Does the ‘inverse screening law’ apply to oral cancer screening and regular dental check-ups?

Gopalkrishnan Netuveli, Aubrey Sheiham and Richard G Watt

INTRODUCTION

Early detection through regular screening is a recommended preventive strategy for some cancers. Several authors consider that the early detection of oral cancers is very amenable to this strategy.1–3 However, evidence from randomized controlled trials on the effectiveness of screening for oral cancer is limited.4 Very recently, Sankaranarayanan et al. published the findings of a cluster-randomized controlled trial conducted in Kerala, India, an area with a very high prevalence of oral cancer.5 A non-significant reduction in oral cancer mortality was found over a nine-year period among the screened group. Only for high-risk individuals did a significant reduction in oral cancer mortality emerge. A recent prospective study in Britain assessed the feasibility of opportunistic oral cancer screening in general dental practice and concluded that this was a realistic alternative to population screening.6 A previous expert review of oral cancer screening in the UK also recommended opportunistic screening.7

Due to the paucity of evidence on screening for oral cancer, the US Preventive Services Task Force (USPSTF) was not able to make a clear decision for or against recommending screening US adults routinely for oral cancer.8 Other organizations, like the American Cancer Society, recommend an annual cancer check-up, including oral examination for people over 40 years of age.9 The US National Institute of Dental Research encouraged dentists to include screening for oral cancer during routine dental check-ups.10

In the absence of good evidence to support population screening for oral cancer, opportunistic screening as part of the routine dental check-up should be investigated, particularly in countries like the UK, where oral cancer rates are relatively low.11 There are other questions than whether dentists are able to screen their patients and identify oral lesions that need to be addressed. The procedure may be very costly, and, more importantly, those at higher risk of oral cancer may not attend regularly enough for routine dental checks, and therefore may not be screened by dentists. The objective of this paper was to assess whether people at high risk of oral cancer do visit dentists on a regular basis, and thus afford the opportunity for screening for oral cancer.

METHODS

Secondary analysis of two large national data-sets was undertaken to answer the study objective. Firstly we used data from the Health Survey for England, 2001, an annual national representative survey, which included questions on dental attendance. A working data-set containing information on the main risk factors for oral cancer, namely age, sex, cigarette smoking, consumption of alcohol, and eating fruit and vegetables, was created.12 Our outcome of interest was self-reported dental attendance behaviour. We also extracted data on education and social class, which are potential confounders. Dental attendance behaviour was...
re-coded as 1 if reported as regular, and 0 if dentists were visited occasionally, only with trouble or never. We also did dichotomization with different cut-off points for the purpose of sensitivity analyses. Based on recognized risk factors for oral cancer, the non-dental variables were dichotomized as either positive (a score of 1) or negative (a score of 0). The thresholds for giving a score of 1 were age >40 years, male sex, alcohol intake >28 units per week, cigarettes >20 per day, and fruit and vegetables < five times a day. A summary risk score was computed from the risks associated with individual variables. The analyses were limited to data on participants with complete information on all variables and in those who had some natural teeth present (n = 13,784).

In addition to the Health Survey for England data, we also used data from the British Household Panel Survey (1991–2001) to test whether the dental attendance behaviour is sustained over a period of time. Data for 5547 participants who had complete data on age, sex, smoking, and dental check-ups on all 11 waves of the survey were analysed to investigate the probability of visiting a dentist in 1, 3, 5 and 10 years conditioned on baseline characteristics (age >40 years, being male and a smoker) and adjusted for covariates education and social class. The data were analysed in STATA Version 7 using logistic regression.

### RESULTS

In the Health Survey for England sample, there were 15,647 adults (16 years or more), of whom 13,784 had some natural teeth and complete information (183 [1.3%], had missing information). About 63% of the dentate population reported visiting dentists regularly (Table 1). The proportions of regular attendees among those aged 40+ years was 67.8% compared with 55.6% in the younger group. However, the proportions for men (56.0%), those consuming 28 units or more of alcohol (52.3%), those smoking 20 cigarettes or more (42.9%) and those eating less than five servings of fruit and vegetables (59.8%), were less than for some categories with lower risk of oral cancer (Table 1).

The probability of visiting dentists regularly was also smaller for the ‘higher risk’ groups with the exception of age (odds ratios: age 1.88, male 0.60, consuming 28+ units of alcohol 0.80, smoking 20+ cigarettes 0.49, and eating less than 5 servings of fruit and vegetables 0.76). When the odds for self-reports of regular dental check-ups were computed for groups with 0, 1, 2, 3, 4, and 5 of the high risk factors, the odds ratios decreased as the number of factors increased (Table 2). This ‘dose-response’ trend was significant (P<0.0001).

Our sensitivity analyses using different cut-off points showed that changing the cut-off point for dichotomization did not alter our findings significantly, except for alcohol consumption in Model 3 (Table 3). The odds ratios for different models were not significantly different and the area under the receiver operating characteristic curve did not change more than three percentage points.

In the longitudinal sample from the British Household Panel Survey, of the 5547 participants, 2818 (50.8%) were above 40 years of age, 2492 (44.9%) were men and 1622 (29.2%) were smokers in 1991. The conditional probabilities for visiting a dentist in a 1-, 3-, 5- and 10-year period given the participant is a male, above 40 years of age in 1991, or a smoker in 1991 were less than 0.5 in all instances, suggesting that the dental health check-up behaviour was stable over time (Table 4). The opportunity of screening for oral cancer did not improve by increasing the lengths of the period for dental check-ups.

### DISCUSSION

If people with a greater risk of oral cancer visited dentists more frequently, the feasibility of effective opportunistic screening by dentists would be enhanced. This study of two national representative samples of adults, shows that the probability of visiting a dentist regularly was low in those at greatest risk of oral cancer. The greater the risk of oral cancer, the lower the probability of regular dental check-ups. This was most striking in the case of smoking.

In addition, we found that these findings are stable over time so that if there was a low probability of visiting the

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**Table 1** Association between regular dental check-ups and factors favouring oral carcinogenesis in Health Survey for England, 2001

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>n</th>
<th>Percentage</th>
<th>Odds ratio</th>
<th>Adjusted odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>&lt;40 years</td>
<td>5800</td>
<td>56</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>40+ years</td>
<td>7984</td>
<td>68</td>
<td>1.68 [1.57-1.81]</td>
<td>1.88 [1.74-2.04]</td>
</tr>
<tr>
<td>Sex</td>
<td>Female</td>
<td>6222</td>
<td>68</td>
<td>0.68 [0.55-0.77]</td>
<td>0.63 [0.51-0.78]</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>7562</td>
<td>56</td>
<td>0.59 [0.55-0.64]</td>
<td>0.60 [0.55-0.64]</td>
</tr>
<tr>
<td>Alcohol</td>
<td>&lt;28 units/wk</td>
<td>12,035</td>
<td>64</td>
<td>1.61 [0.55-0.67]</td>
<td>0.80 [0.57-0.89]</td>
</tr>
<tr>
<td></td>
<td>28+ units/wk</td>
<td>1749</td>
<td>52</td>
<td>0.61 [0.55-0.67]</td>
<td>0.80 [0.72-0.89]</td>
</tr>
<tr>
<td>Cigarettes</td>
<td>&lt;20/day</td>
<td>12,708</td>
<td>64</td>
<td>1.00 [0.82-1.21]</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>20+/day</td>
<td>1076</td>
<td>43</td>
<td>0.61 [0.37-0.67]</td>
<td>0.49 [0.43-0.56]</td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>5+ portions/day</td>
<td>3086</td>
<td>70</td>
<td>0.63 [0.58-0.68]</td>
<td>0.76 [0.70-0.83]</td>
</tr>
<tr>
<td></td>
<td>&lt;5 portions/day</td>
<td>9988</td>
<td>60</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>13,784</td>
<td>63</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Adjusted for education and social class*
dentist regularly on an annual basis, there is little chance
that there will be future visits. So...cancer screening in dental practices 49
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three years. 14 Mucci and Brooks also found that older
a dental check-up other than for a problem in the previous
screening during dental visits. Our results are in agreement
screening law' casts doubt on the utility of opportunistic
was adopted are at low risk of oral cancer. This 'inverse
opportunistic screening for oral cancer in general dental
behaviour. Heavy smokers and drinkers are the least
likely to be low. In conclusion, this study has shown
that opportunistic screening for oral cancer in general dental
practice in the UK is unlikely to be an effective preventive
strategy.

### Table 3 Sensitivity analyses: association* between regular dental check-ups and factors favouring oral carcinogenesis

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.89 (1.74–2.04)</td>
<td>1.73 (1.59–1.89)</td>
<td>1.52 (1.29–1.80)</td>
</tr>
<tr>
<td>Sex</td>
<td>0.60 (0.55–0.64)</td>
<td>0.58 (0.54–0.63)</td>
<td>0.50 (0.43–0.59)</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.80 (0.72–0.89)</td>
<td>0.78 (0.70–0.88)</td>
<td>0.95 (0.77–1.18)</td>
</tr>
<tr>
<td>Cigarettes</td>
<td>0.49 (0.43–0.56)</td>
<td>0.49 (0.43–0.56)</td>
<td>0.69 (0.54–0.87)</td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>0.77 (0.70–0.83)</td>
<td>0.72 (0.65–0.79)</td>
<td>0.76 (0.63–0.92)</td>
</tr>
<tr>
<td>Area under receiver operating characteristic curve</td>
<td>65%</td>
<td>67%</td>
<td>68%</td>
</tr>
</tbody>
</table>

*Adjusted and for education and social class

Regular dental check-ups defined as:
0 = attendance (never, only with trouble, occasionally) 1 = (regularly)
0 = attendance (never, only with trouble), 1 = (regular, occasional)
0 = attendance (never), 1 = (regular, occasional, only with trouble)

### Table 4 Probability* of making a dental check-up visit in future conditioned on baseline factors favouring oral carcinogenesis in British Household Panel Survey 1991–2001

<table>
<thead>
<tr>
<th>Factors favouring oral carcinogenesis</th>
<th>Baseline (1991)</th>
<th>1 year</th>
<th>3 years</th>
<th>5 years</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt;40 years</td>
<td>0.48 (0.44–0.51)</td>
<td>0.46 (0.43–0.50)</td>
<td>0.44 (0.39–0.48)</td>
<td>0.38 (0.34–0.43)</td>
<td>0.22 (0.17–0.27)</td>
</tr>
<tr>
<td>Male</td>
<td>0.37 (0.34–0.40)</td>
<td>0.38 (0.35–0.41)</td>
<td>0.37 (0.34–0.41)</td>
<td>0.37 (0.32–0.41)</td>
<td>0.35 (0.30–0.42)</td>
</tr>
<tr>
<td>Smoker</td>
<td>0.39 (0.35–0.43)</td>
<td>0.40 (0.37–0.44)</td>
<td>0.40 (0.36–0.45)</td>
<td>0.42 (0.37–0.47)</td>
<td>0.38 (0.32–0.45)</td>
</tr>
</tbody>
</table>

*Adjusted for age, sex, smoking status, education, and social class

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