ORIGINAL ARTICLE

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

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Objective Early detection through regular screening is a measure used in certain cancer prevention strategies. This approach has been advocated for the prevention of oral cancers in the UK. The objective of this study was to assess whether people at higher risk of oral cancer in the UK visit dentists on a regular basis, and thereby afford opportunities for oral cancer screening.

Methods Data from two large national surveys were used. Firstly, data from the Health Survey for England, 2001, were used to assess the relationship between dental attendance (the outcome measure) and recognized oral cancer risk factors; there were 13,784 participants with complete data. We used known risk factors for oral cancer (age >40 years, male sex, alcohol intake >28 units per week, cigarettes >20 per day, and fruit and vegetables <5 times a day) to generate a risk score for oral cancer. Logistic regression was used to compute the odds ratios for regular dental attendance according to risk score. All analyses used education and social class as covariates. We also used data from the British Household Panel Survey to assess whether dental attendance behaviour is sustained over a set period of time (5547 participants with complete data).

Results In persons in the higher risk category (as defined above) of the five risk factors, age, sex, alcohol, smoking, and fruit/vegetables, 68%, 56%, 52%, 43% and 60%, respectively reported regular dental check-ups. In persons with 0, 1, 2, 3, 4 and 5 of these risk factors, the odds ratio for regular dental check-ups was 1.00, 0.93, 0.81, 0.64, 0.50 and 0.28, respectively. The probability of regular dental attendance was low in all groups with a higher risk of oral cancer. In the longitudinal sample, the low probability of visiting a dentist regularly was stable over time.

Conclusion Opportunistic screening for oral cancer in general dental practice in the UK is unlikely to be an effective preventive strategy.

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.[13] 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 the corresponding 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

Table 2 Odds ratios for regular dental check-ups according to the number of factors favouring oral carcinogenesis

Number of factors	Odds ratio (95%CI)*
0	1
1	0.93 (0.78–1.10)
2	0.81 (0.68–0.96)
3	0.64 (0.54–0.77)
4	0.50 (0.39–0.63)
5	0.28 (0.17–0.46)

*Adjusted for education and social class
Test for trend of odds $P < 0.0001$

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

			Regular dental attendance		
Variables	Categories	*n*	Percentage	Odds ratio	Adjusted odds ratio*
Age	<40 years	5800	56	1	1
	40 + years	7984	68	1.68 (1.57–1.81)	1.88 (1.74–2.04)
Sex	Female	6222	68	1	1
	Male	7562	56	0.59 (0.55–0.64)	0.60 (0.55–0.64)
Alcohol	<28 units/wk	12,035	64	1	1
	28+ units/wk	1749	52	0.61 (0.55–0.67)	0.80 (0.72–0.89)
Cigarettes	<20/day	12,708	64	1	1
	20+/day	1076	43	0.41 (0.37–0.47)	0.49 (0.43–0.56)
Fruits and vegetables	5+ portions/day	3796	70	1	1
	<5 portions/day	9988	60	0.63 (0.58–0.68)	0.76 (0.70–0.83)
Total		13,784	63	—	—

*Adjusted for education and social class

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

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

*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

		Probability of making a dental visit in the next			
Factors favouring oral carcinogenesis	Baseline (1991)	1 year	3 years	5 years	10 years
Age >40 years	0.48 (0.44–0.51)	0.46 (0.43–0.50)	0.44 (0.39–0.48)	0.38 (0.34–0.43)	0.22 (0.17–0.27)
Male	0.37 (0.34–0.40)	0.38 (0.35–0.41)	0.37 (0.34–0.41)	0.37 (0.32–0.41)	0.35 (0.30–0.42)
Smoker	0.39 (0.35–0.43)	0.40 (0.37–0.44)	0.40 (0.36–0.45)	0.42 (0.37–0.47)	0.38 (0.32–0.45)

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

dentist regularly on an annual basis, there is little chance that there will be future visits. So although it has been shown that in a general dental practice setting screening opportunistically for oral cancer is feasible,[6] our results show the people who would be screened if that approach was adopted are at low risk of oral cancer. This 'inverse screening law' casts doubt on the utility of opportunistic screening during dental visits. Our results are in agreement with those of Klassen *et al.*, who found that older African American women who smoked were less likely to have had a dental check-up other than for a problem in the previous three years.[14] Mucci and Brooks also found that older smokers were less likely to visit the dentist.[15]

The 'inverse screening law' also applies to population-based screening programmes. Only 35% of high-risk (heavy smoking and drinking) individuals complied with invitations for screening for oro-pharyngeal cancers in Italy.[16] Even after detection of an oral lesion in population oral cancer screening programmes, compliance with further examination was only between 54% and 72%.[17,18] Compliance with attendance for referral was low in participants with oral lesions with malignant potential in a general practice setting.[19]

A probable explanation for our finding might be that risk behaviours tend to cluster in the same individuals.[20,21] Drinking, smoking and a poor diet commonly go together. Smokers are more likely to eat a diet high in fats and sugars and low in fibre, polyunsaturated fatty acids, fruit and nutrient-rich foods, exercise less and drink more alcohol than non-smokers.[22–24] Indeed the higher rate of cancer in smokers may be affected by their lower intake of nutrients with antioxidants.[25] A regular dental check-up is largely a preventive visit and is a part of risk aversion behaviour. Heavy smokers and drinkers are the least likely to take preventive action such as regular dental visiting. The results of this study indicate that the dental attendance behaviour of people at higher risk of oral cancer is poor; therefore, the yield from opportunistic screening for oral cancer during dental check-ups is 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.

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