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Discussion

Commentary: Oral cancer examinations and lesion discovery as reported by U.S. general dentists

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Oral and oropharyngeal cancer (OPC) is a group of devastating neoplasms occurring in the oral cavity and pharynx. They have a much lower probability of survival (< 50%) than common cancers (e.g., breast, prostate) (Marcu and Yeoh, 2009) and the highest morbidity (Zeller, 2006; Lydiatt et al., 2009) and suicide rates of all cancers (Zeller, 2006; Misono et al., 2008). In addition, they are among the most expensive solid tumors to treat (Lee et al., 2004). While the overall incidence of OPC has decreased in recent years, paralleling a decrease in tobacco use, human papillomaviruses (HPV) are changing the epidemiology of OPC. With the sharp increase in OPC related to HPV (as much as 225%), these cancers will overcome cervical cancer rates by 2020 (Chaturvedi et al., 2011). Almost all OPC are thought to develop from squamous dysplastic precursor lesions (Gupta et al., 1989), which occur in a subset of common white (leukoplakia) or red (erythroplakia) plaques in the oral and oropharyngeal mucosa. While as much as 30% of the population may develop such plaques in their lifetime, the likelihood of such lesions transforming into invasive carcinoma can be as little as 4% and as high as 40%. Primary care providers are at the critical front line of our battle against cancer as they are the ones most likely to detect, refer, and biopsy suspicious cases. Their timely involvement represents patients' best chances of survival through early diagnosis and intervention.

In this issue, Psoter et al. investigate the role general dentists play in diagnosing oral and oropharyngeal premalignant or malignant lesions in their routine practice using a sample from the USA National Dental Practice-Based Research Network. The literature is rich with studies that have attempted to assess dentists' knowledge of HNC (Patton et al., 2005; Alaizari and Al-Maweri, 2014; Yellowitz et al., 2000). For example, results of a survey that included 7,000 USA dentists showed that knowledge on oral cancer was inadequate (Yellowitz et al., 2000). However, the study by Psoter and colleagues is unique in that it attempts to estimate the average number of suspicious oral lesions biopsied or referred for consultation by general dentists, as well as the average number of histopathologically-confirmed malignant lesions per dentist over a year.

Among the strengths of this work, a large database of general dentists helps advance translation of scientific research into application that is likely to benefit dental practice. Moreover, the oral cancer examination questionnaire was designed by an expert panel on oral premalignant and malignant lesions, and showed moderate to strong reliability. However, the objective arguably warrants a standardization technique based on survey weights. The authors' choice of an unweighted parametric model to estimate the conditional mean of number of suspicious and malignant lesions (count outcomes) may reduce the external validity of the estimates of average count. Due to the strong assumptions of this model, any variance in the number of lesions that cannot be explained by the covariates is irrelevant. The resulting estimate of average outcome is limited to how well the model can predict the observed data, thereby reducing our confidence in the conclusions of the study. The authors could have opted for a simple technique using the weighted average of number of lesions for estimation. If their interest was to average out the differences in covariates among dentists, an unweighted regression provides merely a conditional mean and not marginal mean of the outcome. Additionally, the average number of suspicious lesions found by a general dentist will depend on how many patients they examine and it is unclear how the authors accounted for this difference among participating dentists.

Even if the study's objective was formulated in way that the proposed analytical technique was adequate, we argue that the choice of a data-driven approach to build the prediction models is questionable. Such an approach is heavily dependent on *p*-values to identify variables that predict responses to the oral cancer questionnaire. The statistical and epidemiological literature is replete with articles advising against inferences made based on *p*-values (Amrhein et al., 2019; McShane et al., 2019). Moreover, given the authors' aim to accurately estimate the average count of suspicious and malignant lesions, predictive modeling might be more appropriate than variable selection.

The authors are commended for attempting to minimize the non-response rate and comparing the characteristics of respondents and non-respondents on eight key questions from the enrollment questionnaire. However, given that their target population is all practicing general dentists in the USA, it is not clear whether the exchangeability

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between participants and non-participants ensures external validity.

In their discussion, Psoter et al. argue that, by multiplying the estimated average of oral cancer cases detected by the estimated number of active general dentists in the USA, there could be 44,325 lesions diagnosed annually by general dentists alone. In order for that to be true, one must assume the generalizability of the study's findings to the overall active dental workforce in the USA, and that the estimated mean of histopathologically-confirmed cancer cases per dentist is marginal and free of bias. These assumptions are difficult to uphold, especially considering that no sampling weights were used, and that the regression model produces conditional estimates rather than marginal ones. Rightly the authors pointed out that, even if the actual numbers were half of the reported estimates, the overall number of cases diagnosed is still relevant. While this may be true, from a public health perspective, screening for cancer should be designed with more specific parameters (who can screen, how to screen and whom should be screened for oral cancers) (Wender et al., 2019).

Given the role dentists play in diagnosing premalignant and malignant lesions in the general population, we believe it is important to improve oral cancer knowledge and training for dental students. Studies in the literature, mostly from developing countries with high incidence of OPC, have shown a deficiency in knowledge about oral cancer and inadequacy in diagnostic skills among dental students (Hassona et al., 2016; Cannick et al., 2005; Al-Maweri et al., 2015). We are concerned that this can translate into many undiagnosed cases. It is therefore important to use innovative teaching techniques to ensure superior oral cancer knowledge and diagnostic skills among future dentists (Clark et al., 2014).

Prevention efforts constitute the best avenues to decrease the burden of OPC and this project is a step towards achieving this. Oral cancer screening and referrals should also involve dental hygienists and medical primary care providers. While we agree with the authors' notion that dentists are better trained and equipped to screen for oral cancers, medical providers are likely to examine and treat high-risk individuals (Yellowitz and Goodman, 1995). By integrating dental and medical healthcare (Donoff et al., 2014), the oral health of the population will likely improve, and we expect patients will benefit from early cancer detection and better survival rates. The work presented by Psoter and colleagues uses a large dataset on clinically active general dental practitioners to show the importance of general dentists in the detection of OPC. Undoubtedly this project is the launchpad for future research using this and similar data sources to produce policy-relevant estimates on the impact and cost-effectiveness of a nationwide screening program for OPC.

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