Caries Risk Assessment in South Australian School Dental Services

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Background

- Categorization of children’s risk of caries is an initial step in determining appropriate preventive treatment ¹
- Caries risk assessment (CRA) schemes designed for use in daily practice rely on clinician subjective assessment ²
- South Australian School Dental Service has been practicing CRA for 15 years
- However, accuracy of clinicians’ CRA has not been reported

¹ Spencer, Community Dent Oral Epidemiol, 1997
² Disney et al, Community Dent Oral Epidemiol, 1992
Aims

1. To quantify clinicians’ accuracy in predicting caries development among children

2. To determine factors associated with accuracy of caries risk assessment

Method

- Two data sources:
  1. Questionnaire mailed to School Dental Service’s clinicians (clinician data)
Statistical analysis

Step 1: Clinician’s risk assessment at baseline examination was judged against child’s subsequent caries rate to determine accuracy (Se, Sp and Se+Sp)

- Other child factors were computed by summarizing data for all children seen by each clinician:
  - mean dmfs and DMFS,
  - mean age,
  - % of children born outside Australia,
  - % of Indigenous children

Step 2: Clinician factors were obtained from the questionnaire

Step 3: Calculated Sensitivity (Se), Specificity (Sp), and combined accuracy (Se+Sp) were used as dependent variables to evaluate associations with:

- clinician factors
- child factors

Clinician factors

- Characteristics
  - Age, sex, years of experience, qualification

- Routine practice of CRA
  - ask children brush teeth before examination,
  - use transillumination for examination,
  - assess tooth crowding,
  - evaluation of child's stress and circumstances,
  - number of bitewing radiographs taken
Child data

- Clinical caries data of 5-15-year-old children from 2002-2005 were extracted from SA Dental Service computerised clinical records (TITANIUM) system.
- Children who had at least 2 recorded examinations with 6+month interval were selected.

Definition of gold standard

- New caries rate between examinations (dmfs and DMFS)
  - Caries rate = number of surfaces with new carious events per 100 surfaces at risk per year.
- Caries rate was used as gold standard to evaluate accuracy.
  - Children with caries rate of <1.2 were classified as having a “low-medium” rate.
  - Children with caries rate of ≥1.2 were classified as having a “high” rate.
Results

- 61,882 children were examined by 112 clinicians during 2002-2005
- 21% were assigned as high risk at the baseline
- 20.4% had a high rate of developing caries (rate ≥ 1.2 new carious events per 100 surfaces at risk per year)

Overall accuracy

<table>
<thead>
<tr>
<th>Predicted caries risk at 1st examination</th>
<th>Caries rate between 1st and 2nd examination</th>
<th>Gold Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High rate (≥1.2)</td>
<td>Low/Medium rate (&lt;1.2)</td>
</tr>
<tr>
<td>High risk</td>
<td>6,223</td>
<td>7,077</td>
</tr>
<tr>
<td>Low/Medium risk</td>
<td>6,747</td>
<td>41,413</td>
</tr>
<tr>
<td>Total</td>
<td>12,970</td>
<td>48,490</td>
</tr>
</tbody>
</table>

\[
\text{Se} = \frac{6,223}{12,970} \times 100 = 48\% \\
\text{Sp} = \frac{41,413}{48,490} \times 100 = 85\%
\]

\[\text{Se + Sp} = 48 + 85 = 133\%\]
Distribution of overall accuracy (Se+Sp)

Number of values: 112
Minimum: 97
25% Percentile: 128
Median: 133
75% Percentile: 139
Maximum: 160
Mean: 133
Sum: 14872

Theoretical range: 0 to 200

Multivariate linear regression models

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Model 1: Sensitivity</th>
<th>Model 2: Specificity</th>
<th>Model 3: Se + Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Un-std β</td>
<td>Un-std β</td>
<td>Un-std β</td>
</tr>
<tr>
<td>Evaluation of child’s stress and circumstances (high vs low)</td>
<td>6.09</td>
<td>-1.28</td>
<td>4.81</td>
</tr>
<tr>
<td>Average number of bitewing taken per 10 children (high vs low)</td>
<td>5.61</td>
<td>-1.08</td>
<td>4.69</td>
</tr>
<tr>
<td>Children age (mean in years)</td>
<td>-3.93</td>
<td>2.34</td>
<td>-1.59</td>
</tr>
<tr>
<td>% children born overseas (%)</td>
<td>0.76</td>
<td>-0.25</td>
<td>0.50</td>
</tr>
<tr>
<td>Children DMFS + dmfs (mean)</td>
<td>7.47</td>
<td>-4.70</td>
<td>2.77</td>
</tr>
<tr>
<td>Intercept</td>
<td>53.3</td>
<td>84.1</td>
<td>137.3</td>
</tr>
</tbody>
</table>

Red numbers indicate significance with p value <0.05
Other factors in the models: Clinician’s sex, using transillumination in detecting caries, % indigenous children and assess tooth crowding
Discussion

- Overall accuracy of CRA among SA SDS dental therapists was comparable to that reported for dentists in routine practice.
- Clinician- and child-related factors had independent effects on CRA accuracy.
- Child’s age and baseline caries experience were the largest contributing factors to the overall accuracy of CRA.

Acknowledgements

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