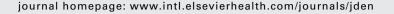Available online at www.sciencedirect.com

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Do socioeconomic determinants affect the quality of posterior dental restorations? A multilevel approach

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ARTICLE INFO

ABSTRACT

Objectives: This study aimed to evaluate posterior restorations placed in young adults, investigating the association between social determinants experienced during the life course and the quality of tooth fillings.

Methods: A representative sample (*n* = 720) of all 5914 individuals who were born in Pelotas in 1982 was prospectively investigated, and posterior restorations were assessed at 24 years of age. Exploratory variables included demographic and socioeconomic, oral health and dental service payment mode during the life course. Tooth-related variables (type of tooth, material and size of cavity) were also analysed.

Results: Multilevel logistic regression models showed that individuals who were always poor from birth to age 23 [odds ratio (OR) 2.35 (1.38–4.00)] and whose mothers had less years of education at their birth (OR 2.60 (1.44–4.68)) were with unsatisfactory restorations in posterior teeth more often. In addition, caries presence at age 15 (high decayed, missing, filled teeth (DMFT) tertile) (OR 1.95 (1.25–3.03)) and cavities with four or more surfaces (OR 18.67 (9.25–37.68)) were associated with the outcome.

Conclusions: These results show that socioeconomic characteristics of the individuals play an important role in restoration failures, reinforcing the need for preventive dental strategies and public policies to reduce inequalities as a major topic of oral health. In addition, the size of cavity appears as the most important determinant for restoration failure.

Clinical significance: Individual socioeconomic characteristics were associated with failure in posterior restorations in detriment of other clinical variables such as restorative material and type of tooth.

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1. Introduction

Although a significant decrease in caries prevalence has been observed in some parts of the world, dental caries remains a public health problem.[1] Caries attack is more frequent in the posterior teeth and direct restorations have been largely employed to replace the lost dental structure because of their low cost, ability to remove less sound dental structures and good clinical performance.[2,3]

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Restoration replacement is one of the most common dental procedures in public and private dental offices, representing a high financial cost for the individual and for the health system. The yearly expenses for the National Health System- NHS (England) only with dental restoration replacement have been estimated to be £173 million.[4]

When evaluating failures in posterior direct restorations, studies have generally focussed on the clinical variables and characteristics related to materials and operators.[5,6] On the other hand, studies that investigate the influence of patient-related factors are very rare, and most of them were conducted in university clinical settings,[7] with a lack of population-based data. In addition, these studies consider tooth restorations as the unit of analysis, drawing erroneous inferences for individual determinants.

From a life-course perspective, health status at any given age is a result not only of current conditions but also of the embodiment of prior living conditions from conception onwards. Secondary caries is one of the most frequent reasons for restoration failure and considering that dental caries is strongly associated with social determinants experienced during the life-course,[1,8] it is plausible that these determinants could influence the longevity of restorations.

The aim of this study was to investigate the association between social determinants experienced during the life course and the quality of posterior restorations placed in young adults. In addition, the influence of clinical aspects was also investigated.

2. Methods

This study was carried out in Pelotas, a medium-sized city located in south Brazil. In 1982, all infants born in the city were identified. The 5914 live-born infants and their mothers were weighed and measured. The mothers were also interviewed. This population was followed up several times and further information is available elsewhere.[9] In 1997, a systematic sample of 27% of the city's census tracts was selected and every household was visited. We interviewed 1076 cohort members. Of these, 900 were randomly selected for the Oral Health Study (OHS-97). In 2006, the 888 adolescents (98.7%) who were evaluated in the OHS-97 were invited to be interviewed and examined for several oral health conditions.[10]

2.1. Tooth-level variables (level 1)

Restorations in posterior teeth were assessed according to: (1) tooth location – molars or premolars; (2) type of cavity – class and number of surfaces; (3) restorative material used – composite or amalgam; (4) estimated time in the mouth – indicated by the individual – up to 5 years or more than 5 years; (5) quality of restoration – satisfactory or unsatisfactory; and (6) reason for failure – secondary caries, fracture, etc. The quality of restorations was directly evaluated in accordance with the modified United States Public Health Services (USPHS) criteria.[11] Restorations were classified as satisfactory (0) when ranked with criterion A or B and unsatisfactory (1) when ranked with criterion C or D (except for secondary caries

when B means unsatisfactory). To consider a restoration as unsatisfactory due to staining, this problem must have been associated with other restoration problems such as lack of marginal adaptation or proximal contour.

2.2. Personal-level variables (level 2)

The independent variables were obtained from the different assessments made in this cohort. For maternal schooling at childbirth, the mothers' years of education were considered and categorised into four groups: $\geq$12; 9–11; 5–8 and $\leq$4 years. Family income data were collected in 1982, using five categories of Brazilian minimum wage (<1, 1–3, 3.1–6, 6.1–10 and >10). Unfortunately, information on the continuous level of income was not available. To classify families into tertiles for the data analyses, it was necessary to regroup the five categories. A principal component analysis was carried out using four variables strongly related to wealth in our sample – delivery care payment mode, schooling, height and mother's skin colour. After this, second and third tertiles were grouped in one category ('not poor'), while the first tertile was referred to as the 'poor' category.[12]

Family income at age 15 and 23 were collected in continuous level and the subjects were divided into tertiles. The middle and higher tertiles were merged into a group that was deemed 'not-poor', while the lower tertile was designated as 'poor'. We performed group-based trajectory analysis to estimate the family income trajectory groups.[13] The combination of this classification resulted in four different family income trajectories from birth to 23 years of age: (1) those who were always poor; (2) those who were never poor; (3) those who were poor at birth and 'not-poor' later on (upwardly mobile) and (4) those who were 'not-poor' at birth and then became poor (downwardly mobile).

Dental service payment mode (out-of-pocket, public-free or private health insurance) was verified at 15 years of age. Dental caries at age 15 was determined by the decayed, missing, filled teeth (DMFT) index[14] but, as the outcome of the study was restoration failures (unsatisfactory restorations), only the component D (decayed), which was divided into tertiles, was taken into account.

The fieldwork team was comprised of six dentists and four advanced dental students from the Federal University of Pelotas (UFPel), who were trained and evaluated following previously described methodology.[15] Examiner reliabilities were calculated and the lowest kappa value for the quality of restorations was 0.70. For data quality control, 10% of the interviews were repeated by telephone with a short version of the questionnaire.

2.3. Data analysis

The software STATA version 11.0 was used for the analysis. Descriptive analyses were carried out to assess the distribution of posterior restorations by independent variables. Associations between variables were tested using the chi-squared test and chi-squared test for linear trends when appropriate. To determine the factors associated with unsatisfactory posterior restorations, a multilevel analysis model was used to adjust the results considering the effects of