



Social gradients in oral health status in Korea population

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ABSTRACT

Objectives: The aim of the present study was to investigate whether clinical (severe tooth loss) and subjective (chewing difficulties) indicators of oral health outcomes are associated with socioeconomic position and to explore the age-sex differences in the magnitude of the social gradient in Korea using data from the representative national data.

Methods: Data were acquired from 10,939 men and women, ≥ 30 years of age who participated in the Korea National Health and Nutrition Examination Surveys conducted from 2012 to 2014. Education and income were used as socioeconomic position. Self-rated chewing difficulties and severe tooth loss were assessed by dentists and trained interviewers. Confounding variables were demographic factors, general health behaviors, and systemic health status.

Results: Significant differences in oral health outcomes were observed according to the quartiles of income and education. In particular, the quartiles of education were significantly associated with oral health outcomes in the fully adjusted model with a dose-response trend. In participants aged 40–49 (OR = 2.30, 95% CI = 1.37–3.88) and 50–59 years (OR = 2.16, 95% CI = 1.49–3.14), the associations between the lowest quartiles of income and chewing difficulties were stronger than in the total population.

Conclusions: Our findings demonstrate a clear and distinct social gradient in clinical and subjective oral health indicators based on socioeconomic position.

1. Introduction

Research has documented socioeconomic disparities in morality (Giesinger et al., 2014; Pillay-van Wyk & Bradshaw, 2017) and general health outcomes (Sabbah, Tsakos, Chandola, Sheiham, & Watt, 2007). As with other chronic diseases, oral disease disproportionately affects socially disadvantaged members of society and produces a substantial social gradient in many studies (International Centre for Oral Health Inequalities Research & Policy, 2015). In other words, studies have shown that individuals of lower socioeconomic position are more likely to have poorer oral health status.

Most epidemiological studies demonstrated an association between socioeconomic position and various oral health outcomes, including self-reported oral health status (Tsakos, Demakakos, Breeze, & Watt, 2011), chewing difficulties (Di Bernardi, Tsakos, Sheiham, Peres, & Peres, 2016), periodontal disease (Lee & Han, 2016; Sabbah et al., 2007), tooth loss (Han & Khang, 2016; Ravaghi, Quinonez, & Allison, 2013), and edentulism (Cunha-Cruz, Hujuel, & Nadanovsky, 2007; Elani, Harper, Allison, Bedos, & Kaufman, 2012; Tsakos et al., 2011).

In the Korean National Health and Nutrition Examination Survey (KNHANES) 2014, 61.5% of respondents stated that they had ≥ 20

natural teeth, and the prevalence of chewing difficulty was 43.8%, respectively (Korea Center for Disease Control & Prevention, 2014). These results have changed positively since 2000 and improvement and maintenance of oral health status is now one of the major oral health policies of the Korean government among Korean elders (Korea Center for Disease Control & Prevention, 2016).

Some studies have reported age and sex differences in the pattern of oral health inequalities in terms of the number of natural teeth (Ravaghi et al., 2013; Shen, Wildman, & Steele, 2013; Steele et al., 2015) and self-reported oral health status (Shen et al., 2013). Until now, no study has examined the social gradient of oral health outcomes according to age and sex of Korean adults. Additional evidence is needed to determine whether the social gradient and magnitude of oral health in Korea differs according to age group and sex in Korean adults. In addition, we included severe tooth loss and chewing difficulties, which are meaningful indicators of oral health in all Koreans (Locker, 2002).

The aim of the present study was to investigate whether clinical (severe tooth loss) and subjective (chewing difficulties) indicators of oral health outcomes are associated with socioeconomic position and to explore the age-sex differences in the magnitude of the social gradient

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in Korea using data from the KNHANES 2012–2014.

2. Methods

2.1. Study design

The present analysis is based on data from the 2012–2014 KNHANES, an ongoing surveillance system in Korea. KNHANES is a nationwide cross-sectional survey conducted every year since 1998 by the Korea Centers for Disease Control and Prevention (KCDC) (Kweon et al., 2014). The target population consists of nationally representative non-institutionalized Korean citizens. The sampling framework of the KNHANES uses the most recent National Census data. The sampling plan follows a complex, stratified, multistage, and probability-cluster design. The sampling method is a two-stage stratified sampling method with survey area and household as the first and second sampling units. The sampling frame was stratified based on province and city, town and village, housing type, and the ratio of residential area and education of the head of household was used as internal stratification criteria (Kweon et al., 2014).

A total of 192 primary sampling units (PSUs) were chosen from geographical PSUs in Korea over the 3 years. A total of 567 PSUs were extracted for the 3 years, and the final 20 sampled households were selected using the systematic sampling method. All household members aged ≥ 1 year were selected as the target population. Sample weights were constructed for the sample participants to represent the Korean population by accounting for the complex survey design, survey non-response, and post-stratification. The weights based on the inverse of the selection probability and response rate were modified by adjusting them to the age- and sex-specific Korean population. A more detailed explanation of the sampling and selection methods in KNHANES is available (Kweon et al., 2014; Shin, 2017).

KNHANES provides information about participant socio-demographic factors, health and oral health status, and nutritional status from a health interview, an oral and health examination, and a nutrition survey. The national survey was approved by the Institutional Review Board of the KCDC (2012-01EXP-01-2C, 2013-07CON-03-4C, and 2013-12EXP-03-5C). The individual health questionnaire data were collected in face-to-face interviews. The physical examinations and blood sampling were performed at a mobile examination center, and clinical measurements were carried out by trained medical personnel. The participation rates were 80% in 2012, 79.3% in 2013, and 77.8% in 2014.

2.2. Eligibility and exclusion criteria

A total of 23,626 respondents participated in the 2012–2014 KNHANES. Of these, adults aged > 30 years were included in the analysis. Because the prevalence of severe tooth loss and chewing difficulties was very low for participants in their 20s, participants aged < 30 years were excluded from analyses ($n = 7196$). Exclusion criteria for the 16,430 participants aged > 30 years were as follows: 1) those who did not receive an oral examination or health interview (including socioeconomic status variables) and 2) those with missing information for the confounders. The final sample comprised 10,939 participants (4516 males and 6423 females, age range: 30–93 years; mean age: 52.7 years), and 5491 participants were excluded.

2.3. Assessment of the oral health outcomes

Presence or absence of chewing difficulties (subjective oral health outcome) and severe tooth loss (clinical oral health outcome) were used as outcome variables.

One of the most critical consequences of oral disorders is reduced chewing ability (Locker, 2002). Self-rated chewing difficulty was assessed through the question “Do you have difficulties chewing food due

to intraoral problems, including teeth, gums, or dentures? (If you are using dentures, please select the condition you have while wearing the dentures.)”. A trained interviewer interviewed the participants using a structured questionnaire. The survey staff members were required to complete an intensive training course seven times per year and to conduct supervised practice before working on the survey. The response options were assessed by a 5-point rating scale: very much, quite a lot, some, very little, or not at all. The response options were dichotomized into no (some, very little, and not at all) and yes (very much and quite a lot). The criteria for this categorization were based on the annual KNHANES report (Korea Center for Disease Control & Prevention, 2014). The prevalence of chewing difficulties is an indicator that has been monitored in the elderly.

A trained dentist conducted a full-mouth oral examination and recorded dental status to obtain information on the number of existing permanent teeth. Calibration for dental status was conducted annually and the mean kappa values for interexaminer reliabilities were as follows: 0.892 in 2012, 0.931 in 2013, and 0.920 in 2014.

The number of existing permanent teeth was obtained after excluding implants, missing teeth, impacted teeth, and wisdom teeth. According to the World Health Organization report (World Health Organization, 1992), having ≥ 20 natural teeth is defined as functional dentition. Retention of a minimum of 20 natural teeth is also a key indicator of the oral health plan in Korea (Korea Center for Disease Control & Prevention, 2014). The number of existing permanent teeth was dichotomized into having ≥ 20 teeth and having ≤ 19 teeth. As with previous evidence (Han, Khang, & Lee, 2015; Shin, 2017), severe tooth loss was defined as having ≤ 19 teeth.

2.4. Assessment of the socioeconomic position

Education and income were used to define socioeconomic position. Trained interviewers rated socioeconomic position in face-to-face interviews. Information on education level was collected by asking the participants to indicate the highest level of education they had achieved (It was classified as previous education if completed, dropped out, enrolled, or absent from school). We categorized the level of education into four groups: below primary school (lowest), middle school, high school, and college or higher (highest).

Income was collected by asking participants for their monthly household income. Monthly household income was adjusted for the number of household members and divided into quartiles as follows: first quartile (lowest), second quartile, third quartile, and fourth quartile (highest) of total equivalized income.

2.5. Assessment of potential confounders

Confounders in this study included demographic factors, health-related behavioral factors, and health status variables.

Interviews using structured questionnaires were administered to assess potential confounders. Age, sex, and area of residence were selected as the demographic factors. Age was categorized into four groups for statistical analyses: 30–39 years, 40–49 years, 50–59 years, ≥ 60 years. The area of residence was classified into urban (called *Dong*) and rural (called *Eup* and *Myeon*) according to administrative district.

Health-related behaviors included smoking, dental visits, and tooth-brushing frequency. The participants were asked whether they were currently smoking, and the answers were categorized into: no (never smoker and past smoker) and yes (current smoker). Regular dental checkups were identified by asking “Have you visited a dentist to determine your oral health condition without any oral problems during the last year?” The answers were categorized into: no and yes. Daily tooth-brushing frequency was assessed by asking the following question “How many times did you brush your teeth yesterday?” The answers were grouped into less than two times and two or more times.

In order to obtain information regarding the general health status,

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