

# Atherosclerotic disease and risk factor modification in Saudi Arabia: a call to action

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**Purpose:** Atherosclerotic disease (AD) is the leading cause of death worldwide and in Saudi Arabia. Intensive risk reduction therapy plays a major role in reducing adverse cardiovascular outcomes in patients with AD. The level of awareness of this important fact amongst physicians (family physicians, general internists, cardiologists and vascular surgeons) in managing these patients in Saudi Arabia is not currently known. This study was conducted to examine the perceptions and knowledge of risk reduction therapy in patients with AD amongst physicians in Saudi Arabia in two clinical presentations; coronary artery disease (CAD) and peripheral artery disease (PAD).

**Materials and methods:** We conducted a cross-sectional self-administered survey of 897 physicians at different hospitals in four provinces in Saudi Arabia.

**Results:** The recommended targets of low density lipoprotein-cholesterol (LDL-C), blood glucose, and blood pressure in patients with CAD and PAD were known as 40% and 36%; 70% and 66%; and 32% and 28% of physicians, respectively. The initiation of antiplatelet medications, angiotensin converting enzyme (ACE) inhibitors, statins, and nicotine replacement therapy for smokers in patients with CAD and PAD were recommended by 98% and 97%; 52% and 34%; 61% and 56%; and 50% and 43% of physicians, respectively. Compared to other specialties, cardiologists had the lowest threshold for initiating risk reduction therapy, whereas vascular surgeons had the highest threshold.

**Conclusion:** The level of physician awareness of atherosclerosis risk reduction therapy across Saudi Arabia has revealed knowledge and action gaps. A call to action to implement effective strategies to encourage health professionals to use risk reduction therapy and increase public awareness is needed.

**Keywords:** coronary artery disease, peripheral arterial disease, risk reduction, atherosclerosis

## Introduction

Atherosclerotic disease (AD) is a systemic disease that affects all arterial beds and can present with multiple clinical manifestations according to the end organ supplied, including the heart in coronary artery disease (CAD), and the lower extremities in peripheral artery disease (PAD). Risk factors for AD include male sex, advanced age, cigarette smoking, hypertension, diabetes, and hyperlipidaemia.<sup>1</sup>

Atherosclerotic disease is the leading cause of death worldwide and in Saudi Arabia.<sup>2,3</sup> In Saudi Arabia, both CAD and PAD are a major public health problem, with an overall prevalence of 5.5%<sup>4</sup> and 11.7% amongst people aged 45 years and older,<sup>5</sup> respectively. PAD is a marker of advanced atherosclerosis and is associated with an elevated risk of cardiovascular mortality and morbidity; with a

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four-fold increased risk of myocardial infarction<sup>6</sup> and a two to three-fold increased risk of stroke.<sup>7</sup> Furthermore, the risk of cardiovascular mortality and morbidity in patients with PAD is comparable to that in patients with CAD.<sup>8</sup>

Reducing the adverse cardiovascular outcomes of atherosclerosis through risk factor identification and modification has been an active area of research over the past few decades. As a result, several large scale randomized clinical trials<sup>9–11</sup> and observational studies<sup>12,13</sup> have shown intensive risk reduction therapy to be very effective and critical in reducing adverse cardiovascular outcomes in patients with AD, with many expert international committees recommending the use of risk reduction practices as summarized in Table 1.<sup>14–17</sup> However, the level of awareness of this information and the implementation of risk factor reduction therapy amongst all physicians is felt to be low, and has been shown to be suboptimal amongst general practitioners, internal medicine specialists, cardiologists, and vascular surgeons in the United States, Canada, and Europe.<sup>18–24</sup>

A small pilot study carried out at a university hospital in Saudi Arabia<sup>25</sup> showed that there is a knowledge and action gap among physicians with respect to risk factor modification in patients with PAD. However, the knowledge and attitudes of physicians across Saudi Arabia towards risk reduction therapy for patients with AD are not known. Therefore, this study was performed to assess the knowledge of the

recommended target levels for blood pressure, blood glucose, and low density lipoprotein-cholesterol (LDL-C), as well as to explore physicians' knowledge and attitudes towards risk reduction therapy in patients with AD. We also examined differences among physicians in the management of these factors in patients with PAD compared to patients with CAD in Saudi Arabia.

## Materials and methods

A self-administered questionnaire was mailed to all family physicians, general internists, cardiologists, and vascular surgeons working at different hospitals in four provinces in Saudi Arabia: central – Riyadh and Qassim; east – Dammam, Khobar, Qatif, Jubail, Hafof, and Hafer Albatin; west – Jeddah, Makkah, and Madinah; and south – Abha, Jizan, and Najran. The hospitals were randomly selected and included public, teaching, and private hospitals between March 1, 2009 and February 28, 2010. The questionnaire was based on a previously published and validated questionnaire.<sup>25</sup> The questionnaire was anonymous and physicians provided consent prior to participation. This study was approved by the King Khalid University Hospital ethics review board, Riyadh, Saudi Arabia.

The survey consisted of multiple choice questions. Participant demographic information was collected, including age, sex, specialty, board certification status, and

**Table 1** Current recommendations of the American Heart Association and American College of Cardiology for risk reduction in patients with coronary artery disease compared to patients with peripheral artery disease<sup>14,16,17</sup>

Recommendation		Class of recommendation		Level of evidence	
		CAD	PAD	CAD	PAD
Medications used					
Antiplatelet	All patients	I	I	A	A
Statin	All patients	I	I	B	B
ACE inhibitors	Symptomatic patients	I	I	A	B
	Asymptomatic patients	2a	2a	B	B
Goals in managing					
Blood pressure	Systolic				
	<140 mmHg in all patients	I	I	A	A
	<130 mmHg in diabetic patients				
	Diastolic				
	<90 mmHg in all patients				
	<80 mmHg in diabetic patients				
LDL-C	LDL < 2.5 mmol/L in all patients	I	I	A	A
Diabetes	HbA <sub>1c</sub> < 7% in diabetic patients	I	I	B	B
Smoking	Complete cessation in all patients	I	I	B	B
BMI	18.5–24.9 kg/m <sup>2</sup> in all patients	I	I	B	B

**Notes:** Class 1: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is beneficial, useful, and effective; Class 2: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment; Class 2a: Weight of evidence/opinion is in favor of usefulness/efficacy. Level of evidence A: data derived from multiple randomized clinical trials or meta-analyses; Level of evidence B: data derived from a single randomized trial or non-randomized studies.

**Abbreviations:** AHA/ACC, American Heart Association and American College of Cardiology; CAD, coronary artery disease; PAD, peripheral artery disease; ACE, Angiotensin converting enzyme; LDL-C, low density lipoprotein-cholesterol; HbA<sub>1c</sub>, glycosylated hemoglobin A<sub>1c</sub>; BMI, body mass index.

years of experience. All questions were asked with regards to patients with PAD and CAD. The questions aimed to: (1) assess participant knowledge of AD risk factors, including target levels of blood pressure, LDL-C, and blood glucose; and (2) assess participant attitudes towards AD risk reduction therapies. Participants were asked about their attitudes towards: patient counseling of cardiovascular risk reduction; comfort with recommending and instituting risk reduction therapy (smoking cessation, antiplatelet medications, statins, angiotensin converting enzyme [ACE] inhibitors, and anti-hypertensive medications); factors that influence adequate risk reduction therapy delivery; proportion of patients with PAD or CAD who have their vascular risk factors evaluated systematically; and self-assessment of PAD or CAD risk reduction knowledge.

All survey results were expressed as percentages. The number of respondents who completed each question was used as the denominator for proportions of responses. The prespecified subgroups for comparison analysis of responses to PAD or CAD scenarios were by specialty type – family physicians, general internists, cardiologists, and vascular surgeons. Chi-square tests were used to compare proportions between different subgroups. All *P*-values reported were two-tailed, and values of *P* = 0.05 were considered significant.

## Results

529 of the 897 surveyed physicians completed the survey, representing a response rate of 59%. Family physicians, general internists, cardiologists, and vascular surgeons represented 20.2%, 41.4%, 28%, and 10.4% of the surveyed physicians, respectively. The results are depicted in Tables 2–5.

## Physicians' characteristics

Two-thirds of participating physicians were board-certified in their specialties and had been practicing for more

than 10 years. Most of the respondents were working in nonacademic institutions (Table 2).

## Physicians' knowledge and attitude

The knowledge of the surveyed participants about the recommended targets of LDL-C, blood pressure, and blood glucose was low for both CAD and PAD, and there was no statistical difference between the knowledge for both entities by specialty (Table 3). Only 38% knew that an ACE inhibitor can be initiated as an anti-atherosclerotic therapy in PAD patients irrespective of blood pressure status, compared to 46% for CAD (*P* < 0.05). Although surveyed cardiologists still showed a knowledge gap in the use of ACE inhibitors for patients with AD, their positive response was statistically higher compared with other specialties (*P* < 0.05). The majority of surveyed physicians indicated that their self-assessment of risk reduction in PAD and CAD (78% and 77%, respectively) was average to above average. One-third of surveyed family physicians indicated that their self-assessment of risk reduction knowledge in CAD and PAD (31% and 30%, respectively) was below average.

Although surveyed physicians' attitudes towards routine risk factor evaluation and associated patient counseling showed a very optimal response, the attitude towards patient assessment for risk factors was suboptimal (Table 4). Apart from routine initiation of antiplatelet therapy (98% for CAD and 96% for PAD), the attitude towards routine initiation and/or modification of other risk reduction therapy was very poor, especially for the initiation of ACE inhibitors (52% for CAD and 34% for PAD). The surveyed cardiologists were observed to be more likely to initiate different risk reduction therapies when compared to other specialists (*P* < 0.05); however, on the whole, it was still suboptimal. On the other hand, vascular surgeons appeared to have the highest threshold for initiating these therapies; it was, however, only statistically significant for low rates of ACE inhibitor initiation (*P* < 0.05).

**Table 2** Characteristics of physicians who completed the survey by specialty (N = 529)

	Family physicians (N = 107)	General internists (N = 219)	Cardiologists (N = 148)	Vascular surgeons (N = 55)	All (N = 529)
Response rate, %	66	53	53	85	59
Mean age, y, ±SD	43.2 ± 5.2	39.7 ± 7.2	38.8 ± 6.5	39.5 ± 4.2	40.8 ± 5.3
Male sex, %	69	74	74	93	75
Board-certified, %	60	56	69	58	61
Academic institute, %	33	22	22	16	24
Years in practice					
<5 years, %	19	12	8	17	13
5–10 years, %	25	28	24	15	25
>10 years, %	56	60	68	68	62

**Abbreviations:** N, number; SD, standard deviation.

**Table 3** Knowledge of surveyed physicians of risk reduction in patients with atherosclerotic arterial diseases expressed in percentage

	Family physicians (N = 107)		General internists (N = 219)		Cardiologists (N = 148)		Vascular surgeons (N = 55)		All (N = 529)	
	CAD	PAD	CAD	PAD	CAD	PAD	CAD	PAD	CAD	PAD
Knowledge of the current recommended target of LDL-C (<2.5 mmol/L)	37	35	42	39	43	45	31	24	40	36
Blood pressure (<140/90 mmHg)	29	28	33	25	36	31	28	28	32	28
Blood glucose (HbA <sub>1c</sub> < 7%)	62	59	72	64	76	73	64	54	70	65
Knowledge of the relationship between BP and ACE inhibitors in patients with atherosclerosis										
Not indicated in normal BP	45	36	27	31	25	19	20	31	29	29
Initiate irrespective to BP status	42	29	51	41	45	47	34	23	46	38
Unclear about recommendations	14	35	22	28	30	34	45	46	25	33
Self-assessment of atherosclerosis risk reduction knowledge										
Average	31	43	28	38	17	25	29	31	25	34
Above average	38	27	50	40	65	56	50	57	52	44
Below average	31	30	22	22	18	19	21	12	23	22

**Abbreviations:** ACE, angiotensin converting enzyme; LDL-C, low density lipoprotein-cholesterol; HbA<sub>1c</sub>, glycated hemoglobin A<sub>1c</sub>; CAD, coronary artery disease; PAD, peripheral arterial disease; BP, blood pressure.

## Barriers to the delivery of risk reduction therapy

The barriers to the delivery of adequate risk reduction therapy are shown in Table 5.

## Discussion

In this study we found that even though the majority of surveyed physicians evaluate and counsel patients with AD (CAD and PAD) for their risk factors, knowledge and action remain suboptimal, with clear gaps in knowledge identified. The majority of surveyed physicians rated their knowledge about risk reduction as average or above average. However, clear deficiencies in knowledge were identified including: (1) the recommended target levels for blood pressure, blood glucose, and LDL-C; and (2) that ACE inhibitor medications can be used in patients with atherosclerosis irrespective of blood pressure status to reduce atherosclerotic complications and cardiovascular death, with less than half of participants aware of this fact. Furthermore, initiation of all components of risk reduction therapy except antiplatelet medication was poor. The action gap was most prominent amongst family physicians and vascular surgeons when compared to other specialties.

Our findings could be explained by the absence of national or locally adapted guidelines in managing patients with AD, self-audit of practice, and focused continuing medical education programs on risk reduction therapy. Furthermore, suboptimal use of ACE inhibitors could be explained by the fact that the supporting evidence for the use of ACE inhibitors in patients with PAD to reduce the risk of adverse cardiovascular events is not Level A evidence, and is also dependent on the presence of symptoms (ie, class 2a recommendation for symptomatic patients with PAD, and Class 2b recommendation for asymptomatic patients).<sup>14</sup>

Knowledge and action gaps in managing risk factors in patients with AD have also been shown amongst physicians in the United Kingdom, the United States, and Canada.<sup>18,22,23,26,27</sup> Cassar et al<sup>22</sup> showed that over a quarter of UK vascular surgeons did not screen for diabetes or measure blood pressure in patients with PAD. For instance, only 34% of vascular surgeons treated patients with claudication if cholesterol levels were greater than 5.5 mmol/L. McDermott et al<sup>18</sup> showed that only 45.5% of internal medicine physicians prescribe antiplatelet medications to patients with PAD compared with 52.5% of vascular surgeons, and only 16.8% of vascular surgeons were aware of the large effect of cholesterol lowering on the risk of future

**Table 4** The attitudes of surveyed physicians towards risk reduction in patients with atherosclerotic arterial diseases expressed in percentage

	Family physicians (N = 107)		General internists (N = 219)		Cardiologists (N = 148)		Vascular surgeons (N = 55)		All (N = 529)	
	CAD	PAD	CAD	PAD	CAD	PAD	CAD	PAD	CAD	PAD
<50%	30	59	31	33	21	27	31	27	28	36
>50%	56	37	65	60	75	67	69	69	66	58
Attitude towards routine evaluation of risk factors										
Lipid profile measurement	97	91	99	95	99	99	93	89	98	95
Blood pressure measurement	100	99	100	100	98	100	98	96	99	99
Blood glucose measurement	97	94	100	97	100	96	98	94	99	96
Asking about smoking	98	97	100	100	100	99	100	100	99	99
Attitude towards routine patient counseling with regards to the importance of										
LDL-C reduction	98	96	99	96	99	97	91	89	98	96
Blood pressure control	98	99	100	100	100	98	93	96	99	99
Blood glucose control	98	97	97	97	99	97	96	96	98	97
Smoking cessation (advising to stop)	93	94	99	98	100	98	100	100	98	97
Attitude towards routine initiating/modifying risk-reduction pharmacotherapy										
Statin	55	42	62	57	68	63	48	57	61	56
ACE inhibitor	39	23	55	37	66	44	24	17	52	34
Anti-hypertensive	53	47	63	61	76	68	43	45	63	58
Anti-platelets	97	96	99	97	100	99	93	93	98	97
Nicotine replacement therapy	36	30	54	44	57	50	38	42	50	43
Referral to smoking cessation program	30	28	47	41	41	39	46	37	42	37

**Abbreviations:** ACE, angiotensin converting enzyme; LDL-C, low density lipoprotein-cholesterol; CAD, coronary artery disease; PAD, peripheral arterial disease.

**Table 5** Barriers to the delivery of risk reduction therapy in patients with atherosclerotic arterial disease as viewed by surveyed physicians expressed in percentage

Barriers	Family physicians (N = 107)		General internists (N = 219)		Cardiologists (N = 148)		Vascular surgeons (N = 55)		All (N = 529)	
	CAD	PAD	CAD	PAD	CAD	PAD	CAD	PAD	CAD	PAD
Lack of knowledge of treating physicians about AD	11	20	9	9	11	10	10	15	10	12
Lack of AD locally adapted management guidelines	19	17	14	14	13	17	12	10	15	15
Absence of continuing education about risk reduction therapy for AD	30	18	23	24	21	25	12	18	22	22
Combination of all above factors	40	44	54	45	55	45	66	55	53	46

**Abbreviations:** AD, atherosclerotic arterial disease; CAD, coronary artery disease; PAD, peripheral arterial disease.



cardiovascular events in patients with PAD compared to 43.6% of the internal medicine physicians. Furthermore, even amongst cardiologists who were surveyed there were knowledge and action gaps in dealing with atherosclerotic risk. Al-Omran et al<sup>23</sup> showed that utilization of risk reduction pharmacotherapy and knowledge of the recommended target levels of blood glucose, blood pressure, and LDL-C levels in patients with PAD amongst Canadian vascular surgeons was suboptimal. Mukherjee et al<sup>26</sup> showed a suboptimal use of lifestyle modifications including: smoking cessation; exercise; weight reduction and diet for lipid control; and evidence-based therapy including antiplatelet medications, ACE-inhibitors, beta-blockers, and statins, in patients undergoing peripheral vascular interventions for PAD at hospital discharge and at 6 months follow-up. The knowledge and action gaps in managing risk factors in patients with AD from previously published studies<sup>18,22–23,27</sup> along with our data, support the fact that there is an international trend of suboptimal use of atherosclerotic risk reduction therapies.

In the evaluation of these results, certain limitations merit emphasis. The validated questionnaire used in this study was based on the 2006 recommendations for secondary prevention.<sup>16</sup> An update of recommendations has been released in 2011;<sup>17</sup> however, there were no major differences in the recommendations that were used in the questionnaire for surveyed physicians. As the data represented self-reported perceptions of knowledge, they may indicate an underestimation of the true knowledge gap that exists. Lastly, the survey form did not differentiate between symptomatic and asymptomatic atherosclerotic disease with regards to the use of ACE inhibitors as a risk reduction therapy.

## Conclusion

In Saudi Arabia there are knowledge and action gaps with regards to AD risk reduction therapy amongst physicians, despite a considerable effort to evaluate and counsel patients for their risk factors. Given the heightened risk of cardiovascular adverse outcomes in patients with AD, and the fact that AD is the leading cause of death in Saudi Arabia,<sup>3</sup> the results of this study have important and immediate implications. This study may be used to support a call to action for AD management and provide guidance for targeted interventions including: locally adapted clinical practice guidelines, self-audit of practice, continuing medical education programs, public awareness campaigns, the inclusion of risk reduction

pharmacotherapy as a plenary topic at scientific meetings, and other educational outreach programs that aim to bring physicians' practice into agreement with current guidelines for AD risk reduction.

## Disclosure

The author reports no conflicts of interest in this work. This paper was presented in part at the 5th Gulf Vascular Surgery Society Conference, Dubai, UAE, February 28–March 1, 2011.

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