Audit of cardiovascular risk assessment and lipid management by Canadian primary care physicians

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BACKGROUND: Assessment of cardiovascular risk is an essential component of preventive cardiology. Despite guideline recommendations, risk assessment remains highly variable. Further efforts to understand the knowledge and action gaps for risk assessment and lipid management in contemporary primary care are warranted.

METHODS: A retrospective chart audit of 105 physicians participating in an observational registry of healthy middle-age Canadians free of known cardiovascular disease (CVD), diabetes or treated dyslipidemia seen between 2008 and 2009 was conducted.

RESULTS: A total of 1061 patients from across Canada were reviewed. The mean age was 57 years, 61% were male, 75% were Caucasian, 39% were hypertensive and 29% had a smoking history. The Framingham risk score (FRS) was used by 61% of physicians for CVD risk assessment.

A total of 105 Canadian primary care physicians were invited to participate as part of the Primary Care Audit of Global Risk Management (PARADIGM) registry. These physicians were identified to provide balanced national representation from nine of the 10 Canadian provinces excluding Alberta. Ontario was represented by 75% practicing in an urban setting and 20% having an academic affiliation. The audit included 1061 patients (75% Caucasian) from all Canadian provinces excluding Alberta. Ontario was represented by 75% practicing in an urban setting and 20% having an academic affiliation.

Methods A total of 105 Canadian primary care physicians were invited to participate as part of the Primary Care Audit of Global Risk Management (PARADIGM) registry. These physicians were identified to provide balanced national representation from nine of the 10 Canadian provinces excluding Alberta. Ontario was represented by 75% practicing in an urban setting and 20% having an academic affiliation. The audit included 1061 patients (75% Caucasian) from all Canadian provinces excluding Alberta. Ontario was represented by 75% practicing in an urban setting and 20% having an academic affiliation.

Overall, 48% of patients were considered to be low risk, 40% intermediate and 12% high risk by physician assessment. This was a significant overestimation of risk (P<0.001) compared with centrally derived FRS of 64%, 26% and 10%, respectively. Risk was overestimated more often in women (P<0.002). Statin therapy was prescribed to 390 patients (37%); however, 36.5% of patients who were eligible for treatment, according to national guidelines, were not treated, while 19.9% of noneligible patients did receive therapy.

CONCLUSIONS: Despite guideline recommendations, the FRS was underutilized by Canadian primary care physicians. There was considerable discrepancy between centrally derived and physician-derived risk scores. Appropriate statin therapy appeared to be underprescribed by physicians despite an overestimation of risk. Improved dissemination of risk stratification tools and guideline recommendations are needed to optimize CVD risk reduction in primary care.

Key Words: Cardiovascular disease; Lipids; Primary prevention; Risk stratification; Treatment gap

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TABLE 1
General characteristics of the cohort and according to sex

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Overall (n=1061)</th>
<th>Male (n=649)</th>
<th>Female (n=412)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>57±9</td>
<td>54±9</td>
<td>60±9</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Current or past smokers, %</td>
<td>29</td>
<td>33</td>
<td>23</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Family history of premature vascular disease in a first-degree relative, %</td>
<td>20</td>
<td>22</td>
<td>18</td>
<td>0.0009</td>
</tr>
<tr>
<td>Hypertension, %</td>
<td>39</td>
<td>38</td>
<td>41</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blood pressure, mmHg</td>
<td>129/80±15/9</td>
<td>129/81±15/9</td>
<td>129/79±16/9</td>
<td>0.0002</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>28.7±5.6</td>
<td>29.0±4.8</td>
<td>28.0±6.8</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Waist circumference, cm</td>
<td>97±14</td>
<td>100±12</td>
<td>91±16</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Data presented as mean ± SD unless otherwise indicated. BMI, Body mass index.

36% of patients, followed by British Columbia (24%) and Manitoba (16%), with the remaining provinces comprising 24% of the cohort. The general characteristics of the cohort and according to sex are summarized in Table 1. The mean (± SD) age was 57±9 years and 61.2% were male. Hypertension was identified in 39% of patients, and 29% were current or past smokers. One-fifth (20%) of patients reported a family history of premature vascular disease in a first-degree relative. Compared with women, men were younger based on the inclusion criteria (54±9 years versus 60±8 years; P<0.01), had higher BMI (29±5 kg/m² versus 28±7; P<0.01), and greater waist circumference (100±12 cm versus 91±16 cm; P<0.01). No significant differences in blood pressure (129/81±15/9 mmHg versus 129/79±16/9 mmHg) or family history of CVD (22% versus 18%) were noted. Men were more often smokers (33% versus 18%; P<0.01). In both men and women, physician-reported CVD risk varied significantly from the centrally derived FRS risk score. In men, low risk was underestimated (40% versus 48%; P<0.04) and intermediate risk was overestimated (45% versus 39%; P<0.03). Perceived FRS was concordant (15% by both scores) for high-risk males.

More striking differences in risk assessment were apparent in women. Notably, low risk was underestimated (60% versus 93%; P<0.0001), intermediate risk was overestimated (6% versus 33%; P<0.0001) and high risk was also overestimated (1% versus 7%; P<0.002).

Based on the centrally derived scores, more women compared with men had low FRS (93% versus 46%; P<0.0001) and fewer women had intermediate FRS (6% versus 39%; P<0.0001). Consequently, fewer women compared with men had high FRS (1% versus 15%; P<0.0001).

TABLE 2
Main laboratory parameters for the overall cohort and according to sex

<table>
<thead>
<tr>
<th>Baseline parameter</th>
<th>Overall (n=1061)</th>
<th>Male (n=649)</th>
<th>Female (n=412)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol, mmol/L</td>
<td>5.9±1.0</td>
<td>5.8±1.0</td>
<td>6.1±1.0</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>HDL, mmol/L</td>
<td>1.3±0.4</td>
<td>1.2±0.3</td>
<td>1.5±0.4</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>LDL, mmol/L</td>
<td>3.8±0.9</td>
<td>3.7±0.9</td>
<td>3.9±0.9</td>
<td>0.0009</td>
</tr>
<tr>
<td>TG, mmol/L</td>
<td>1.8±1.2</td>
<td>1.9±1.3</td>
<td>1.6±0.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Fasting blood glucose, mmol/L</td>
<td>5.4±0.8</td>
<td>5.5±0.9</td>
<td>5.3±0.6</td>
<td>0.0002</td>
</tr>
<tr>
<td>A1C, %*</td>
<td>5.7±0.7</td>
<td>5.7±0.8</td>
<td>5.7±0.4</td>
<td>1.0</td>
</tr>
<tr>
<td>hsCRP, mg/L¹</td>
<td>3.8±7.7</td>
<td>3.6±7.5</td>
<td>4.8±9.2</td>
<td>0.02</td>
</tr>
<tr>
<td>Creatinine, µmol/L</td>
<td>82±17</td>
<td>88±15</td>
<td>71±14</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

*n=212; ’n=73. A1C, Glycated hemoglobin; HDL, high-density lipoprotein; LDL, low-density lipoprotein; TG, Triglycerides.

Sex differences
There were 649 men (61%) and 412 women in the present study. Significant sex differences were identified in this cohort (Table 1). Compared with women, men were younger based on the inclusion criteria (54±9 years versus 60±8 years; P<0.01), had higher BMI (29±5 kg/m² versus 28±7; P<0.01), and greater waist circumference (100±12 cm versus 91±16 cm; P<0.01). No significant differences in blood pressure (129/81±15/9 mmHg versus 129/79±16/9 mmHg) or family history of CVD (22% versus 18%) were noted. Men were more often smokers (33% versus 18%; P<0.01). In both men and women, physician-reported CVD risk varied significantly from the centrally derived FRS risk score. In men, low risk was underestimated (40% versus 48%; P<0.04) and intermediate risk was overestimated (45% versus 39%; P<0.03). Perceived FRS was concordant (15% by both scores) for high-risk males.

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Based on the centrally derived scores, more women compared with men had low FRS (93% versus 46%; P<0.0001) and fewer women had intermediate FRS (6% versus 39%; P<0.0001). Consequently, fewer women compared with men had high FRS (1% versus 15%; P<0.0001).

Lipid and other laboratory parameters
Table 2 summarizes the main laboratory parameters for the overall cohort and according to sex. The mean total cholesterol level was 5.9±1.0 mmol/L, low-density lipoprotein cholesterol (LDL-C) was 3.8±0.9 mmol/L and the high-density lipoprotein cholesterol (HDL-C) was 1.3 mmol/L. The mean fasting glucose level was 5.4±0.8 mmol/L and hemoglobin A1c was 5.7±0.7%. The mean serum creatinine level was 82±17 µmol/L. hs-CRP was documented in 7% of cases, with a mean value of 3.8 mg/L.

Pharmacological treatment
Based on the risk assessment performed at the time of the physician visit, statin therapy was prescribed in 390 (36.8%) of the overall population. Specifically, statin prescription was observed in 9%, 55% and 90% of low-, intermediate- and high-risk individuals, respectively, based on physician-derived risk estimation (Figure 2). Based on centrally derived FRS, 411 patients should have been prescribed a statin according to national lipid guidelines.
The mean LDL-C for patients prescribed statin was 4.4±1.0, 4.2±0.8, 4.3±1.0 mmol/L in the low-, intermediate- and high-risk categories respectively, as determined by physicians. The most commonly prescribed statin was rosuvastatin (63%, mean dose 10.1 mg), followed by atorvastatin in 29% (mean dose 16.4 mg) and simvastatin in 7% (mean dose 24.5 mg). Non-statin therapies including niacin, fenofibrate, ezetimibe, gemfibrozil and cholestyramine were used in very few patients (2.7% collectively). Combination therapy was also rarely used in this primary prevention population (2.4%).

Subsequently assessed was whether statin prescription was appropriate based on risk level and baseline LDL-cholesterol level. There were 642 patients in whom the physician reported calculating the FRS (as opposed to other methods of CVD risk assessment), of which 232 should have been treated based on the 2006 CCS lipid guidelines. Central assessment of risk identified a total of 19 individuals at low risk, with an LDL-C >5.0 mmol/L, who according to guidelines, would be deemed eligible for statin therapy. Compared with this value, the actual number of patients treated with statin was nine. Similarly, the number of patients with a centrally calculated FRS in the intermediate risk category with an LDL >3.5 mmol/L and, hence, eligible for statin therapy was 147, compared with 101 who were actually treated. In high-risk patients, 66 were eligible for treatment based on central assessment; however, the actual number treated was 57. These results suggest consistent undertreatment (72%) in all risk categories. At the same time, the analysis revealed that of the 410 patients who should not have been recommended statin therapy, 18 (5.1%) in the low-risk group, 11 (18.3%) in the intermediate-risk group and none in the high-risk group were treated (Figure 3A).

In the 419 patients in whom FRS was not calculated locally, there were 215 who should have been treated, 10 in the low risk, 147 in the intermediate risk and 58 in the high-risk group. Treatment occurred in four patients in the low-risk group, 97 in the intermediate-risk and 54 in the high-risk. Again, this indicates undertreatment (72.1%) in individuals in whom FRS was not calculated. At the same time, the analysis revealed that of the 204 patients who should not have been on statin therapy in this subset, 13 (7.6%) in the low-risk group, 26 (36.1%) in the intermediate-risk group and none in the high-risk group were treated (Figure 3B).

In men, statins were prescribed to 9%, 54% and 89% of low-, intermediate- and high-risk patients, respectively. Similar percentages were observed in women: 8%, 57% and 93%, respectively.

**DISCUSSION**

The primary objective of the PARADIGM retrospective audit was to determine how primary care physicians in Canada perform CVD risk assessment, and to evaluate the concordance between their assessment of risk and a centrally calculated FRS. A secondary objective was to evaluate whether lipid-lowering therapy was prescribed appropriately based on physician-reported risk level.

Several important observations merit discussion. Only 64% of primary care physicians reported using the FRS for global risk assessment. This finding is consistent with an earlier survey of 846 primary care physicians, in which 69% reported using FRS to assess risk (5).

Although the limitations of the FRS are well characterized (6), the FRS remains the most widely recommended and validated risk calculator in North America. Despite Canadian guidelines recommending the use of the FRS, it is unclear why more than one-third of primary care physicians in PARADIGM chose to use other forms of risk assessment (7,8).

Considerable discrepancy was noted between physician-reported risk and centrally calculated FRS. It is not clear why this difference exists unless physicians are imputing data that are different from what was abstracted from the chart. The implications of this are substantial in that only 72% of patients who should have been prescribed statin therapy were initiated while 7.1% of patients who likely should not have been treated were also initiated. It is notable that under prescribing occurred just as often in patients in whom the FRS was not used to risk stratify.

This also raises a broader issue of why national guidelines are not fully adopted. Recently, following an abstraction review of 53 American College of Cardiology/American Heart Association practice guidelines on 22 topics between 1984 and 2008, Tricoci et al (9) determined that there has been a 48% increase in the number of recommendations, with the largest increase occurring among class...
Inappropriate or inadequate risk stratification can result in inappropriate or inadequate treatment. Although our study involved seasoned physicians, we demonstrated that 36.5% of patients who met treatment guidelines were not treated due to misclassification. In contrast, 19.9% of misclassified patients who likely should have been treated were treated. Consequently, it is important to develop better risk stratification tools that will be more widely and successfully adopted by primary care physicians.

It is of interest that physicians overestimated risk but undertreated based on the risk assessment. The decision to initiate statin therapy is dependent on more than a mere risk score (14). Patient preferences, potential side effects, comorbidities, concomitant drugs, family history and nonincorporated risk factors all play a role (19). One of the limitations of our study was the inability to determine how much these factors played into physician decision making. Another limitation was the short duration of analysis. Some patients may not have initially been recommended statin therapy to allow an adequate attempt at dietary modification and lifestyle changes. Others may have started treatment but stopped shortly after (20). Our study also had some selection bias in that the participating physicians likely had more of an interest in lipid management and, thus, may not be fully representative of the broader primary care physician population.

Since the completion of the present retrospective audit, the national lipid guidelines have undergone two further guidances (21,22). In addition, in 2013, the AHA/ACC challenged the notion of treatment targets and introduced a new risk calculator to the public domain. The impact of conflicting guidelines and conflicting guidance will potentially make it even more difficult for primary care physicians to appropriately risk stratify their patients.

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