	11	16%	7	11%	25	11%
	> 1.0	23	22%	18	26%	26	40%	67	28%
	> 1.0	14	14%	9	13%	6	9%	29	12%
	> 1.2	39	38%	22	32%	24	38%	85	36%
	< 1.2	14	13%	4	6%	0	0%	18	7%
6. Based on your knowledge, a patient with diabetes should have LDL cholesterol level (expressed in mmol/L): (< 2.5)	< 5.0	15	15%	13	19%	12	18%	40	17%
	< 4.0	12	12%	18	26%	13	20%	43	18%
	< 3.0	33	32%	19	28%	25	38%	77	33%
	< 2.5	42	41%	18	26%	15	23%	75	32%
7. Based on your knowledge, what is the recommended blood pressure for subjects with high risk for cardiovascular diseases is (in mmHg): (< 140/90)	< 150/90	22	21%	17	23%	6	9%	45	18%
	< 140/90	17	16%	28	38%	25	36%	70	28%
	< 130/85	18	17%	18	25%	23	33%	59	24%
	< 120/80	48	46%	10	14%	15	22%	73	30%
8. Is it important to increase very low HDL cholesterol in patients at high risk for coronary heart disease? (Yes, it is very important)	Yes, it is very important	65	61%	42	57%	39	54%	146	58%
	It is relatively important	29	27%	24	32%	26	36%	79	31%
	It is not so important	3	3%	5	7%	5	7%	13	5%
	It is not important at all; important are the other lipid parameters	9	9%	3	4%	2	3%	14	6%

	It always causes diabetes	25	23%	2	3%	2	3%	29	12%
	It increases significantly cardiovascular risk	50	47%	40	54%	35	50%	125	50%
9. Which of the following statements about metabolic syndrome is correct? (It increases significantly cardiovascular risk.)	This is a rare metabolic disease	3	3%	6	8%	4	6%	13	5%
	It increases cardiovascular risk only very slightly, but it is important because of the potential impact on other diseases	22	21%	9	12%	14	20%	45	18%
	I do not know what metabolic syndrome is	7	6%	17	23%	15	21%	39	15%
10. Will you always prescribe a lipid-lowering drug to patients with a history of myocardial infarction, proven coronary artery disease, diabetes, stroke, transient ischemic attacks and/or proven carotid plaque? (Yes)	Yes	49	45%	36	48%	45	64%	130	51%
	No	15	14%	8	11%	10	14%	33	13%
	I do not know	44	41%	31	41%	16	23%	91	36%
11. Based on your knowledge, what is the recommended duration of physical activity (at least of moderate intensity) per week? (2.5–5 hours)	2.5–5.0 hours	45	50%	26	35%	35	49%	115	45%
	2- 5.0–7.0 hours	30	28%	6	8%	13	18%	49	19%
	0.5–1.0 hour	15	14%	25	33%	14	19%	54	21%
	1.0–2.5 hours	9	8%	18	24%	10	14%	37	15%
12. Based on your knowledge, what is the recommended servings of fruit &/or vegetable per day? (2-3 servings per day)	1–2 servings per day	30	28%	21	28%	19	26%	70	27%
	2–3 servings per day	51	47%	30	40%	38	53%	119	47%
	3–4 servings per day	20	19%	12	16%	10	14%	42	17%
	≥ 5 servings per day	7	6%	12	16%	5	7%	24	9%

Abbreviations: CVD, cardiovascular disease; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

**Table 2: Factors associated with knowledge of risk factors for cerebrovascular and cardiovascular diseases<sup>1</sup>**

Variables	Level of Knowledge		p-value
	Insufficient (n = 188)	Sufficient (n = 70)	
Academic level			
Third-year (n = 108)	84 (77.8)	24 (22.2)	0.045
Fifth-year (n = 75)	56 (74.7)	19 (25.3)	
Sixth-year (n = 75)	48 (64.0)	27 (36.0)	
Awareness of blood pressure value			
Yes (n = 149)	104 (69.8)	45 (30.2)	0.195
No (n = 109)	84 (77.1)	25 (22.9)	
Awareness of plasma cholesterol concentration			
Yes (n = 31)	19 (61.3)	12 (38.7)	0.122
No (n = 227)	169 (74.4)	58 (25.6)	
Smoking Status			
Smoker (n = 9)	6 (66.7)	3 (33.3)	0.524
Non-smoker (n=246)	179 (72.8)	67 (27.2)	
Ex-smoker (n=3)	3 (100.0)	0 (0.0)	

<sup>1</sup>Data are presented as frequency (percent) unless otherwise specified.