Factors influencing accuracy of caries risk assessment among South Australian children

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Abbreviations

ADJCI	Adjusted caries increment
AIHW	Australian Institute of Health and Welfare
ANOVA	Analysis of variance
ARCPOH	Australian Research Centre for Population Oral Health
AUC	Area Under Curve
CART	Classification and regression tree analysis
CCI	Crude caries increment
CRA	Caries Risk Assessment
dmfs	Decayed, missing, filled deciduous surfaces
DMFS	Decayed, missing, filled permanent surfaces
dmft	Decayed, missing, filled deciduous teeth
DMFT	Decayed, missing, filled permanent teeth
DT	Dental therapist
EXACT	Electronic clinical record data management system
F	Factor
FDA	Food and Drug Administration
GLM	Generalised Linear Regression Model
h^2	Communality
ID	Incidence density
IDR	Incidence density ratio
KMO	Kaiser-Meyer-Olkin
LRA	Logistic regression analysis
LDA	Linear discriminant analysis
Max	Maximum
Min	Minimum
n	Sample size
NA	Not available
NC	Not calculated
NCI	Net caries increment
NHMRC	National Health and Medical Research Council
NIDR	National Institute of Dental Research

NS	Not significant
P	p-value
PDC	Personalised Dental Care
PHR	Percentage high risk patients
R^2	Per cent variance explained
Ref	Reference category
ROC	Receiver Operating Curve
SDS	School Dental Service
SA	South Australia
SA SDS	South Australian School Dental Service
SADS	South Australian Dental Service
SD	Standard deviation
Se	Sensitivity
Se+Sp	Sensitivity + Specificity
SES	Socioeconomic status
Sp	Specificity
WHO	World Health Organization
99%CI	99% Confidence Interval

Abstract

This thesis examined factors associated with the accuracy of caries risk assessment by South Australian Dental Service (SADS) staff for children enrolled in the school dental service. Understanding those factors can help to address variation in accuracy of assessment and ultimately caries risk among children. The aims of this thesis were to examine the relationship between clinician's assessment of caries risk at a baseline examination and subsequent caries development and to explore the association between accuracy in caries risk assessment and clinician- and patient-related factors.

This study consisted of four sub-studies which addressed a set of specific objectives. Two data sources were used in the analysis. The first dataset was obtained from the South Australian component of the Child Dental Health Survey, an ongoing national surveillance survey of the oral health status of Australian children attending school dental services in all states and territories. Data on caries experience were extracted from electronic examination records collected during the period 2002–2005. These data included caries experience (decayed, missing and filled tooth surfaces) of the deciduous (dmfs) and permanent dentition (DMFS). The level of risk status assigned by clinicians at the baseline examination as well as socio-demographic factors of those children, were obtained. This first dataset was used for sub-study no. 1 and sub-study no. 2. Sub-study no. 3 and sub-study no. 4 used additional information from the second dataset, which contained responses to a self-completed clinician questionnaire. This questionnaire collected data on clinicians' personal characteristics, routine caries risk assessment practices and their perception of factors that were important in caries risk assessment and their confidence in their routine clinical activities.

Sub-study no. 1 described caries experience and increment and their associations with clinicians' caries risk assessment. Children who had at least two recorded examinations with an interval of more than six months between them were included. Caries experience in both permanent and deciduous dentitions at baseline examination was described by assigned risk status. Net caries increment and caries incidence density between examinations were computed. Caries incidence density was contrasted according to children' risk status at the baseline examination. Children who were classified as high-risk at baseline had a significantly higher rate of new dental caries regardless of their caries experience status at

baseline. This result supported the conclusion that clinicians' judgement was a valid predictor of future caries development.

Clinicians who examined more than 20 children during the study period were selected for study no. 2. This study aimed to evaluate clinician accuracy in predicting caries risk for South Australian children. Computed caries rate between the two examinations (caries incidence density) was used as the gold standard and compared with clinicians' classification of children' risk status at the baseline examination. Sensitivity (Se) and specificity (Sp) were calculated as measures of clinician accuracy. Accuracy in predicting caries development was moderate, although there was large variation between clinicians. This finding suggested that a number of clinician-related characteristics influenced caries risk assessment accuracy.

In sub-study no. 3, a survey was conducted among all SADS school dental service clinicians using a self-completed questionnaire. The aim of this sub-study was to identify clinician-related factors that associated with caries risk assessment. Factor analysis was used for a group of items collected in the questionnaire. The factor analysis revealed three main constructs belonging to reported clinician routine caries risk assessment practices: clinical procedure during the first examination; child behaviour; and child's stressful life events and family circumstances. Further eight constructs were derived by factor analysis from data items on clinician perception of caries risk assessment including: Ecology; Plaque; Current caries; Past caries; Diet; Socioeconomic status; Fluoride exposure; and Dental behaviour.

Clinician accuracy (Se, Sp and Se+Sp) was used as the dependent variables in sub-study no. 4. The independent variables were clinician characteristics, clinician-related factors which were derived from sub-study no. 3 and children's characteristics which were obtained from the Child Dental Health Survey. Evaluating a child's stressful life events and family circumstance was associated with clinicians' accuracy in both bivariate and multivariate analysis. Clinicians who evaluated a child's stressful life events and family circumstance more frequently had a higher sensitivity and combined sensitivity and specificity than their colleagues. Clinician accuracy was also strongly influenced by the child's caries experience at the baseline examination. Caries risk assessment performed among children with higher level of caries experience was significantly more accurate compared with that observed among children with no level of caries experience at baseline.

In conclusion, the accuracy of caries risk assessment performed by clinicians in routine practice in SADS was comparable to that reported in other studies. Further staff

development in improving clinicians' understanding of a child's stressful life events and family circumstance can potentially improve the accuracy of caries risk assessment. However, the accuracy of caries risk assessment depended largely on the child's level of past caries experience. This finding indicated that among children with no caries experience, the current caries risk assessment is not adequate in predicting caries development. The study also revealed even if risk is correctly identified, and if more preventive treatment is allocated to high risk children, those children still developed significant amount of caries. The focus of future research should be on identifying approaches to limit that disappointing outcome.

Declaration

This thesis contains no material that has been accepted for the award of any other degree or diploma in any university. To the best of the candidate's knowledge and belief, the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

I give my consent to the thesis being made available for photocopying and loan if accepted for the award of the degree.

Signed:.....

Date:.....

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