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COMPETING RISKS SURVIVAL MODELLING OF CHILDHOOD CARIES

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INTRODUCTION

The survival of primary molar teeth to caries was investigated using data from a cohort study of 2,654 children aged ~5 years at baseline, undertaken by Cardiff University School of Dentistry in 1999-2003.

AIMS & OBJECTIVES

- To model the occurrence of caries in primary molar teeth using parametric survival analysis methods, and to assess the effect of exfoliation on the survival of primary molar teeth and surfaces to caries
- To identify factors significantly linked with childhood caries within the framework of a hierarchical frailty model structure
- To compare and contrast survival to caries across children, teeth and surfaces with differing characteristics

MATERIALS & METHODS

Children were selected from fluoridated areas in the West Midlands and non-fluoridated areas in South Wales. Caries data was recorded on all surfaces of all primary molar teeth on 3 occasions at intervals of ~2 years. The gender, age at each exam and socio-economic status (SEC score) of all children was recorded. Tooth and surface parameters were also recorded. Parallel analyses were undertaken on the surface data, and on the data transformed into tooth-level responses.

Parametric survival modelling was undertaken using 4 contrasting survival distributions, considering the concurrent risks of caries and exfoliation.

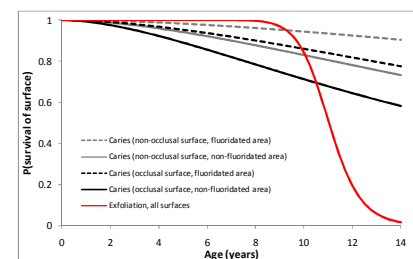
RESULTS

Marginal survival models

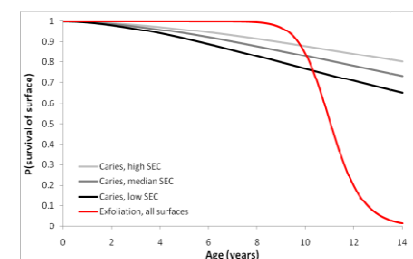
Marginal survival of primary molar teeth and surfaces were derived with respect to caries and exfoliation, using frailty models with *surface*- and *tooth*-level observations nested within children. These may be interpreted as the survival experience that would be observed in the absence of other risks. *Surface*-level results are illustrated.

Calculation of likelihood ratio statistics show the log-logistic distribution to be the best fit to the data.

Failure mode	Null model log likelihood from assumed distribution			
	Exponential	Weibull	Gompertz	Log-logistic
Caries	-53,802	-53,261	-53,369	-53,240
Exfoliation	-76,153	-44,908	-45,203	-44,685



Survival to caries is affected by surface type and fluoridation status. Non-occlusal surfaces of children from areas with fluoridated water show best survival rates.



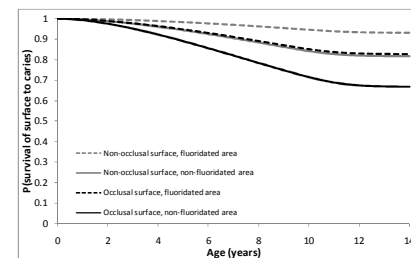
SEC score also affects marginal survival to a lesser extent. Other covariates have little substantive effect.

Exfoliation rates are not affected by surface type or demographics.

RESULTS (continued)

Cumulative incidence functions

Cumulative incidence functions for caries give the actual survival experience. The effect of fluoride and surface type on survival of molar surfaces to caries is illustrated.



The curves resemble the marginal survival curves up to about 11 years, and then start to flatten as the risk of exfoliation increases.

A differential effect of fluoride across surface type may be observed.

Up to 31% of potential caries occurrences by 14 years are latent (do not occur) due to prior exfoliation.

Effect of covariates is estimated by variation in survival up to 14 years compared with a reference surface.

Surface characteristics	Median survival time	95% CI for survival time
Reference ¹	10.9yr	(4.5yr, 13.2yr)
Fluoridated	11.4yr	(8.6yr, 13.6yr)
Occlusal	10.6yr	(3.0yr, 13.0yr)
Fluoridated, Occlusal	11.2yr	(5.2yr, 13.5yr)
High SEC	11.1yr	(5.6yr, 13.4yr)
Low SEC	10.7yr	(3.6yr, 13.0yr)

¹Median SEC, non-occlusal surface, non-fluoridated area

The concurrent risk of exfoliation significantly modifies survival to caries. Only the lower ends of intervals are substantively affected.

CONCLUSIONS

Survival of primary tooth surfaces to caries is substantively associated with fluoridation status, SEC score and surface type. Exfoliation is a significant limiter on caries occurrence later in life.