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Social inequalities and dental caries in six-year-old children from the Netherlands

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ABSTRACT

Objectives: The purpose of our study was to investigate the association of different socioeconomic and sociodemographic factors with dental caries in six-year-old children. Furthermore, we applied a district based approach to explore the distribution of dental caries among districts of low and high socioeconomic position (SEP).

Methods: In our cross-sectional study 5189 six-year-olds were included. This study was embedded in a prospective population-based birth cohort study in Rotterdam, the Netherlands, the Generation R Study. Parental education level, parental employment status, net household income, single parenting, and teenage pregnancy were considered as indicators for SEP. Dental caries was scored on intraoral photographs by using the decayed, missing, and filled teeth (dmft) index. We compared children without caries (dmft = 0) to children with mild caries (dmft = 1–3) or severe caries (dmft > 3). Multinomial logistic regression analyses and binary logistic regression analyses were performed to study the association between SEP and caries, and between district and caries, respectively.

Results: Only maternal education level remained significantly associated with mild caries after adjusting for all other SEP-indicators. Paternal educational level, parental employment status, and household income additionally served as independent indicators of SEP in children with severe caries. Furthermore, living in more disadvantaged districts was significantly associated with higher odds of dental caries.

Conclusion: Dental caries is more prevalent among six-year-old children with a low SEP, which is also visible at the district level. Maternal educational level is the most important indicator of SEP in the association with caries.

Clinical significance: Our results should raise concerns about the existing social inequalities in dental caries and should encourage development of dental caries prevention strategies. New knowledge about the distribution of oral health inequalities between districts should be used to target the right audience for these strategies.

1. Introduction

Dental caries in children leads not only to tooth pain, but also leads to significant health losses in a population, affecting the quality of life of both children and their parents [1–3]. Moreover, it leads to considerable costs in the short and long term [4]. Identifying high-risk populations for developing dental caries can help to lower the incidence of these health issues by targeting the right audience with preventive strategies.

It is well known that a lower socioeconomic position (SEP) is related to poorer health outcomes [5]. This also seems to apply for oral health outcomes. For example, a recent meta-analysis by Schwendicke et al. [6] showed a low socioeconomic position (SEP) to be significantly associated with a higher risk of having dental caries in both children and adults. Various other studies in oral health research also presented a higher caries prevalence in children with a low SEP [7–9]. Possible mediating pathways for the association between SEP and caries, however, have been suggested but have not been studied well yet.

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Moreover, among these studies SEP was not measured in a uniform way. Often only one or two indicators for SEP are chosen, i.e. parental educational level, household income or parents' employment status. In the Netherlands, maternal educational level or residential neighborhood are most commonly used as indicator for SEP [10–12]. However, different studies have advised using more than one or two indicators of SEP. This may increase comparability and may avoid residual confounding [6,13]. Therefore, we wanted to study all advised indicators for family SEP in relation to dental caries [13].

Recently, dental caries was found to be clustered in more deprived areas within a country and even within a city [14–16]. This could be associated with clustering of low SEP families within a particular district. Less access to dental care within a district due to a lower density of available (pediatric) dentists could also be an explanation. It is important to distinguish between these explanations, since this information could help to improve targeting of preventive strategies. Moreover, possible weaknesses within a living area, perpetuating health inequalities, could be identified. Therefore, we also wanted to study the distribution of caries in the city of Rotterdam, the Netherlands. With this information we hoped to answer the question whether possible differences could be only explained by differences in social background or also by characteristics of the district itself.

Summarizing, the purpose of our study was to investigate the association of different socioeconomic and sociodemographic factors on dental caries in six-year-old children. Furthermore, we applied a district approach to explore the distribution of dental caries within the city of Rotterdam, the Netherlands. With this information we also tried to identify possible explanations of the identified differences between districts.

2. Materials & methods

2.1. Study design

We conducted a cross-sectional study, embedded in the Generation R Study, situated in the city of Rotterdam, the Netherlands. The Generation R Study is a prospective population-based cohort study and was designed to identify environmental and genetic determinants of growth, development and health. The design of this cohort is described in detail elsewhere. For this purpose, children have been followed from fetal life until adulthood in Rotterdam, the Netherlands [17]. The Medical Ethics Committee of Erasmus Medical Center, Rotterdam, approved this study (MEC-2007-413). All participants of this study gave written informed consent.

2.2. Study population

All pregnant women with a delivery date between April 2002 and January 2006 and who lived in the study area of Rotterdam, the Netherlands, were eligible for participation in the Generation R Study. From all included children, 8305 mothers gave consent to participate in the school aged period (5 years onwards) of the Generation R Study. Ultimately, 6690 children had actually visited the research center. From these, we excluded all participants with incomplete information on dental caries (n = 1367) and all twin participants (n = 134), leaving a total study population of 5189 children.

2.3. Socioeconomic position

Since young children cannot have yet established their own socioeconomic level, they were classified according to their parents' socioeconomic position. We named this family SEP. We considered the following socioeconomic and sociodemographic factors as indicators for family SEP: parental education level, parental employment status (paid job vs. unpaid job), net household income, parenting, and teenage pregnancy. Educational level was categorized based on the Dutch Standard Classification of Education [18]. We defined four educational levels that could be obtained by a parent: low (no education, primary school, lower vocational training, intermediate general school, or three years or less general secondary school), mid-low (more than three years general secondary school, intermediate vocational training, or first year of higher vocational training), mid-high (higher vocational training), and high (university or PhD degree). Paternal and maternal employment status was defined as paid job or no paid job. Net household income was divided into three categories; < 2000 euro/month, 2000–3200 euro/month and > 3200 euro/month. Teenage pregnancy was defined as pregnancy in girls aged 19 years or younger and was based on maternal age at enrolment. All information on socioeconomic and sociodemographic factors were obtained by questionnaires [17].

2.4. Dental caries

We scored the presence of dental caries on intraoral photographs by using the decayed, missing, and filled teeth index (dmft index). We took these pictures with either the Poscam USB intraoral (Digital Leader PointNix) or Sopro 717 (Acteon) autofocus camera. Both cameras had a resolution of 640 × 480 pixels and a minimal scene illumination of 1.4 and 30 lx. The usage of intraoral photographs, compared to ordinary oral examination, in scoring dental caries with a dmft index has been described elsewhere and showed to have high sensitivity and specificity (85.5% and 83.6% respectively) [19]. Furthermore, we evaluated intra-observer reliability (K = 0.98) and inter-observer reliability (K = 0.89), both indicating an almost perfect agreement [20].

For the analyses, we categorized the children as having no dental caries (dmft = 0), having mild caries (dmft = 1–3), or having severe caries (dmft > 3). The cut-off values for mild and severe caries were based on the mean dmft index of five-year-old Dutch children obtained from a recent report by Schuller et al. [21].

2.5. Covariates

We considered children's age, sex, ethnicity, and oral health behavior as potential confounders in the relationship between dental caries and SEP. Children's ethnicity was based on the birth country of both parents [22]. If one of the parents was born in another country than the Netherlands, the child's ethnicity was defined as the birth country of that parent. Birth country of the mother was conclusive if both parents were born in another country. For this study we categorized children into two different groups; Dutch/Western and non-Western. Mothers had to fill in questionnaires on oral health behavior of their children at age six. Oral health related behavior was measured by age at first dental visit (0–3 years, > 3 years, or never), dental visits in the past year (yes or no), and tooth brushing frequency (once a day, twice a day, or more than twice a day).

2.6. District approach

To compare caries prevalence between districts with different levels of SEP, the four-digit postal codes were collected from the mothers when the children were six years of age. The postal code had to be their current living area at the moment of dental caries measurement. We only considered children living in the city of Rotterdam, the Netherlands, for analysis (n = 3942). In general, Rotterdam has fourteen different districts (Centrum, Prins Alexander, Pernis, Overschie, Noord, Kralingen-Crooswijk, IJsselmonde, Hoogvliet, Hoek van Holland, Hillegersberg-Schiebroek, Feijenoord, Delfshaven, Charlois, and Rozenburg), however we excluded Pernis, Hoek van Holland, and Rozenburg due to low sample sizes within these districts (n < 20). We ranked the districts from socioeconomically weakest to strongest district, using individual based indicators of SEP. For this, we calculated the prevalence of low SEP, for each SEP indicator, within a district. Afterwards, we took the sum of these to calculate a total prevalence of