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Social inequality in tooth extraction in a Brazilian insured working population

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Abstract – *Objectives:* Given the scant evidence of the socioeconomic gradient in tooth loss incidence, the purpose of this study was to compare the odds of individuals of distinct social strata being subjected to tooth extraction. *Methods:* We undertook a case–control study at the head office of a large Brazilian company whose employees had access to dental care through the company's dental insurance. *Results:* During 2 years of observation, 264 teeth were extracted and the distribution of such extractions was rather unequal. A strong suggestion of a social gradient was noted and the odds of tooth extraction occurring per social strata, adjusted by age and gender, were five times higher in employees pertaining to the lowest social stratum, when compared with those at the highest. *Conclusions:* We concluded that lower social strata were strongly associated with increased risk of having teeth extracted. Dental insurance was not able to equalize the chances of tooth extraction among different social strata, in a population of employed adults.

Key words: case – control studies – dental care – socioeconomic status – tooth extraction

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Oral diseases may be the preponderant direct cause of tooth losses (7) and social factors may play a significant indirect role (8) not only in the development and progression of such diseases but also in the decision for extracting a tooth, even when it appears that, clinically, there are better options (9). Low income and educational level are strong risk factors for tooth loss (7, 8, 10–14). Access to dental care seems to decrease the risk of tooth loss (10, 14–16). Tooth loss has declined over the past years in certain populations; however, even in rich countries, a substantial proportion of adults who regularly attend the dentist still undergo dental extraction (6).

The Whitehall Studies followed up British civil servants over three decades. A social gradient had been demonstrated both for mortality and for morbidity, as well as for absence from work because of illnesses, which extended from workers at the top of the social hierarchy down to those at the lower end. Social position had a strong association with these outcomes, with rates decreasing progressively as one moved from the lower to the upper social stratum. Among junior administrators, those at the lower ranks presented mortality and absence rates four and six times higher, respectively, than those at the top (1, 25, 26).

Low income is associated with poor diet, poor housing and difficult access to education, information and health services. Material restrictions that accompany low-income families may interfere with the adoption of healthy behaviors. Cumulative effects of socioeconomic adversities may affect the whole life of human beings (2, 3).

Socioeconomic status may also affect health through a psychosocial route. In this case, the significant fact is not the absolute level of material deprivation of a certain individual but how or where this individual is in relation to others in society. This suggests that income is a marker of the social position of an individual (1, 25–30, 32, 33). Processes activated by social comparisons, capable of causing an increase in basal levels of cortisol seem to be the most plausible reason for the

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chronic stress related to lower social position. Chronic anxiety, lack of self-confidence, low self-esteem, social isolation, and lack of control over one's own work seem to impact negatively upon both physical and mental health of human beings (1, 25–30, 32, 33). In Brazil, an association was noted between work stress and periodontal status, even after controlling for income and education. Workers who reported high demand and low work control were 3.3 times more likely to have periodontal diseases than workers who reported high work control (4). Individuals with high anxiety and stress levels may have salivary hypofunction, and, accordingly, be more susceptible to dental caries (5).

Given the scant evidence of the socioeconomic gradient in tooth loss incidence, the purpose of this study was to compare the odds of individuals of distinct social strata being subjected to tooth extraction.

Materials and methods

Design and setting of the study

We conducted a retrospective unmatched case–control study of incident cases of tooth loss. The base population consisted of 3708 insured employees working in the administrative headquarters of a large Brazilian company in the city of Rio de Janeiro.

The city of Rio de Janeiro has a population-to-dentist ratio of 676 people per dentist, and there are a large number of dental clinics both in the state and in the private oral health care sectors. In Brazil, dental care in the state sector is free of charge and offers limited services, predominantly clinical exams, tooth extractions, and fillings. The private system is financed by direct payment to the dentists and by private dental insurance. Employees had access to dental care through private health insurance, which included dental care in all specialties, except for dental implants, with a network of 700 registered professionals (380 general dental practitioners, 30 oral surgeons, 90 endodontists, 120 children's dentists, 130 orthodontists, 66 periodontists, 26 services of dental-maxilla-facial imaging, 3 stomatologists). Co-payment of dental procedures by the insured workers varied from 7% to 50% of the dental fee, according to the employees' salary with increasing percentage as the salary increases. Free choice of a dental provider was also available and employees using a provider outside the network have complete or partial reimbursements of the dental fees. Only 2% of the total amount paid for dental procedures is processed through the reimbursement system.

Definition of cases and controls

Cases were defined as all employees of the base population, who had undergone at least one tooth extraction from January 1, 2000 to December 31, 2001. We used the company's computerized dental insurance information system, in which tooth extraction procedures were recorded by means of code numbers, which identified each extracted tooth per employee registration number. We excluded employees who extracted only third molars and those who were subject to orthodontic dental care in the period of the study, as such extractions could be either preventive or auxiliary in orthodontic treatments, and may not necessarily represent an adverse oral health outcome.

For each case, two controls were randomly selected without matching from the list of employees without records of tooth extraction in the same period. The final sample of the study consisted of 181 cases and 362 controls.

Main exposure: socioeconomic position

The main explanatory variable was ''social stratum'', obtained from the combination of two indicators: the occupational position and the employee's monthly income. For the occupational position, employees were classified as professionals and technicians according to his/her occupational level during the period of the study (17, 18). Fifty percent of workers in the base population were professionals (business administrators, lawyers, system analysts, economists, statisticians, engineers, doctors, psychologists, geologists, chemists, accountants, and social assistants) with monthly salaries varying from U$950 to U$1850. The other employees worked in technician levels (maintenance, security guards, accounting, construction, projects, installation, systems, and administrative assistants) with monthly salaries varying from U$260 to U$1200.

The employee's monthly income was based on the basic monthly salary on 12/31/2001 and it was divided by the national minimum salary in force on that date, i.e. approximately U$80. Thus, the income is presented as the number of minimum salaries.

Employees were classified into four social strata according to their occupational level and monthly

income as follows: (i) social stratum 1: high-income professionals (between 18 and 21 national minimum salaries); (ii) social stratum 2: low-income professionals (between 11 and 17 national minimum salaries); (iii) social stratum 3: high-income technicians (between 8 and 14 national minimum salaries); and (iv) social stratum 4: low-income technicians (between 3 and 7 national minimum salaries).

Covariates

Other covariates included were age (in quartiles), gender (female/male) and number of years of employment.

Statistical analysis

We assessed the number of teeth extracted in each social stratum. Chi-square test and *t*-test for categorical and continuous variables, respectively, were used to assess whether the differences between cases and controls by social strata, age, gender, and years of employment were statistically significant. Logistic regression models were used to assess the association of tooth loss incidence with social strata adjusting for age and gender. Analyses were performed using Stata 6.0 (Stata Corporation, College Station, TX, USA).

The study protocol was approved by the Review Board of the Institute of Social Medicine of the State University of Rio de Janeiro.

Results

Excluding the employees who underwent tooth extractions of third molars only (190) and those who were under orthodontic treatment during the period of the study (106) (26 employees underwent both procedures), 181 employees had 264 teeth extracted. A 73% of the cases had one tooth extracted while 20% had two and seven percent, three or more teeth extracted in the 2-year period (Table 1).

In relation to gender, no statistically significant difference was found between cases and controls. Cases were, on average, 2.8 years older and worked in the company for 1.9 years more than the controls. A 63% of the cases and 42% of the controls consisted of people in social strata 3 and 4 (Table 2).

The variables ''years of employment in the company'' and ''age'' captured similar experience (multicollinearity). The final logistic model included three explanatory variables, ''social stratum'', ''age'' (in quartiles), and ''gender''.

Adjusted by age and gender, the individuals of social stratum 2, 3 and 4 presented odds of undergoing tooth extraction 1.79 (0.93–3.43), 2.91 (1.79–4.70) and 5.09 (2.69–9.63) times higher than individuals of social stratum 1. The unadjusted odds were much lower (Table 3).

Discussion

We found a strong suggestion of a gradient in the odds of undergoing tooth extraction, which extended from workers at the top of the social hierarchy down to those at the lower end. This gradient occurred across groups not so distant socially, as they were all nonmanual workers, resident in urban areas of a big city in Brazil.

When the population of this study started having access to comprehensive dental care through the company's dental insurance, they were relatively young, 25 years old, and maintained this access for

Table 1. Frequency of tooth extractions and of employees who underwent at least one tooth extraction in the period of the study[a] (cases), in each social stratum[b]

Number of teeth extracted	Social stratum 1 (n = 47)	Social stratum 2 (n = 21)	Social stratum 3 (n = 79)	Social stratum 4 (n = 34)	Number of employees (cases) (n = 181)
1	34	17	57	24	132
2	12	2	17	5	36
3	–	–	2	3	5
4	1	–	–	1	2
5	–	1	2	1	4
8	–	1	–	–	1
9	–	–	1	–	1
Total	62	34	116	52	264

[a]From 1/1/2000 to 12/31/2001; [b]1 = High-income professional, 2 = Low-income professional, 3 = High-income technician, 4 = Low-income technician.

Table 2. Characteristics of cases and controls

Variables	Cases (n = 181)	Controls (n = 362)	Total (n = 543)
Age (in years)			
Mean (SD)	47.2 (5.5)	44.4 (5.0)	45.3 (5.3)
Range	35–64	30–61	30–64
Gender			
Men	139 (76.8%)	285 (78.7%)	424 (78.1%)
Women	42 (23.2%)	77 (21.3%)	119 (21.9%)
Years of employment			
Mean (SD)	20.6 (6.1)	18.7 (5.5)	19.4 (5.8)
Range	3–39	2–37	2–39
Social stratum[a]			
1	47 (26.0%)	143 (39.5%)	190 (35.0%)
2	21 (11.6%)	68 (18.8%)	89 (16.3%)
3	79 (43.6%)	116 (32.0%)	195 (35.9%)
4	34 (18.8%)	35 (9.7%)	69 (12.7%)

[a]1 = , High-income professional; 2 = , Low-income professional; 3 = , High-income technician; 4 = , Low-income technician.

Table 3. Association of social strata with incidence of tooth extraction among a Brazilian insured working population

Social strata	Adjusted odds ratio[a] (95% CI)	Crude odds ratio (95% CI)
Social stratum 4	5.09 (2.69–9.63)	2.96 (1.66–5.26)
Social stratum 3	2.91 (1.79–4.70)	2.07 (1.34–3.21)
Social stratum 2	1.79 (0.93–3.43)	0.94 (0.52–1.69)
Social stratum 1	1.00	1.00

[a]Adjusted for age (in quartiles) and gender.

nearly 20 years; probably the experience analyzed over the 2 years of this study (2000/2001) partly reflects the history of the access and use of dental services offered by the health insurance plan of the company over the past 20 years. Our results are in line with Marmot and Wilkinson (1, 29) and with others (25–28, 30–33), who demonstrated that socioeconomic differences in general health remained even when individuals had access to health care. Access to dental care was not sufficient to equalize the tooth loss incidence (23).

The inequality in the odds of undergoing tooth extraction that we found may be a consequence of a higher incidence of oral diseases in individuals of lower socioeconomic status (24). The results may also reflect the option made by these individuals to extract teeth when they have to face the financial and technical implications required for complex dental treatments. Another explanation for such disparity could be the role played by dentists, who would offer fewer possibilities of complex dental treatment to patients of lower socioeconomic status, assuming that they have lower expectations (14, 7).

The number of years worked in the company up to 12/31/2001, representing the time a certain employee had been having access to the dental insurance plan, and, presumably had been obtaining preventative dental care, was a bit higher in the cases (20.6 years) than in the controls (18.7 years). This result suggests that such variable merely reflected the age of the employee. Age probably represented a cumulative factor of tooth exposure to oral diseases and habits related to oral health (19–21). As noted in a previous study (6), in this study, no difference was found between the sexes in the incidence of tooth extraction.

Limitations of this study include lack of control of other potentially important confounders such as smoking, the possibility of employees having tooth extractions outside the dental insurance network, and the lack of information about the number of teeth at baseline. Although smoking seems to be an important risk factor for tooth loss (10, 6, 22), smoking status could not be included in our study, as this information was not available during the period of the study. However, records of 1362 dental occupational exams in 2003 showed that smokers were distributed in a similar way among the various occupational strata. We may conclude that although smoking might have contributed, independently, to the incidence of tooth extraction, it would probably not alone be able to significantly change the difference found in tooth extractions among the four social strata.

Given the retrospective nature of the study, we were only able to retrieve administrative data of current employees as of 12/31/2001. This limitation prevented us from performing a cohort study.

However, during the 2 years of the study, only 10% of the 3708 base-population left the company; being 186 from social strata 1 and 2 and 197 from social strata 3 and 4. This indicates that losses were balanced between the social strata and biases are likely to be small.

The possibility of having tooth extractions outside the dental insurance network may underestimate the association, as low-social-strata employees may be more likely to have a tooth extraction in public dental services. The lack of information about the number of teeth at baseline may also underestimate the association, as low-social-strata employees more likely have had fewer teeth exposed (at risk) during the study period.

In our study, the adjusted odds ratios were bigger than the crude ones, probably because higher social stratum protects against tooth loss, age (confounding) increases the risk of tooth loss, and the employees in the higher strata are older. Therefore, age reduced the force of the crude association between social strata and tooth extraction.

In conclusion, lower social strata were strongly associated with increased risk of having teeth extracted. Therefore, dental insurance was not able to equalize the chances of tooth extraction among different social strata, in a population of employed adults. Studies should be carried out to analyze how social strata may influence the decision made by dentists and patients to extract or to keep a tooth. Such information could help to reduce social inequality in tooth extractions.

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Conflict of interest

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