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Associations between dental checkups and unmet dental care needs by gender and age: an examination of cross-sectional data from the 7th Korea National Health and Nutrition Examination Survey (2016–2018)

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Abstract: To identify gender- and age-related associations between adult dental checkups and unmet dental care needs, we analyzed data of 14,000 participants, ages ≥ 19, from the 7th Korea National Health and Nutrition Examination Survey (2016–2018) (KNHANES VII). Data was collected via self-report questionnaires and interviews. Complex sample chi-square test and multiple logistic regression analysis indicated 31.7% of participants had unmet dental care needs; in the prior 12months, 67.1% had not utilized dental services, and 43.3% had not received dental checkups. Odds ratios (ORs) for dental checkups and unmet dental needs were 8.87 (CI:7.80–10.09, $p < 0.001$) for those who used dental services and 1.28 (CI: 1.13–1.44, $p < 0.001$) for those who had not. Significant age-dependent associations between those not receiving dental checkups and the rate of unmet dental care include men and women aged 50–59 years (OR: 1.77; CI = 1.22–2.58 and OR: 1.43; CI: 1.02–2.02; $p = 0.040$, respectively) and women ≥ 70 years (OR = 1.79, CI = 1.20–2.66, $p = 0.004$). Reducing unmet dental care needs requires greater public health promotion and education regarding regular dental checkups; additional practical strategies could enhance dental checkup compliance.

Keywords: oral health, dental checkup, Korea National Health and Nutrition Examination Survey (KNHANES), dental care, dental service utilization

1. Introduction

In South Korea, all citizens are obliged to join the National Health Insurance under the National Health Insurance Act (exception for those with an approved exemption for a specific reason), and the insured and their dependents are entitled to free preventive dental checkups [1]. However, the reported rate of compliance with routine dental checkups is very low (31.0% in 2015; 31.8% in 2017) compared to general health examinations (76.1% in 2015; 8.5% in 2017) [2,3].

Regular dental checkups make early detection of any dental health issues possible, thus preventing them from developing into serious dental problems and minimizing the cost and time necessary for treatment [4]. Adults with dental risk factors (e.g., smoking and diabetes) can reduce the incidence of tooth loss by receiving dental checkups every six months [5]. Children who received dental checkups as infants incur lower dental costs than children that did not, offsetting the costs for frequent visits to the dental clinic [6]. Furthermore, regular dental checkups provide dental service users with an accurate evaluation of their oral health status, enhancing their motivation to prevent and treat oral diseases [7]. Cho et al.al [8] reported that mothers who received dental checkups are twice as likely to have their children treated with pit and fissure sealant as mothers that did not.

The main factor contributing to unmet dental care needs is that those who do not receive dental checkups cannot know their accurate dental health status, often failing to recognize their dental problems unless accompanied by pain [10]. In particular, a study on the unmet dental care needs among older adults (≥ 65 years) reported that 75% of them had no experience of dental checkup [1].

Having unmet dental care needs is a state of not being able to acquire timely dental treatment [10]. The OECD-wide mean rate of unmet dental care needs has been gradually decreasing, falling from 10% in 2015, 8.7% in 2016 to 6.0% in 2017 [11]. Against this global trend, the rate of unmet dental care needs in South Korea has remained at a very high level: 29.7% in 2013, 32.4% in 2014, and 32.2% in 2015. That is, almost one-third of the Korean population does not receive dental care despite their perceived needs [9]. The most frequent reason for this, as found in KNHANES VI, is "economic burden," followed by "less important than other problems" [12]. This highlights the need to raise public awareness about the importance of using primary preventive dental services such as regular dental checkups. Many previous studies have reported various factors related to unmet dental care needs among Koreans [4,10,12–19]. However, to reduce the rate of unmet dental care needs and educate people to accurately recognize oral health problems and implement preventive and timely dental care, an in-depth analysis needs to examine the factors related to dental checkups the. Designing an adult oral health promotion programs must be preceded by determining the current situation of dental checkups and unmet dental care needs. The KNHANES is a nationwide cross-sectional survey providing representative and reliable data on the health and nutritional status of the general population. The purpose of this study was to identify the current state and related factors regarding the unmet dental-care needs perceived during the past 12 months by Korean adults aged 19 years or older, using KNHANES VII (2016–2018) datasets, and to identify the association between dental checkups and unmet dental care needs for different genders and age groups.

2. Materials and Methods

2.1. Study Design and Participants

This study analyzed the association between dental checkups and unmet dental care needs among Korean adults using the KNHANES VII. Data files for KNHANES datasets are available for public use [20]. The survey participants were selected by complex sampling with progressively applied proportional allocation and systematic sampling.

The data for KNHANES VII used in this study were collected from the survey population selected based on the 2010 Population and Housing Census, with the basic sampling framework supplemented with the declared values of public housing to include the latest information that reflects the characteristics of the current population. Sampling was performed using a method based on a two-stage stratified clustering method, whereby the enumeration districts and households are sampled as the primary and secondary sampling units, respectively. KNHANES VII stratified the sampling framework according to the divisions of si-do (municipality-province, the largest administrative units in Korea), dong-eup-myeon (enumeration districts, the smallest administrative units in municipality and province), and housing type (detached and multi-family). Variables such as the ratio of residential area and the education level of the householder were used as the criteria for implicit stratification. From the first year (2016), 192 enumeration districts were selected as the primary sampling units; 23 appropriate households were sampled from each of the districts using a systematic sampling method that excluded facilities such as nursing homes, military barracks, prisons, and foreign households. In each sample household, all household members over the age of 1 year, considered to meet the requirements of appropriate household members, were selected as survey participants.

After excluding those aged 18 years or younger (n = 4,880) and those who provided incomplete information (n = 5,389) from 24,269 study population (8,150 in 2016, 8,127 in

2017, and 7,992 in 2018), 14,000 participants were selected for final analysis (Figure 1).

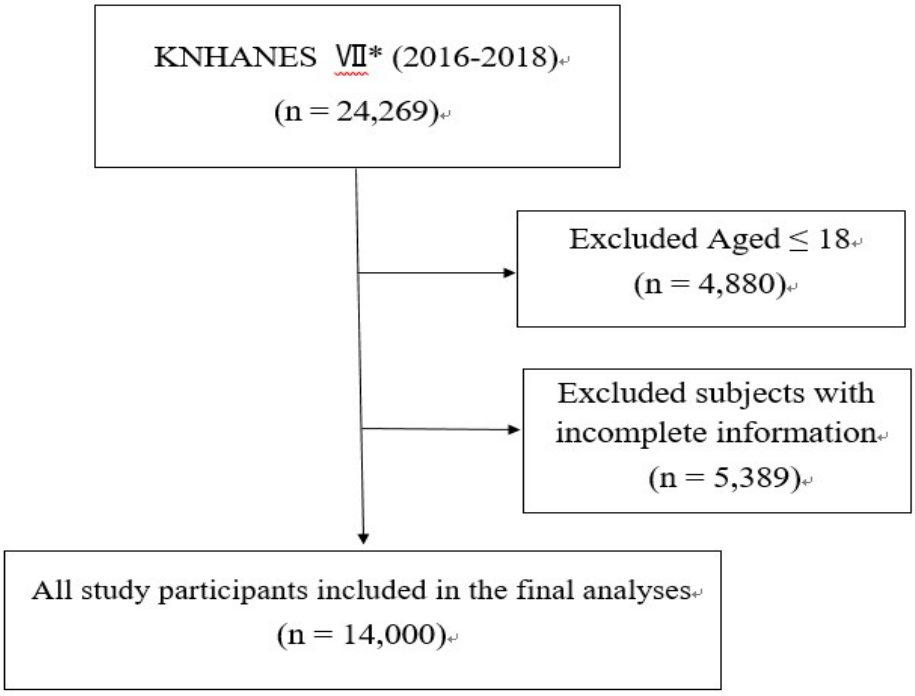

Figure 1. Flow chart of the study population.
*The seventh Korea National Health and Nutrition Examination Survey.

2.2. Measurement variables and data collection

Interviewers were trained based on the KNHANES survey guidelines performed interviews with structured self-report questionnaire items after obtaining consent to voluntarily participate in the study.

The independent variable was dental checkup, specifically whether the participant experienced dental checkup within the previous 12 months, which was quantified by assigning a score to the response (yes/no) to the question: "Within the previous 12 months, have you ever received a dental checkup to find out your oral health status?" [5]. The utilization of dental clinic service was quantified by assigning a score to the response (yes/no) to the question: "Within the previous 12 months, have you ever visited any dental clinic?" [21].

The dependent variable was defined as the unmet dental care needs, which was quantified by assigning a score to the response (yes/no) to the question: "Within the previous 12 months, have you perceived a need for dental care (examination or treatment) but could not receive it?" [10].

Sociodemographic variables were set as control variables: region (Seoul, Metropolitan City, and Other), gender (male and female), age (19–29, 30–39, 40–49, 50–59, 60–69, and ≥ 70 years), household income (low, lower-middle, upper-middle, and high), education level (elementary school, middle school, high school, and post-secondary education), and marital status (married and single). Variables related to health behavior included alcohol consumption (no/yes), smoking status (current smoker, past smoker, and non-smoker), and walking days per week (never, 1–2, 3–4, 5–6, and every day). Perceived health (good, moderate, bad) was defined as the variable related to health status.

2.3. Statistical analysis

A complex sample chi-square test was performed to identify the unmet dental care

needs, reflecting the respondents' characteristics. Logistic regression analysis was performed to determine the association between dental checkups and unmet dental care needs. Additionally, the association between dental checkups and unmet dental care needs was also analyzed by gender and age (19–29, 30–39, 40–49, 50–59, 60–69, and ⩾ 70 years). Data analysis was performed using the statistical software package SAS 9.4 (SAS Institute Inc., Cary, NC, USA).

Although KNHANES VII, as a survey conducted by the government for public benefits pursuant to the Bioethics and Safety Act, was exempted from the review by the Institutional Review Board (IRB) of the Centers for Disease Control and Prevention, this study was approved by the IRB of Dankook University (DKU: 2020-08-009) for ethical considerations. In addition, the authors followed the guidelines of the Declaration of Helsinki.

3. Results

3.1. Effects of general characteristics on the unmet dental care needs within the previous 12 months

Table 1 outlines the analysis results of the unmet dental care needs perceived within the previous 12 months according to the participants' general characteristics. Of the study population, 31.7% had unmet dental care needs, 67.1% had not visited within the previous 12 months, and 43.3% had no experience of dental checkup. ($p < 0.001$). Within the previous 12 months, 56.5% did not receive any dental checkup, of whom 43.3% perceived unmet dental care needs ($p < 0.001$).

The effects of general characteristics of the participants on their unmet dental care needs are as follows: women were had a higher rate of unmet dental care needs than men (34.0 vs. 29.2%) ($p < 0.001$); the older, the higher the unmet dental care needs (≥ 70 years: 34.4%) ($p < 0.001$); the lower the income and education levels, the higher the unmet dental care needs ($p < 0.001$), marred participants had a higher rate of unmet dental care needs than single participants (32.6 vs. 28.2%) ($p < 0.001$); Perceived health status was associated with unmet dental needs in increasing order of "good" (24.0%), "moderate" (31.5%), and "bad" (44.1%) ($p < 0.001$); smoking status was associated with unmet dental are needs in increasing order of non-smokers (27.4%), past smokers (31.2%), and current smokers (37.4%) ($p < 0.001$); and the frequency of walking days per week was inversely related with unmet dental care needs in increasing order (never: 39.5% – every day: 27.9%) ($p < 0.001$).

Table 1. Unmet dental care needs according to general characteristics of subjects

Variables	Division	Total	Yes	No	*p*-Value **
		N (%*)	N (%*)	N (%*)	
Unmet dental care needs	All	14,000 (100.0)	4,561 (31.7)	9,439 (68.3)	
Dental checkups	No	8,056 (56.5)	3,555 (43.3)	4,501 (56.7)	< 0.001
	Yes	5,944 (43.5)	1,006 (16.6)	4,938 (83.4)	
Dental service utilization	No	4,062 (29.3)	2,801 (67.1)	1,261 (32.9)	< 0.001
	Yes	9.938 (70.7)	1,760 (17.0)	8,178 (83.0)	
Area	Seoul	2,690 (19.4)	814 (29.9)	1,876 (70.1)	0.058
	Metropolitan city	3,666 (27.8)	1,157 (30.6)	2,509 (69.4)	
	Etc.	7,644 (52.8)	2,590 (32.9)	5,054 (67.1)	
Sex	Male	5,998 (48.6)	1,761 (29.2)	4,237 (70.8)	< 0.001
	Female	8,002 (51.4)	2,800 (34.0)	5,202 (66.0)	
Age	29 ≥	1,559 (16.8)	415 (25.1)	1,144 (74.9)	< 0.001
	30-39	2,089 (17.1)	705 (33.8)	1,384 (66.2)	
	40-49	2,625 (20.8)	864 (32.8)	1,761 (67.2)	
	50-59	2,811 (21.2)	910 (31.7)	1,901 (68.3)	
	60-69	2,524 (13.4)	853 (33.1)	1,671 (66.9)	

	70 ≤	2,392 (10.7)	814 (34.4)	1,578 (65.6)	
Household income	Low	2,697 (15.8)	1,058 (38.5)	1,639 (61.5)	< 0.001
	Middle-low	3,345 (23.2)	1,264 (37.9)	2,081 (62.1)	
	Middle-high	3,791 (29.0)	1,224 (32.2)	2,567 (67.8)	
	High	4,167 (32.0)	1,015 (23.3)	3,152 (76.5)	
Education	Elementary	2,856 (14.4)	1,058 (38.5)	1,711 (59.5)	< 0.001
	Middle	1,442 (8.9)	1,264 (37.9)	900 (63.7)	
	High	4,472 (35.0)	1,224 (32.2)	3.030 (68.1)	
	University or high	5,230 (41.7)	1,015 (23.3)	3.798 (72.6)	
Marriage	Married	11,804 (78.0)	3,909 (32.6)	7,895 (67.4)	< 0.001
	Single	2,196 (22.0)	652 (28.2)	1,544 (71.8)	
Perceived health	Good	3,850 (29.1)	946 (24.0)	2,904 (76.0)	< 0.001
	Moderate	7,260 (52.3)	2,334 (31.5)	4,926 (68.5)	
	Bad	2,890 (18.6)	1,281 (44.1)	1,609 (55.9)	
Drinking	No	1,579 (9.0)	538 (33.1)	1,041 (66.9)	0.282
	Yes	12,421 (91.0)	4,023 (31.5)	8,398 (68.5)	
Smoking	Current smoker	2,492 (21.3)	958 (37.4)	1,534 (62.6)	< 0.001
	Past smoker	3,023 (21.6)	841 (27.4)	2,182 (72.6)	
	Non-smoker	8,485 (57.1)	2,762 (31.2)	5,723 (68.8)	
Walking days per week	Never	2,707 (17.7)	1,073 (39.5)	1,634 (60.5)	< 0.001
	1-2	2,331 (16.7)	786 (33.5)	1,545 (66.5)	
	3-4	2,747 (19.7)	842 (30.0)	1,905 (70.0)	
	5-6	2,337 (17.6)	724 (30.0)	1,613 (70.0)	
	Everyday	3,878 (28.3)	1.136 (27.9)	2,742 (72.1)	

*Weighted %; **p-Value was calculated by complex sample chi-square test

3.2. Association between dental checkups and unmet dental care needs

Table 2 outlines the results of the logistic regression analysis of the association between dental checkups and unmet dental care needs according to sociodemographic characteristics, perceived health status, and health behavior.

Model 1 was adjusted for all variables excluding "dental service utilization within the previous 12 months": the odds ratio (OR) of those who did not receive dental checkups had a higher rate of unmet dental care needs (OR: 3.83; CI: 3.48–4.22; $p < 0.001$). Model 2 was adjusted for all variables excluding "dental checkups within the previous 12 months": the OR of those who did not utilize dental service concerning the rate of unmet dental care needs was 8.38 (CI: 7.40–9.48; $p < 0.001$); the OR of those who did not receive dental checkups for the rate of unmet dental care was 1.41(CI: 1.25–1.58; $p < 0.001$). Model 3 was adjusted for all variables: the OR of those who did not utilize dental service for the rate of unmet dental care needs was 8.87 (CI: 7.80–10.097.80–10.09; $p < 0.001$); the OR of those who did not receive dental checkups with respect to the rate of unmet dental care was 1.28 (CI: 1.13–1.44; $p < 0.001$).

Table 2. Relationship between dental checkups and unmet dental care needs

Variavles	Model 1		Model 2		Model 3	
	OR (95% CI)	*p*-Value*	OR (95% CI)	*p*-Value*	OR (95% CI)	*p*-Value*
Dental checkups						
No	3.64 (3.30-4.02)	< 0.001			1.28 (1.13-1.44)	< 0.001
Yes	1.00				1.00	
Dental service utilization						
No			10.04 (8.95-11.25)	< 0.001	8.87 (7.80-10.09)	< 0.001
Yes			1.00		1.00	
Area						
Seoul	1.04 (0.93-1.18)	0.494	1.22 (1.07-1.38)	0.003	1.22 (1.07-1.38)	0.003
Metropolitan city	0.95 (0.85-1.07)	0.413	0.87 (0.75-1.06)	0.061	0.88 (0.76-1.01)	0.075
Etc.	1.00		1.00		1.00	
Sex						
Male	0.73 (0.64-0.82)	< 0.001	0.68 (0.60-0.78)	< 0.001	0.68 (0.60-0.78)	< 0.001
Female	1.00		1.00		1.00	
Age						
29≥	1.07 (0.82-1.39)	0.644	0.97 (0.72-1.31)	0.836	0.97 (0.72-1.31)	0.856
30-39	1.68 (1.37-2.06)	< 0.001	1.28 (1.01-1.61)	0.042	1.30 (1.03-1.64)	0.030
40-49	1.71 (1.41-2.07)	< 0.001	1.30 (1.05-1.61)	0.016	1.34 (1.08-1.66)	0.008
50-59	1.46 (1.22-1.74)	< 0.001	1.34 (1.10-1.64)	0.003	1.36 (1.12-1.66)	0.002
60-69	1.31 (1.12-1.53)	0.001	1.25 (1.05-1.48)	0.012	1.27 (1.07-1.51)	0.006
70≤	1.00		1.00		1.00	
Household income						
Low	1.50 (1.28-1.75)	< 0.001	1.46 (1.22-1.74)	< 0.001	1.43 (1.19-1.71)	< 0.001
Middle low	1.64 (1.45-1.87)	< 0.001	1.51 (1.31-1.73)	< 0.001	1.50 (1.30-1.72)	< 0.001
Middle high	1.39 (1.23-1.56)	< 0.001	1.36 (1.19-1.54)	< 0.001	1.39 (1.18-1.54)	< 0.001
High	1.00		1.00		1.00	
Education						
Elementary	1.11 (0.94-1.33)	0.226	1.30 (1.07-1.58)	0.010	1.25 (1.02-1.52)	0.031
Middle	1.06 (0.87-1.28)	0.568	1.16 (0.93-1.45)	0.176	1.13 (0.91-1.41)	0.264
High	1.05 (0.94-1.17)	0.390	1.07 (0.96-1.21)	0.233	1.06 (0.95-1.20)	0.307
University	1.00		1.00		1.00	
Marriage						
Married	1.02 (0.86-1.21)	0.857	1.04 (0.85-1.27)	0.718	1.04 (0.85-1.27)	0.688
Single	1.00		1.00		1.00	
Perceived health						
Good	0.49 (0.43-0.56)	< 0.001	0.45 (0.39-0.53)	< 0.001	0.46 (0.39-0.53)	< 0.001
Moderate	0.63 (0.56-0.70)	< 0.001	0.57 (0.50-0.65)	< 0.001	0.57 (0.50-0.65)	< 0.001
Bad	1.00		1.00		1.00	
Alcohol consumption						
No	0.89 (0.76-1.04)	0.129	0.81 (0.68-0.97)	0.020	0.81 (0.68-0.97)	0.019
Yes	1.00		1.00		1.00	
Smoking						
Smoker	1.39 (1.20-1.61)	< 0.001	1.50 (1.07-1.38)	< 0.001	1.49 (1.28-1.77)	< 0.001
Past smoker	0.99 (0.86-1.15)	0.935	1.11 (0.95-1.30)	0.204	1.11 (0.95-1.30)	0.235
Nonsmoker	1.00		1.00		1.00	
Walking days per week						
Never	1.28 (1.11-1.47)	0.001	1.20 (1.07-1.38)	0.027	1.19 (1.02-1.40)	0.036
1-2	1.15 (1.00-1.32)	0.043	1.15 (1.07-1.38)	0.070	1.15 (0.99-1.34)	0.081

3-4	1.03 (0.89-1.19)	0.735	1.02 (1.07-1.38)	0.834	1.01 (0.87-1.20)	0.879
5-6	1.10 (0.96-1.27)	0.163	1.08 (1.07-1.38)	0.339	1.08 (0.92-1.26)	0.319
Everyday	1.00		1.00		1.00	

OR: adjusted odds ratios, CI: confidence interval; * *p*-Value was calculated by complex sample multiple logistic regression; Model 1 was adjusted for dental checkups, area, gender, age, household income, education, marriage, residence, perceived health, alcohol consumption, smoking, walking days per week excluding dental service utilization ; model 2 was adjusted for dental service utilization, area, gender, age, household income, education, marriage, residence, perceived health, alcohol consumption, smoking, walking days excluding dental checkups; model 3 was adjusted for all variables ; Dependent variable; unmet dental care needs (ref. no).

3.3. Association between dental checkups and unmet dental care needs by gender and age

Table 3 outlines the results of the logistic regression analysis of the association between dental checkups and unmet dental care needs by gender and age.

In Model 1, OR ranged between 1.74 and 4.89 ($p < 0.01$) for men and between 2.94 and 5.49 for women, with statistical significance in both groups ($p < 0.001$). In Model 2, the unmet dental needs were significantly higher in men in their 50s (OR = 1.94, CI = 1.33–2.82, $p = 0.001$), and the ORs of the three female age groups (30s, 50s, and 70s) were statistically significant, ranging from 1.57 to 1.99 ($p < 0.01$). In Model 3, men in their 50s had a higher OR (1.77; CI = 1.22–2.58), and significant differences were observed in women in aged 70s years or older (OR = 1.79, CI = 1.20–2.66, $p = 0.004$) and 50s (OR: 1.43; CI: 1.02–2.02; $p = 0.040$). What is noteworthy with regard to gender difference is that a significant association between dental checkups and unmet dental care needs was observed in women in their 70s years or older, but not in their male counterparts ($p = 0.311$).

Table 3. Association between dental checkups and unmet dental care needs by gender and age

Variables		**Model 1**		**Model 2**		**Model 3**	
Sex	Age, years	OR (95% CI)	*p*-Value*	OR (95% CI)	*p*-Value*	OR (95% CI)	*p*-Value*
Male	All	3.39 (2.91-3.95)	< 0.001	1.32 (1.09-1.59)	0.005	1.22 (1.01-1.48)	0.038
	29 ≥	3.13 (1.97-4.96)	< 0.001	1.06 (0.60-1.90)	0.834	0.85 (0.47-1.52)	0.572
	30-39	4.89 (3.37-7.10)	< 0.001	1.56 (0.98-2.49)	0.061	1.51 (0.92-2.47)	0.104
	40-49	3.28 (2.44-4.40)	< 0.001	1.06 (0.72-1.56)	0.752	1.00 (0.67-1.49)	0.982
	50-59	4.25 (3.11-5.81)	< 0.001	1.94 (1.33-2.82)	0.001	1.77 (1.22-2.58)	0.003
	60-69	3.30 (2.33-4.66)	< 0.001	1.51 (1.00-2.27)	0.050	1.32 (0.88-1.98)	0.182
	70 ≤	1.74 (1.15-2.65)	0.009	0.84 (0.52-1.34)	0.461	0.77 (0.47-1.27)	0.311
Female	All	4.29 (3.80-4.85)	< 0.001	1.49 (1.28-1.72)	0.001	1.30 (1.12-1.52)	0.001
	29≥	3.65 (2.49-5.34)	< 0.001	1.11 (0.68-1.82)	0.670	1.04 (0.63-1.71)	0.874
	30-39	5.23 (3.85-7.11)	< 0.001	1.03 (0.67-1.59)	0.883	0.94 (0.62-1.44)	0.788
	40-49	5.49 (4.19-7.18)	< 0.001	1.57 (1.10-2.23)	0.014	1.40 (0.98-2.02)	0.068
	50-59	4.58 (3.59-5.85)	< 0.001	1.68 (1.23-2.30)	0.001	1.43 (1.02-2.02)	0.040
	60-69	2.94 (2.20-3.94)	< 0.001	1.24 (0.90-1.71)	0.180	1.13 (0.81-1.56)	0.473
	70 ≤	3.92 (2.77-5.54)	< 0.001	1.99 (1.36-2.92)	0.000	1.79 (1.20-2.66)	0.004

OR: adjusted odds ratios, CI: confidence interval; * *p*-Value was calculated by complex sample multiple logistic regression; Model 1 was unadjusted; model 2 was adjusted for dental service utilization; model 3 was adjusted for dental service utilization, area, gender, age, household income, education, marriage, residence, perceived health, alcohol consumption, smoking, walking days per week; Dependent variable; unmet dental care needs (ref. no).

4. Discussion

This study analyzed the association between dental checkups and unmet dental care needs using the KNHANES VII datasets. The rate of unmet dental care needs among Korean adults was calculated as 31.7%, a moderate rise from the rate drawn from the KNHANES VI datasets (27.4%) [12]. An increase in unmet dental care needs means an increase in the prevalence of oral diseases due to the failure to provide timely treatment, exacerbated over time. This problem is particularly detrimental in Korea, where single-member households are increasing, as are the numbers of vulnerable populations such as the elderly and people with disabilities [3]. Senior citizens living alone without caregivers or individuals with physical and economic vulnerabilities are at a higher risk of having unmet dental care needs.

Many studies have been conducted on the causes of the unmet dental care needs among Koreans: sociodemographic characteristics [13], factors related to dental pain [14], insecurity in the employment market [15,19], the Decayed, Missing, and Filled Teeth (DMFT) index [16], and geographic accessibility [22]. In general, economic burden was found to be the most frequent cause of unmet dental care needs [17,18]. Jun and Gyu [23] reported that Koreans do not visit dental clinics for economic reasons, primarily; Moon and& Song [12] reported similar findings. Although Korea has a well-developed health insurance system, dental care often involves dental prostheses (e.g., crowns and bridges), which are not covered by the insurance, and the coverage for implants and dentures is limited to 65 years of age or older, thus imposing a considerable burden on the budgets of many people in need of dental care [17,18]. Since early-phase dental treatment and preventive care are mostly covered by insurance with affordable copays, and oral diseases are not cured spontaneously—and worsen when left unattended—preventive care (before disease occurs) is important [24]. The first step in preventive care is dental checkup [25]. A dental checkup not only provides a precise diagnosis of untreated teeth but also promotes and maintains oral health by inducing correct perceptions of oral hygiene and dental care.

Previous studies on unmet medical needs in Korea [26,27] reported that a higher rate of unmet medical needs was associated with the absence of a spouse, low household income or education level of the householder, medical aid recipients, chronic diseases, and poor perceived health status. In this study, no significant association was found between unmet dental care needs and present/absence of the spouse. However, the association with household income, education level, and perceived dental health status was also verified in this study. Regarding the association with health behavior, the unmet dental care needs of current smokers was found to be 1.49-fold higher compared to past smokers and non-smokers, and alcohol consumption was found to be inversely associated with unmet dental care needs.

Poor oral health, such as chronic periodontal disease and an increasing number of missing teeth, can lead to nutritional imbalance due to impaired masticatory function and discomfort associated with food intake, which may affect systemic health [23]. People with impaired systemic health tend to procrastinate the visit to dental clinics or cannot easily receive dental treatment, thus triggering a vicious cycle.

The analysis of the association between dental checkups and unmet dental care needs after adjusting for the participants' general characteristics revealed that the rate of unmet dental care needs in those who had not received dental checkups within the previous 12 months was 1.28-fold higher than for those who had. In a US study of 126,773 children aged 2–17, Luo et al. [28] reported that children who were given advice by a primary care physician (PCP) to go to dental checkups were 52% more likely to visit a dental clinic compared with those who had not received this advice from their doctor. Jun and& Ryu [23] pointed out that one of the characteristics of people with unmet dental care needs is that they had not received dental checkups within the previous 12 months. Regular dental checkups help people have a clear overview of their oral conditions, along with increased knowledge of periodontal health [29] and awareness of oral health problems, which in

turn increases the rate of patients who undergo yearly visits for dental care [3,21]. In contrast, unmet dental care needs may occur for people who do not receive dental checkups due to delays in receiving dental treatment because they fail to recognize their oral conditions.

In this study, the rate of dental checkups was 43.5%, a significant increase compared to 30.1% in the second year of KNHANES VI (2014) [25]. This may be ascribed ascribable to an increase in people's knowledge of oral health with easy access to related information due to the rapid development of social culture digitization. However, according to a study by Hwang et al. [4], 76.3% of Korean adults did not visit dental clinics for checkup purposes or had no intention of receiving dental checkups within the next 6 months. In addition, compared with the general health checkup rate of 78.5% (as of 2017) [2], the dental checkup rate is still significantly lower. As one of the causes of the low dental checkup rate, a low recognition of the need for regular dental checkup can be assumed [5]. Schouten et al. [30] noted that preferences for regular dental checkups basically arise from one's intrinsic motivation for maintaining oral health. Choi [8] pointed out that the high dental checkup experience rate (83.5%) among the working population was attributable to the fact that checkups were performed at the workplace, highlighting the importance of geographical and economic accessibility to dental checkups. From the results of the studies on the association between the rate of unmet dental care needs and prevalence factors [31–34], it can be assumed that it is necessary to provide citizens with facilities for dental checkups in their neighborhood and gradually expand them to increase the rate of dental checkups and lower the rate of unmet dental care needs. For senior citizens and people with disabilities with limited mobility, it is also necessary to establish a visiting dental care service scheme in which dentists or dental hygienists visit and perform dental checkups. Furthermore, oral health education programs should be reinforced to enhance the motivation for compliance with regular dental checkups by actively informing people of the importance of dental checkups.

The results of this study confirm the association between various factors affecting unmet dental care needs and dental checkups, thus verifying the importance of regular dental checkups. In particular, the rate of unmet dental care needs in men and women in their 50s was 1.77 and 1.43 times higher, respectively, when dental checkups were not performed. This highlights the urgency of preparing strategies for enhancing the rate of dental checkups. In the elderly (≥ 70 years), however, the rate was 1.79 times higher in women, but no significant differences were observed in men, which implies the need to set up and implement oral health promotion strategies taking into account gender and age characteristics. A strong point of this study is the generalizability of its results because it employed a complex sample design using the pertinent datasets from the large-scale KNHANES conducted nationwide. However, as a limitation of this study, it may be pointed out that by the nature of KNHANES VII as a cross-sectional survey, the temporal relationship could not be traced in the association between dental checkups and the rate of unmet dental care needs. Future research will have to investigate the effect of dental checkups on oral health behavior and oral health status, and going a step further, trace the trend of the factors affecting unmet dental care need by conducting longitudinal research.

5. Conclusions

This study revealed that three out of ten (31.7%) Korean adults had unmet dental care needs and that of them, 43% had not received dental checkups within the previous 12 months, thus verifying the close association between dental checkups and unmet dental care needs. In particular, the highest association was found in men in their 50s and women in their 70s and older. Oral diseases can be prevented, and above all, regular dental checkups are essential for early-phase treatment. A higher frequency of dental clinic visits for checkup purposes can contribute to the prevention and treatment of oral diseases through

timely utilization of dental services. Therefore, it is necessary to increase step up the informational and promotional efforts to raise public awareness of the importance of dental checkups in order to enhance the adults' dental checkup rate and to prepare policy strategies to enhance the dental checkup rate at the national level.

Author Contributions: Conceptualization, J.J. and JL.K.; methodology, JH.K. and J.J.; validation, J.J. and JH.K.; formal analysis, J.J. and JH.K.; investigation, JH.K.; resources, J.J.; data curation, JH.K. and J.J.; writing—original draft preparation, JL.K and J.J.; writing—review and editing, J.J and JH.K.; supervision, J.J. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Although KNHANES VII, as a survey conducted by the government for public benefits pursuant to the Bioethics and Safety Act, was exempted from the review by the Institutional Review Board (IRB) of the Centers for Disease Control and Prevention, this study was approved by the IRB of Dankook University (DKU: 2020-08-009) for ethical considerations. In addition, the authors followed the guidelines of the Declaration of Helsinki.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the Corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

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