



Dental Care Utilization for Examination and Regional Deprivation

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Objectives: Receiving proper dental care plays a significant role in maintaining good oral health. We investigated the relationship between regional deprivation and dental care utilization.

Methods: Multilevel logistic regression was used to identify the relationship between the regional deprivation level and dental care utilization purpose, adjusting for individual-level variables, in adults aged 19+ in the 2008 Korean Community Health Survey (n=220 258).

Results: Among Korean adults, 12.8% used dental care to undergo examination and 21.0% visited a dentist for other reasons. In the final model, regional deprivation level was associated with significant variations in dental care utilization for examination ($p < 0.001$). However, this relationship was not shown with dental care utilization for other reasons in the final model.

Conclusions: This study's findings suggest that policy interventions should be considered to reduce regional variations in rates of dental care utilization for examination.

Key words: Utilization, Dental care, Dental health surveys, Residence characteristics, Multilevel analysis

INTRODUCTION

Accessing suitable dental care services is a vital component of good oral health management [1]. The population subgroup with a high socioeconomic status pays significantly more frequent visits to the dentist, which is directly correlated with a higher level of oral health [2,3]. Furthermore, the population subgroup with a high quality of life with respect to oral health is known to visit the dentist for asymptomatic care; the higher

the regional deprivation level, the higher the tendency toward symptomatic visits rather than regular dental check [4,5]. In other words, going to the dentist for a regular check-up as asymptomatic care, rather than only for need-driven symptomatic visits, is closely related to oral health and, above all, crucial for the early detection of oral disease.

Additionally, many studies have shown that various community-specific characteristics of the environment and socioeconomic characteristics are associated with the health index of the residents of that community [6]. Likewise, oral health markers such as perceived oral health status and dental care, as well as dental care utilization, are known to be associated with the socioeconomic characteristics of the local community and its socioeconomic performance [5,7,8].

What, then, is the relationship between visits for dental check-ups and the material deprivation of the local community independently from individual oral health? To explore this relationship, it is essential to understand regional socioeconomic char-

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acteristics distinguished from individual characteristics.

To better understand the regional contextual effect, a large number of recent studies dealing with other interlocal health inequalities have used a multilevel analysis [9-12]. Two errors could be introduced when analyzing data with multilevel structures, namely errors at an individual and a regional level. First, if data are analyzed only at an individual level without considering regional differences in dental care utilization, characteristics of regions with a higher number of samples could excessively influence the dependent variable of dental care utilization. Second and conversely, if only the correlation between the regional deprivation index and the dependent variable of regional dental care utilization rate is analyzed, without considering individual dental care utilization, a significant correlation could emerge, even though individual dental care utilization is not related to the regional deprivation index in reality.

Multilevel analysis is considered a highly useful tool in studying the correlation between individual health and regional socioeconomic characteristics, in that it interlinks lower and higher levels and allows an analysis within one model [13,14]. Thus, it is reasonable to use a multilevel analysis method to calculate the correlation between the material deprivation of a local community, individual dental care utilization for examination, and the contextual effect thereof.

The deprivation index is a representative variable of regional socioeconomic characteristics that is conceptualized as a multidimensional phenomenon reflecting a regional picture of a lack of material resources and a lack of social participation. The deprivation index has a broad spectrum of applications, from the replacement of a simple individual-level socioeconomic index to regional-level variables representing regional socioeconomic characteristics. Its association with oral health has already been proven by many studies [15-17]. Indices of deprivation such as the Townsend index and the Carstairs index have been used, mainly in the UK; in Korea, an adapted Korean version has been developed [18-20].

A study on individual-level and regional-level factors associated with dental care utilization for examination, which has a crucial impact on oral health and the related quality of life, will be useful for informing policy development that promotes the oral health of community residents and establishes a more equitable system of medical service utilization. Thus, this study has been conducted to investigate whether regional deprivation is associated with dental care utilization specifically for asymptomatic examination.

METHODS

Data Sources

We used a data set from the 2008 Community Health Survey (CHS) in this study. The CHS is Korea's only survey on the health status of local residents at the levels of the city (si), county (gun) and district (gu); it is conducted every year and targets adults aged 19 and above. It provides information on the residents' health level, healthy life habits, and use of medical services. The 2008 CHS was conducted from September 1 to November 30 [21].

Taking into account the type of housing and the regions, the community health survey sample was intended to include about 800 individuals from each of the 251 districts. However, because of the adjustment of districts in Korea, the survey was performed in 247 districts, and the final number of subjects after the survey was 220 258. In the community health survey, well-trained interviewers visited and conducted interviews at each sampled household in 247 districts.

Regional-level Variable

This study used the deprivation index for Korea. This index was developed in 2009 by Shin et al. [20] using 2% of the sample survey data from the 2005 Population and Housing Census, along with the data provided at the administrative units of city (si), county (gun), and district (gu). Table 1 shows the subordinate composition indexes included in this index. The final index value was calculated as the average Z-score of the composition indexes of the cities and rural regions.

These regional variables were found to have sufficient validity by Shin et al. [20], and thus were integrated and analyzed along with the data from the 2008 CHS.

Individual-level Variables

Individual characteristics were collected through the CHS data. Age and gender were selected as demographic variables, while education level, income level, economic activity status, and cohabitation with spouse were used as variables reflecting socioeconomic status. Education level was divided into 'no formal education', 'elementary school graduate', 'middle/high school graduate', and 'university and higher'; income level was divided into five levels according to respondents' 'monthly average household equivalent income', which was calculated by dividing household income by the square root of the number of household members.

Table 1. Description on the deprivation index for Korea

Variables	Definition
Ratio of poor residential environments	Ratio of houses with no separate kitchen, no water supply, no hot water for the bathroom, or no flushing toilet
Ratio of aging population	Ratio of elderly individuals 65 years or older in the total population
Ratio of people with academic backgrounds lower than high school	Ratio of individuals with education level below high school graduation among the population of those 25-64 years old
Ratio of lower class members of households	Ratio of all households in a family that belongs to lower than class V on the basis of the family member with the highest social class in terms of the classification of the social level of families
Ratio of apartment households	Ratio of apartment residences
Ratio of single occupant households	Ratio of single-occupant households
Ratio of female householders	Ratio of families with a woman as head of household
Ratio of households without cars (city)	Ratio of households without a car (passenger car) for commuting
Ratio of households without cars (rural area)	Ratio of households without any car (including passenger car, van, or truck/other)

Outcome Variables

For the outcome variables, we created two variables according to the purpose of the dental utilization—‘dental care utilization for examination’ and ‘dental care utilization for other reasons’—using the CHS data. Among people who responded that they had visited the dentist within the past year (assessed by the question, ‘Have you visited a dental clinic in the past year?’), those who responded ‘yes’ to the question, ‘Have you received an oral examination in the past year for purely examination purposes’, were classified as having used dental care ‘for examination,’ while those who responded ‘no’ were classified as having used dental care ‘for other reasons.’ Since this study focused on the purpose of the dental utilization, the actual type of the treatment received was not considered.

Statistical Analysis

To examine the relationship of the deprivation index on dental care utilization purpose and study the regional contextual effects, this study integrated the deprivation index for Koreans into the CHS data and conducted a multilevel logistic regression analysis, using HLM version 7.0 (SSI Inc., Chicago, IL, USA). First, a two-level random intercepts model was fit to the outcome of dental care utilization (null model). We then added the deprivation index for Koreans to the null model in order to evaluate the association between dental care utilization and regional-level variables (model 1). The deprivation index was divided into 5 categories (dep 1 = least deprived, dep 5 = most deprived). Model 2 evaluated the association between dental care utilization and individual-level variables. Age, gender, economic activity status (yes = 1), cohabitation with spouse (yes = 1), education level (edu 1 = no formal education, edu 2 = elementary school graduate, edu 3 = middle/high school graduate, edu 4 = univer-

sity and higher), and income level (income 1 = lowest income, income 5 = highest income) were used as individual-level socioeconomic variables (model 2). Finally, to examine how regional-level variables contribute to interregional variations in dental care utilization including individual-level variables, the deprivation index was added to model 2 (model 3). A total of 184 405 individuals nested within 247 districts were included in the main analysis.

The multilevel analysis results are presented as adjusted odds ratios, with 95% confidence intervals (CI) and intraclass correlation coefficients (ICCs). The ICC represents the level of common experience (group homogeneity) shared by individuals who are temporally and spatially close, and it may be interpreted as a proportion of the variation in the outcome variable by a higher-level unit [22].

RESULTS

Table 2 shows the distribution of dental care utilization purposes according to the sociodemographic characteristics and regional deprivation level of the 2008 CHS respondents. The percentage of Korean adults who used dental care for examination was 12.8%, which was lower than the percentage of those using dental care for other reasons (21.0%). There was a difference in the sociodemographic distribution and regional deprivation level of survey participants according to the dental care utilization purpose. Dental care utilization for examination was significantly higher among people of younger age (excluding the 19 to 29 age group), those living with their spouse, those engaged in economic activity, those with higher income, those with higher education levels, and those in a lower deprivation index group. However, there was no upward or downward trend

Table 2. Demographic and socioeconomic status of subjects in relation to dental care utilization purpose

	Total	Oral examination		Other reasons	
		n (%)	p-value	n (%)	p-value
Individual level					
Age (y)			<0.001		<0.001
19-29	26 074	3735 (14.3)		5101 (19.6)	
30-39	40 047	6767 (16.9)		7610 (19.0)	
40-49	44 837	7208 (16.1)		9215 (20.6)	
50-59	39 078	5254 (13.4)		9071 (23.2)	
60-69	35 766	3480 (9.7)		8581 (24.0)	
>70	34 456	1850 (5.4)		6711 (19.5)	
Gender			0.86		0.39
Men	101 358	13 007 (12.8)		21 220 (20.9)	
Women	118 900	15 287 (12.9)		25 069 (21.1)	
Cohabitation status with spouse ¹			<0.001		<0.001
Yes	151 447	21 116 (13.9)		33 045 (21.8)	
No	37 101	2989 (8.1)		7514 (20.3)	
Economic activity status ¹			<0.001		0.02
Yes	132 811	18 626 (14.0)		28 127 (21.2)	
No	87 389	9657 (11.1)		18 157 (20.8)	
Income ¹			<0.001		0.03
Low	36 712	2288 (6.2)		7669 (20.9)	
Middle-low	34 542	3040 (8.8)		7414 (21.5)	
Middle	37 498	4632 (12.4)		7842 (20.9)	
Middle-high	37 347	5749 (15.4)		8095 (21.7)	
High	35 911	7595 (21.1)		7662 (21.3)	
Education ¹			<0.001		<0.001
No formal education	22 562	863 (3.8)		3857 (17.1)	
Elementary school	42 566	2875 (6.8)		9510 (22.3)	
Middle/high school	92 624	11 724 (12.7)		20 138 (21.7)	
University and higher	62 435	12 821 (20.5)		12 773 (20.5)	
Regional level					
Dep 1	42 179	8455 (20.0)	<0.001	9163 (21.7)	<0.001
Dep 2	46 780	7048 (15.1)		9555 (20.4)	
Dep 3	43 989	5439 (12.4)		9601 (21.8)	
Dep 4	43 525	3994 (9.2)		9263 (21.3)	
Dep 5	43 785	3358 (7.7)		8707 (19.9)	
Total	220 258	28 294 (12.8)		46 289 (21.0)	

Dep, deprivation.

¹Non-response data excluded.

in the percentage of dental care utilization for other reasons among groups by income, education, or deprivation index.

The Association Between Regional Deprivation and Dental Care Utilization for Examination

The average percentage of dental care utilization for examination in survey participants was 12.8% (Table 2). In particular,

when rates of dental care utilization for examination were compared depending on the regional material deprivation index variable, the difference in the rates of dental care utilization for examination was 12.3% between the region with the highest deprivation level and the region with the lowest deprivation level.

In the null model, the estimated ICC was 0.111 (i.e., 11.1% of the variance was explained with significance by the regional

Table 3. Random intercepts model for dental care utilization for oral examination other reasons

	Oral examination				Other reasons			
	Null model	Model 1	Model 2	Model 3	Null model	Model 1	Model 2	Model 3
Fixed effect								
Intercept	0.13 (0.12, 0.14)**	0.24 (0.22, 0.27)**	0.27 (0.25, 0.29)**	0.39 (0.35, 0.43)**	0.26 (0.25, 0.27)**	0.27 (0.25, 0.30)**	0.27 (0.26, 0.29)**	0.28 (0.26, 0.31)**
Age			1.00 (1.00, 1.00)	1.00 (1.00, 1.00)			1.01 (1.01, 1.01)**	1.01 (1.01, 1.01)**
Gender			1.16 (1.13, 1.20)**	1.16 (1.13, 1.20)**			1.01 (0.99, 1.03)	1.01 (0.99, 1.03)
Cohabitation			0.85 (0.80, 0.89)**	0.84 (0.80, 0.89)**			0.94 (0.91, 0.97)**	0.94 (0.91, 0.97)**
Economic activity			0.93 (0.89, 0.97)**	0.92 (0.89, 0.96)**			0.98 (0.95, 1.01)	0.99 (0.96, 1.02)
Edu 1			0.21 (0.19, 0.23)**	0.21 (0.19, 0.24)**			0.67 (0.62, 0.71)**	0.67 (0.62, 0.72)**
Edu 2			0.34 (0.32, 0.37)**	0.35 (0.32, 0.37)**			0.96 (0.91, 1.00)	0.96 (0.91, 1.01)
Edu 3			0.59 (0.56, 0.61)**	0.59 (0.56, 0.61)**			1.02 (0.98, 1.06)	1.02 (0.98, 1.06)
Income 1			0.66 (0.61, 0.71)**	0.66 (0.61, 0.71)**			1.03 (0.98, 1.08)	1.03 (0.98, 1.08)
Income 2			0.69 (0.64, 0.74)**	0.69 (0.65, 0.74)**			1.04 (0.99, 1.09)	1.04 (0.99, 1.09)
Income 3			0.78 (0.73, 0.82)**	0.78 (0.74, 0.82)**			1.00 (0.96, 1.05)	1.00 (0.96, 1.05)
Income 4			0.90 (0.86, 0.94)**	0.90 (0.86, 0.94)**			1.03 (0.99, 1.07)	1.03 (0.99, 1.07)
Dep 2		0.70 (0.61, 0.83)**		0.78 (0.67, 0.91)*		0.90 (0.78, 1.04)		0.92 (0.79, 1.06)
Dep 3		0.55 (0.47, 0.65)**		0.67 (0.57, 0.79)**		1.00 (0.89, 1.14)		1.03 (0.91, 1.17)
Dep 4		0.39 (0.32, 0.47)**		0.56 (0.47, 0.67)**		0.97 (0.86, 1.09)		0.97 (0.86, 1.10)
Dep 5		0.30 (0.24, 0.37)**		0.50 (0.41, 0.62)**		0.85 (0.72, 1.01)		0.86 (0.73, 1.02)
Random effect								
Intercept (variance)	0.410**	0.229**	0.274**	0.220**	0.142**	0.141**	0.137**	0.136**
ICC	0.111	0.065	0.077	0.063	0.041	0.041	0.040	0.040
Deviance	622 205.60	622 095.40	529 831.60	529 877.40	623 434.00	623 467.60	533 804.00	533 836.80
Reliability	0.969	0.946	0.947	0.935	0.951	0.950	0.942	0.941

Values are presented as odds ratio (95% confidence interval) and random effect including intercept, ICC, deviance, and reliability. Reference groups: gender, men; cohabitation with spouse, yes; economic activity, yes; education, university and higher (edu 4); income, high (income 5); deprivation, low (Dep 1).
Edu, education; Dep, deprivation; ICC, intraclass correlation coefficient.
* $p < 0.05$, ** $p < 0.01$.

level variables; Table 3). When other variables were not considered, the relationship between dental care utilization for examination and regional deprivation was significant (model 1, $p < 0.001$). However, the reduction in the ICC between the null model and model 2 (from 0.111 to 0.077, respectively) implies that some of the regional variations are related to the clustering of individual socioeconomic characteristics. In model 2, all factors except for age (i.e., gender, education, cohabitation status, and income) were significantly related to dental care utilization for examination. In the final model (model 3), regional deprivation level showed a significant relationship to dental care utilization for examination, with an ICC of 0.063 ($p < 0.001$).

The Association Between Regional Deprivation and Dental Care Utilization for Other Reasons

The percentage of dental care utilization for other reasons among the survey participants was 21.0%, and there was no clear difference according to the regional deprivation level (Table 2). In the null model, the ICC was 0.041, which indicated that there were differences in dental care utilization for other reason across regions (Table 3). Unlike dental care utilization for examination, dental care utilization for other reasons did not show a significant relationship with regional deprivation in model 1. In model 2, we found that age, cohabitation status, and low education level significantly decreased participants' odds of using dental care for other reasons, while gender, economic activity status, and income level did not show significant relationships. In the final model, which included both regional and individual variables, the regional deprivation index did not show a significant relationship with dental care utilization for other reasons; furthermore, the ICC was 0.040, which was not much different from that in the null model (0.041; $p < 0.001$).

DISCUSSION

Main Finding of This Study

The results of this study showed that there were clear disparities in dental care utilization for examination among regions of Korea, and such regional differences were independent from individual level socioeconomic factors. Korean adults living in regions without severe regional deprivation were more likely to use dental care for oral examination than were those living in regions with severe regional deprivation, indicating that context has a clear effect on dental care utilization for examina-

tion. On the other hand, there were no regional variations in dental care utilization for other reasons, and individual socioeconomic factors had relatively little influence on this variable.

What IS Already Known on This Topic

Researchers in many countries have verified the association between regional deprivation and dental care utilization in adults [5,23]. Locker and Ford [23] reported that regional differences influence dental care utilization of Americans aged 50 and above, independently of their socioeconomic status. Lang et al. [5] showed that disparities in regional dental care utilization differ according to the reason for the visit (asymptomatic/symptomatic).

A study in Korea also reported that the dental care utilization of senior citizens aged 65 and above living in Seoul showed regional disparities according to the material deprivation level [24]. However, no prior study has measured whether the regional deprivation level has a contextual effect on dental care utilization purpose, independent of the effect of individual socioeconomic status, and particularly targeting all adults in Korea.

What This Study Adds

This is the first study to examine the association between dental care utilization for examination or other reasons and regional deprivation level across all districts in Korea. This study aimed to examine how dental care utilization purpose was differentially affected by contextual variables, by classifying dental care utilization purposes as 'examination' and 'other reasons'. This study used multilevel analysis to reveal that differences in dental care utilization for examination between regions are caused by compositional effects (i.e., individual-level socioeconomic gaps) as well as by the contextual effect of regional level. It showed that asymptomatic dental care use, specifically oral examinations and general dental care utilization were influenced differently by these variables, which is similar to the research findings of Lang et al. [5], conducted in Scotland.

Dental care utilization is affected by various factors such as individual concern, dental expenses, belief in the importance of regular dental examinations, household income, education level, unemployment, and other individual socioeconomic variables, as well as regional deprivation level [5,25-27]. The results of the analysis for the two categories of dental care showed the following differences. Individual demographic characteristics and regional deprivation level were related to variations in dental care utilization for oral examination, but had no significant

correlation with dental care utilization for other reasons. These differing results may be because of the influence of National Health Insurance service coverage on individuals' attitudes towards dental care utilization. Korea has universal health insurance, but only 17% of the total cost of dental care is covered; thus, dental expenses would be a considerable financial burden for most people [28]. Consequently, this high financial burden leads to individual variations in preventive dental care utilization. However, for general dental care utilization, actually requiring treatment for oral diseases with symptoms may have acted as the most important factor, rather than individual socioeconomic characteristics.

While regional level had little relationship to dental care utilization, it clearly had a relationship independent from individual socioeconomic characteristics, which matches previous research findings [5]. In particular, dental care utilization for examination showed a relatively high ICC in the multilevel analysis, indicating that regional level has a clear effect independent of individual socioeconomic environment. Using multilevel analysis, we could improve on the limitations of previous analytic tools that could not identify whether the differences in dental care utilization by regional level were due to compositional or contextual effects.

Limitations of This Study

First, it combined data collected across different time periods. Our study data was a combination of the CHS conducted in 2008 in Korea and the deprivation index for Koreans extracted from the population census of 2005. This is because the regional deprivation index was calculated based on data from the Population and Housing Census, which is conducted every 5 years.

However, because there has been no recent rapid social change in Korea, the regional level has not likely changed within a short period, and thus the error may not be significant. In the future, the correlation between the regional deprivation index calculated using the population census data from 2010 and the dental care utilization data from the regional social health survey in the same year should be analyzed; these results should then be compared with those of the present study. Alternatively, a follow-up study should be conducted to analyze changes in correlation between regional variables and dental care utilization using longitudinal methods.

Second, in case of dental care utilization for general purposes, the regional deprivation index might have a different rela-

tionship depending on the number of visits and type of care. Unfortunately, no data were available on care type or number of visits due to the limitations of the CHS data. However, the present study aimed to investigate the correlation between regional deprivation with "dental examination without symptoms" and "dental care utilization for general purposes other than examination" by separation of dental care utilization by purpose. It was determined that the purpose of dental care utilization may be an indication as important as type of care and number of visits, due to the characteristics of dental diseases that require immediate pain relief.

Regional deprivation showed different associations according to the type of dental care utilization purpose. In particular, unlike dental care utilization for other reasons, dental care utilization for examination showed a contextual effect with regional deprivation level independent of the effect of individual socioeconomic status. These findings suggest that policy interventions should be considered to reduce regional differences in rates of dental care utilization for examination.

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CONFLICT OF INTEREST

The authors have no conflicts of interest with the material presented in this paper.

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