Validation of 7 Type 2 Diabetes Mellitus Risk Scores in a Population-Based Cohort: CoLaus Study

One of the challenges for public health in the coming years is the expected increase of type 2 diabetes mellitus (T2DM) prevalence and its resulting health burden and costs. For the physician, although recommendations regarding who to screen for T2DM are available, the application of a validated risk score would enable a better targeting of high-risk subjects and thus an improvement of preventive measures. Indeed, numerous risk scores for T2DM have been developed, but few studies have compared them in populations different from those they have been derived from. It is also unclear whether all risk scores have the same prognostic validity.

The aim of this study was to assess the validity of various T2DM risk scores in predicting the incidence of T2DM in a Swiss population-based cohort.

Methods. Seven T2DM risk scores were selected in the present study. Four were based on clinical data: the 10-year risk score from Kahn et al; the 9-year risk score from Balkau et al; the prevalent undiagnosed diabetes risk score from Griffin et al; the Finnish Type 2 Diabetes Risk Score (FINDRISC), which has been developed in 2 cohorts followed for 5 and 10 years; and finally the risk score from the Swiss Diabetes Association, available online, which is actually adapted from FINDRISC. The 2 remaining risk scores were based on the association of clinical and biological data: the 10-year risk score from Kahn et al (Kahn clinical + biologic) and the 8-year risk score from Wilson et al. We used the thresholds provided by the authors, and each score had its area under the receiver operating characteristic curve (AROC), sensitivity, specificity, and negative and positive predictive values assessed. We tested these scores in 3060 nondiabetic participants from Lausanne, Switzerland (44.6% men; mean [SD] age, 52.6 [10.6] years), followed up for 5 years (study period, 2003–2011). Incident diabetes was defined as fasting plasma glucose level greater than or equal to 126.13 mg/dL (to convert to millimoles per liter, multiply by 0.0555) and/or presence of oral hypoglycemic or insulin treatment.

Results. A total of 169 patients (5.5%) developed T2DM during follow-up. Compared with participants who did not develop T2DM, they were more frequently male (69.8% vs 43.1%); were older (mean [SD] age, 57.1 [9.4] vs 52.3 [10.6] years); had a higher frequency of family history of T2DM (31.4% vs 19.3%) (all P < .001); and had a higher resting heart rate (69 [10] vs 67 [9] beats/min [P < .05]). They practiced less leisure-time physical activity (45.6% vs 60.3%); had higher body mass index (29.0 [3.9] vs 23.1 [4.0] [calculated as weight in kilograms divided by height in meters squared]); waist circumference (100.3 [10.9] vs 86.8 [12.2] cm), and fasting plasma glucose (110.45 [9.37] vs 95.32 [9.37] mg/dL), triglyceride (189.38 [184.07] vs 111.50 [79.65] mg/dL [to convert to millimoles per liter, multiply by 0.0113]), and uric acid (6.03 [1.32] vs 5.11 [1.35] mg/dL [to convert to micromoles per liter, multiply by 0.0594]) levels; and had lower high-density lipoprotein cholesterol levels (53.28 [13.51] vs 64.09 [16.60] mg/dL [to convert to millimoles per liter, multiply by 0.0259]) (all P < .001). The performance of the 7 T2DM risk scores is given in the Table. Most risk scores had a high AROC, specificity, and negative predictive value, while their sensitivity and positive predictive values were low.

Comment. Most variables included in the risk scores were significantly different between participants who developed T2DM and those who did not, which confirms their prognostic role. The best results were obtained by the Kahn clinical + biologic risk score. However, a risk score based on simple clinical data (FINDRISC) also had a high AROC, which could be more convenient regarding health costs and acceptability by patients. Indeed, using data from our hospital, applying the Kahn clinical + biologic risk score would lead to an extra cost of US$ 12.02 per screened patient relative to the FINDRISC score.

Our study has several limitations. Follow-up time was limited to 5 years; still, our findings are in agreement with the performances reported in the original studies, suggesting that our results should also be reliable after a 10-year follow-up. Some factors such as fruit consumption and second-degree familial history could not be assessed in this study owing to lack of information; although we corrected for such missing data, it is possible that the performance of the corresponding risk scores might have been reduced. Still, one of these risk scores (FINDRISC) ranked second best in our study, suggest-
Table. Performances of the Tested Scores

<table>
<thead>
<tr>
<th>Risk Score</th>
<th>AROC (95% CI)</th>
<th>Sensitivity, % (95% CI)</th>
<th>Specificity, % (95% CI)</th>
<th>PPV (95% CI)</th>
<th>NPV (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balkau et al, C</td>
<td>76.3 (73.1-79.5)</td>
<td>10.1 (6.0-15.6)</td>
<td>97.4 (96.8-98.0)</td>
<td>18.5 (11.1-27.9)</td>
<td>94.9 (94.0-95.6)</td>
</tr>
<tr>
<td>Kahn et al, C</td>
<td>79.2 (76.0-82.3)</td>
<td>32.5 (25.5-40.2)</td>
<td>93.2 (92.2-94.1)</td>
<td>21.6 (16.9-27.4)</td>
<td>95.9 (95.1-96.6)</td>
</tr>
<tr>
<td>Griffin et al, C</td>
<td>79.9 (76.8-82.9)</td>
<td>50.9 (43.1-58.6)</td>
<td>86.3 (85.0-87.5)</td>
<td>17.8 (14.5-21.6)</td>
<td>96.8 (96.0-97.4)</td>
</tr>
<tr>
<td>Wilson et al, CB</td>
<td>83.0 (79.2-86.1)</td>
<td>9.5 (5.1-14.2)</td>
<td>99.1 (98.8-99.5)</td>
<td>237.1 (21.6-52.0)</td>
<td>94.3 (91.4-95.7)</td>
</tr>
<tr>
<td>Swiss Diabetes Association, C</td>
<td>84.7 (82.0-87.2)</td>
<td>49.7 (41.9-57.3)</td>
<td>90.0 (88.9-91.1)</td>
<td>22.5 (18.4-27.7)</td>
<td>96.8 (96.1-97.5)</td>
</tr>
<tr>
<td>FINDRISC, C</td>
<td>85.1 (82.7-87.6)</td>
<td>65.7 (58.0-72.8)</td>
<td>85.2 (83.8-86.5)</td>
<td>20.6 (17.3-24.3)</td>
<td>97.7 (97.0-98.2)</td>
</tr>
<tr>
<td>Kahn et al, CB</td>
<td>89.9 (87.9-91.9)</td>
<td>49.1 (41.5-56.9)</td>
<td>93.7 (92.8-94.6)</td>
<td>31.4 (25.9-37.4)</td>
<td>96.9 (92.6-97.5)</td>
</tr>
</tbody>
</table>

Abbreviations: AROC, area under the receiver operating characteristic curve; C, clinical; CB, clinical + biologic; FINDRISC, Finnish Type 2 Diabetes Risk Score; NPV, negative predictive value; PPV, positive predictive value.

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Frequent Fracture of TrapEase Inferior Vena Cava Filters: A Long-term Follow-up Assessment

Pulmonary thromboembolism (PTE) is one of the most significant complications of deep vein thrombosis (DVT) of the lower extremities. To prevent PTE, an inferior vena cava filter (IVCF) is often used.¹ The TrapEase IVCF (Cordis Endovascular, Johnson & Johnson) is one of the most popular permanent IVCFs...