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.1

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

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 arterial disease

| Medications used | Class of recommendation | Level of evidence |
|------------------|-------------------------|------------------|
| Antiplatelet     | All patients            | CAD 1, PAD 1     | A, A               |
| Statin           | All patients            | CAD 1, PAD 1     | B, B               |
| ACE inhibitors   | Symptomatic patients    | CAD 1, PAD 1     | B, B               |
|                  | Asymptomatic patients   | CAD 2a, PAD 2a   | B, B               |
| Goals in managing blood pressure | Systolic | CAD 1, PAD 1 | A, A |
|                  | Systolic < 140 mmHg in all patients | CAD 1, PAD 1 | A, A |
|                  | Systolic < 130 mmHg in diabetic patients | CAD 1, PAD 1 | A, A |
|                  | Diastolic < 90 mmHg in all patients | CAD 1, PAD 1 | A, A |
|                  | Diastolic < 80 mmHg in diabetic patients | CAD 1, PAD 1 | A, A |
| LDL-C            | LDL < 2.5 mmol/L in all patients | CAD 1, PAD 1 | A, A |
| Diabetes         | HbA1c < 7% in diabetic patients | CAD 1, PAD 1 | B, B |
| Smoking          | Complete cessation in all patients | CAD 1, PAD 1 | B, B |
| BMI              | 18.5–24.9 kg/m² in all patients | CAD 1, PAD 1 | 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; HbA1c, glycosylated hemoglobin A1c; 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 antihypertensive 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             | 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       | 29              | 28              | 33              | 25              | 36              | 31              | 28              | 28              | 32              | 28              |
| (<140/90 mmHg)       | 62              | 59              | 72              | 64              | 76              | 73              | 64              | 54              | 70              | 65              |
| Blood glucose (HbA₁c < 7%) | 45              | 36              | 27              | 31              | 25              | 19              | 20              | 31              | 29              | 29              |
| Knowledge of the relationship between BP and ACE inhibitors in patients with atherosclerosis | 42              | 29              | 51              | 41              | 40              | 47              | 34              | 23              | 46              | 38              |
| Not indicated in normal BP | 14              | 35              | 22              | 28              | 30              | 34              | 45              | 46              | 25              | 33              |
| Initiate irrespective to BP status | 31              | 43              | 28              | 38              | 17              | 25              | 29              | 31              | 25              | 34              |
| Unclear about recommendations | 38              | 27              | 50              | 40              | 65              | 56              | 50              | 57              | 52              | 44              |
| Self-assessment of atherosclerosis risk reduction knowledge | 31              | 30              | 22              | 22              | 18              | 19              | 21              | 12              | 23              | 22              |

Abbreviations: ACE, angiotensin converting enzyme; LDL-C, low density lipoprotein-cholesterol; HbA₁c, glycosylated hemoglobin A₁c; CAD, coronary artery disease; PAD, peripheral arterial disease; BP, blood pressure.

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

Barriers to the delivery of risk reduction therapy

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

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, education programs on risk reduction therapy were focused on preventing adverse cardiovascular events and also dependent on the presence of symptoms, with AD self-audit of practice and focused continuing medical education programs on risk reduction therapy being the most prominent. Our findings could be explained by the absence of national or locally adapted guidelines in managing patients at risk of adverse cardiovascular events, and is also dependent on the presence of symptoms (the class 2a recommendation for asymptomatic patients). Furthermore, education programs on risk reduction therapy were focused on preventing adverse cardiovascular events, and also dependent on the presence of symptoms, with AD self-audit of practice and focused continuing medical education programs on risk reduction therapy being the most prominent. Our findings could be explained by the absence of national or locally adapted guidelines in managing patients at risk of adverse cardiovascular events, and is also dependent on the presence of symptoms, with AD self-audit of practice and focused continuing medical education programs on risk reduction therapy being the most prominent.
Table 4 The attitudes of surveyed physicians towards risk reduction in patients with atherosclerotic arterial diseases expressed in percentage

| Attitude towards routine evaluation of risk factors | 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                   | 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 patient counseling with regards to the importance of LDL-C reduction | 97 91                       | 99 95                       | 99 99                  | 93 89                     | 98 95         |
| Blood pressure control                            | 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 initiating/modifying risk-reduction pharmacotherapy | 55 42                       | 62 57                       | 68 63                  | 48 57                     | 61 56         |
| Statin                                            | 39 23                       | 55 37                       | 66 44                  | 24 17                     | 52 34         |
| ACE inhibitor                                     | 53 47                       | 63 61                       | 76 68                  | 43 45                     | 63 58         |
| Anti-hypertensive                                 | 97 96                       | 99 97                       | 100 99                 | 93 93                     | 98 97         |
| Anti-platelets                                    | 36 30                       | 54 44                       | 57 50                  | 38 42                     | 50 43         |
| Nicotine replacement therapy                      | 30 28                       | 47 41                       | 41 39                  | 46 37                     | 42 37         |
| Referral to smoking cessation program             | 11 20                       | 9 9                         | 11 10                  | 10 15                     | 10 12         |
| Lack of knowledge of treating physicians about AD | 19 17                       | 14 14                       | 13 17                  | 12 10                     | 15 15         |
| Lack of AD locally adapted management guidelines  | 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: 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                   | 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\textsuperscript{23} 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\textsuperscript{24} showed a suboptimal use of lifestyle modifications including: smoking cessation; exercise; weight reduction and diet for lipid control; and evidence-based therapy including antplatelet 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\textsuperscript{18,22–23,27} 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.\textsuperscript{16} An update of recommendations has been released in 2011;\textsuperscript{17} 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,\textsuperscript{3} 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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