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Generalised linear modelling and survival modelling of childhood caries

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INTRODUCTION
The occurrence of childhood caries was investigated using multilevel and survival analysis of data from a cohort study of 2654 children aged ~5 years at baseline, undertaken by Cardiff University School of Dentistry from 1999 to 2003.

AIMS & OBJECTIVES
• To identify factors significantly linked with childhood caries within the framework of a hierarchical model structure
• To compare and contrast caries occurrence across individuals with differing characteristics
• To compare the survival of primary molar teeth and surfaces to the competing risks of caries and exfoliation

MATERIALS & METHODS
Children were selected from 2 fluoridated areas (Dudley, Walsall) and 2 non-fluoridated areas (Mid Glamorgan, South Glamorgan). Caries data was recorded on all surfaces of all primary molar teeth on 3 occasions at intervals of ~2 years. Gender, age, and socio-economic status (SEC) of all children were recorded at each exam. Tooth and surface parameters were also recorded. Parallel analyses were undertaken on the surface data, and on the data transformed into tooth-level responses.

Generalised linear models (GLMs) were derived on discretised data using the logit and complementary log-log (CLL) links. Parametric survival modelling was undertaken using the 3-parameter Weibull, Gompertz and log-logistic survival distributions, considering the competing risks of caries and exfoliation.

RESULTS
Generalised linear modelling
Several model structures were tested using variance components multilevel GLMs. Results for a 4-level and a 3-level hierarchy are presented.

The proportion of model variance at each of these levels averaged across all examinations was calculated using a simulation method.

The majority of variance in caries at surface and tooth-level demonstrates the clustering of caries within children.

Multivariate logistic GLMs indicate risk factor significance by odds ratios (95% confidence intervals) and p-values:

A series of multilevel GLMs (CLL link) were used to investigate variation in caries occurrence between groups. Some surface-level analyses are illustrated.

CONCLUSIONS
Childhood caries is associated with all recorded attributes at child level, with lower teeth and with occlusal surfaces. Higher caries rates are found in boys, in older children, in socially deprived children and those living in non-fluoridated areas.

Consideration of multilevel structures did not greatly affect significance of association of risk factors.

Exfoliation is a significant limiter on caries occurrence later in the lifetime of primary molar teeth.