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Validity of dental screening questions in an Indigenous young adult population

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Indigenous Australians have worse oral health than their non-Indigenous counterparts.[1] Despite the public health importance of Indigenous Australian oral health, there is limited epidemiological information available upon which to guide Indigenous oral health policy. This raises an important question regarding the oral health, or more specifically, the untreated dental needs, of Indigenous Australians: can screening questions and other self-reported risk indicators be used to predict Indigenous Australians' probability of experiencing untreated dental decay? A positive answer might permit population-level screening for untreated decay among Indigenous Australians using screening questions that are simpler to administer than processes requiring intra-oral examination.

Our aim was to evaluate the validity of screening questions used to predict untreated dental decay among Indigenous Australian young adults. Participants were members of the Aboriginal Birth Cohort study, a prospective longitudinal investigation of Indigenous Australians living in the Northern Territory's Top End.[2] Data for this analysis was collected at mean age 18 years.

The dental screening questions represented three domains: pain, impact on eating and dental service utilisation. The questions were based on evidence that each was a valid predictor of untreated dental decay in other populations.[3,4] Experience of pain was assessed by two questions: 'Since the last wet, how have your teeth been?' and 'Do you have any trouble with your teeth, gum or jaw right now?' Response options for the former included 'all good, none hurting', 'some good, some hurting' or 'no good, all hurting'. These were dichotomised into 'all good, none hurting' (No) and 'some good, some hurting' and 'no good, all hurting' (yes). Binary responses of 'yes' or 'no' were provided for the latter. Avoiding food because of oral health problems was assessed by asking participants: 'Since the last wet, have you stopped eating some foods because they hurt your teeth?' and response options were 'yes' or 'no'. 'Since the last wet' pertains to the 'wet season' period which typically lasts from November to March in the Northern Territory's Top End. The dental service utilisation question was 'Have you ever had a tooth pulled out because it hurt too much?' with response options of 'yes' or 'no'.

Information about clinical oral health status was collected during standardised examinations conducted by 2 calibrated dentists. The DT (sum of decayed teeth in the permanent dentition) index was used to assess levels of untreated dental decay; defined as percent DT>0.

Using percentage DT>0 as the dependent variable, an initial multivariate model was constructed using the four dental screening questions (Model 1); a second model was constructed using only the identified risk indicators (Model 2) and a third model included all items (Model 3). The predictive validity of each model was estimated using: (1) statistical significance of overall model; (2) 'pseudo' R^2; (3) sensitivity (percentage of occurrences correctly predicted; range 0 to 1) and specificity (percentage of non-occurrences correctly predicted; range 0 to 1); and (4) area under receiver operating characteristics curve (AUC); the plot of sensitivity versus 100 minus specificity obtained from multiple dichotomies of predicted probabilities from a multivariable binary logistic regression model, with each dichotomy cross-classified against clinical diagnosis. AUC has a value of 0.5 under the null hypothesis that the prediction model is no better than chance. Swets proposed the following thresholds for interpretation of AUC values: <0.7 ('poor'), 0.7 to 0.9 ('useful') and >0.9 ('excellent').[5]

Of the 468 who were assessed, 442 agreed to be dentally examined and provided complete information in a self-report dental questionnaire. All subsequent analyses pertain to those 442. The age range was 16 to 20 years and there was approximately equal representation by gender. A matrix of bivariate correlations among the four screening questions indicated that correlations were weak, ranging from zero to 0.23.

Two of the four screening questions were statistically significant predictors of untreated dental decay when assessed in a multivariable binary logistic regression model. Model 1 had moderate sensitivity (0.59) and good specificity (0.78), achieving combined sensitivity plus specificity of 1.37. All three of the traditional risk indicators were statistically significant predictors of untreated dental decay, but together they had worse predictive validity than the initial model (sensitivity plus specificity = 1.26; Model 2). When all seven variables were used to predict untreated dental decay, the overall validity was still less than that obtained for Model 1 alone (sensitivity plus specificity = 1.35; Model 3). Two of the four screening variables remained statistically significant in this full model. When a probability of 0.73 from the DT>0 logistic regression model was used as the threshold to classify participants as predicted cases of untreated dental decay, the AUC was 0.71, 0.66 and 0.74 respectively for the three models.

Our findings suggest that questions designed to screen for untreated dental decay in a birth cohort of Indigenous Australian young adults, together with traditional risk indicators, achieved 'useful' levels of

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prediction based on benchmarks proposed for overall predictive validity. The items were easy to administer and could be readily collected in health interview surveys. Data from this study show some promise in the use of screening questions for assessing levels of untreated dental decay in an Indigenous population, although testing in other settings is warranted.

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