Factors Associated with Unmet Dental Needs among Single-Person Households in Korea

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Background: The purpose of this study is to provide the data for discussions related to oral health promotion policies for single-person households by analyzing the status of unmet dental needs and related factors in single-person households in Korea, based on the Anderson model.

Methods: The data, obtained from 544 single-person households of those over 20 years old who were targeted for the 6th Korea National Health and Nutrition Examination Survey, were analyzed through a complex sample frequency analysis, complex sample cross analysis (Rao–Scott chi-square test), and complex sample binary logistic regression analysis on a complex sampling design.

Results: The most frequently given reason for an unmet dental need among single-person households was economic (52.4%). Factors related to the unmet dental needs of single-person households are smoking, which is a predisposing factor; personal income levels, which are an enabling factor; chewing discomfort; and limited daily activities, which are need factors. Smokers, the high-income group, the chewing-discomfort group, and the limited activity group showed high unmet dental care experience. Smokers had a 2.75 times higher rate of unmet dental care than non-smokers, and the high-income group had a 5.29 times higher rate of unmet dental needs than the median group. The rate of unmet dental needs for the chewing discomfort group was 3.27 times higher than the non-chewing discomfort group, and the limited activity group had a 7.87 times higher rate of unmet dental needs than the non-limited activity group.

Conclusion: It is necessary to map out policies designed to help maintain and promote met dental needs considered to be internally heterogeneous to single-person householders, based on the Anderson model.

Key Words: Dental care, Health surveys, Single person, Smoking

Introduction

Oral health is a factor that can improve overall health and quality of life. Oral diseases are irreversible diseases and diseases with a lower morbidity level tend to have a more favorable prognosis and are treatable at lower cost. However, people often do not receive the necessary dental services at the right time owing to various factors, including economic level, accessibility, and psychological factors, which are referred to as unmet dental needs[1]. A broader concept is that unmet medical needs include "that which a person wants or a physician has diagnosed as required treatment" and "diseases or disabilities that could have been prevented, mitigated, or eliminated if the medical needs were properly met"[2]. "Unmet dental needs" is also a concept that stems from these definitions. The level of unmet medical needs is one of the indicators for the accessibility[2] and equity of medical services, which is because these needs measure the experience of not being able to utilize the care needed, rather than the absolute quantity of care provided. Increased unmet medical needs can lead to higher mortality rates among the elderly population[3], greater disease severity among patients[4], and poorer prognosis due to greater likelihood of complications[5].

The number of dental hospitals continue to increase[6], while some studies have reported that there is a surplus of dentists[7]. However, in the 2016 Korean National Health

and Nutrition Examination Survey (KNHANES) conducted by the Korea Centers for Disease Control and Prevention (KCDC)[8], 22.2% of the respondents answered "Yes" to the question, "Did you have the experience of not receiving dental treatment you needed in the past year?" This is a higher percentage than the unmet medical needs of 7.7% reported in the same study[8]. Dental care services include many more treatments that are not covered by the national health insurance, as compared to medical services, which means that dental care services have less health insurance coverage than medical services. Consequently, an individual's ability to pay becomes an important factor in meeting dental care needs, more so than when using medical services. Therefore, it is necessary to pay attention to experiences of unmet dental needs in identifying the factors associated with inequity in dental care utilization due to low coverage.

In Korean society, the highest percentage of household types is a single-person household[9]. This trend appears not only in Korea, but worldwide, and it is forecast to accelerate even more because of changes in social organization and the progression of population aging[10]. The health status of a single-person household member tends to be lower than that of members of other types of households, and thus, "single-person household" itself falls under the category of socially vulnerable groups[11]. Single-person household members have a higher risk of cardiovascular disease than members of other types of households[12] and have a greater propensity for behavior harmful to health such as smoking and drinking[13]; they also tend to have poorer mental health, including depression[14]. However, owing to various factors, such as household income and enrollment in regional health insurance[15], the medical needs of single-person household tend to go unmet at a higher rate than of members of other types of households[16,17].

Oral health represents the first step in the digestive system and is closely associated with overall health. It is also significant that most oral diseases are irreversible and that the experience of unmet dental needs can be a factor that exacerbates poor oral health. However, there is a lack of previous studies on oral health and unmet dental needs among single-person households. Accordingly, the present study aimed to examine the current status of unmet dental needs among single-person households and to analyze the influencing factors. The findings in the present study provide basic data for establishing reasonable public health policies on oral health care among single-person households or identifying measures for reducing unmet dental need experiences among single-person households.

Materials and Methods

1. Subjects

The present study analyzed raw data from the 6th KNHANES (2013~2015) conducted by KCDC. Among a total of 21,724 people in the raw data from KNHANES based on the 6th complex sampling design, there were 1,704 adults aged 20 years or older who were members of a single-person household, of whom 544 people had experienced unmet dental needs. In the study, 1,704 single-person household members were established as the sub-population and analyzed.

2. Selection of variables

The dependent variable was set as unmet dental needs experience, namely, an affirmative response to "Did you have experience of not receiving dental treatment you needed in the past year?" in the oral health questionnaire survey. The present study used the rate of unmet dental needs experience, rather than the number of people with unmet dental needs experience.

Independent variables were selected based on the Anderson model, which is widely used in studies on the utilization of dental services[18]. This is a model of personal medical utilization based on three types of factors: predisposing factors that include the characteristics of individuals, enabling factors that enable utilization of medical resources or exert disabilities, and need factors that indicate the severity of disease[19]. The Anderson model is a typical socio-behavioral model used as an analytic framework for predicting predisposing, enabling, and need factors that result in the utilization of medical services[20]. It is useful when undertaking analysis based on a systematic theoretical framework concerning factors that affect utilization of dental care services among other

personal factors.

Various factors appearing in KNHANES were classified as predisposing, enabling, and need factors. Two researchers independently classified the variables, and only those that both researchers agreed upon were included. Personal characteristics, such as sex, age, education level, hypertension status, and smoking status, were selected as predisposing factors. Income level (income quartile), type of health insurance, enrollment in private insurance, oral health screening in the past year, toothbrushing the previous day, and economic activity status were selected as enabling factors Subjective oral health status, toothache in the past year, speech impairment, chewing discomfort, periodontal disease, permanent teeth dental caries experience, and activity limitations were selected as need factors that indicate the severity of disease.

The selected variables were calculated to fit a range suitable for the purpose of analyses. Each variable was checked using the user's manual for the 6th KNHANES raw data and missing values were treated as "not known," "excluded," "unable to record," or "no response." Age was divided into groups of 20～29, 30～39, 40～49, 50～59, 60～74 (early elderly), and ≥75 (late elderly) years. Income level was divided into upper, middle (upper-middle and lower-middle), and lower groups. Health insurance was divided into regional subscriber, workplace subscriber, and medical aid recipient (class 1 and 2). Smoking status was divided into "yes" (smoker and smoke sometimes) and "no" (former smoker, not applicable, and unknown). Subjective oral health status was divided into good (very good and good), average, and poor (poor and very poor). Details of the variables are shown in Table 1.

3. Data analysis

The present study constructed a research protocol using variance estimation strata and survey households according to the complex sampling design of the 6th KNHANES raw data and, during the analyses, complex sample analyses were used. The weight was calculated by using the weight applied to the health questionnaire and screening. As the raw data were extracted by complex stratified sampling, weights, stratification variables, and cluster variables were applied in the analysis.

Complex sample frequency analysis was performed to investigate the frequency and percentage of single-person households, while Rao–Scott chi-square (χ^2) test was used to analyze the differences in unmet dental needs experiences among single-person households by predisposing, enabling, and need factors. Moreover, complex sample binary logistic regression analysis was used to analyze the factors associated with unmet dental needs experiences among single-person households, with the number of permanent teeth with dental caries experience adjusted as a covariate. SPSS Statistics (ver. 20.0; IBM Corp., Armonk, NY, USA) was used for statistical analyses with the significance level established at 5%.

Table 1. Definition of Variables

Variable	Content
Unmet dental needs	Yes/no
Predisposing factors	
Sex	Male/female
Age group (y)	20～29/30～39/40～49/50～59/60～74/≥75
Educational level	≤Elementary school/middle school/ high school/ ≥university
Hypertension	Yes/no
Diabetes mellitus	Yes/no
Smoking	Yes/no
Enabling factors	
Personal income level	High/middle/low
Type of medical insurance	Community based/employed/ medical aid
Private health insurance	Yes/no
Residence	Dong/eup, myeon
Regular oral check-ups	Yes/no
Toothbrushing per day	Yes/no
Economic activity	Yes/no
Need factors	
Perceived oral health	Good/normal/poor
Toothache within a year	Yes/no
Speaking difficulty	Comfortable/unawareness/ uncomfortable
Chewing difficulty	Yes/no
Periodontal disease	Yes (periodontal pocket depth ≥4 mm)/no (periodontal pocket depth <4 mm)
Untreated dental caries	Yes (DT[a]≥1)/no (DT[a]=0)
Limitation of activity	Yes/no

[a]Mean number of decayed permanent teeth (DT).

Results

1. Rate of unmet dental needs experiences among single-person households

During the survey period (2013~2015), the highest percentage of single-person households was found in 2015 (35.1%), while the highest rate of unmet dental needs experience among single-person households was found in 2014 (34.3%) (Table 2). The percentage of single-person households appeared in increasing order from 2013 (31.3%), to 2014 (33.6%), to 2015 (35.1%), while the rate of unmet dental needs experience among single-person households appeared in the order of 2014 (34.3%), 2013 (32.4%), and 2015 (33.3%).

2. Reasons for unmet dental needs experiences as perceived by members of single-person households

Among the responses given by member of single-person households as the reason for unmet dental needs experiences, economic reasons were highest at 52.4% (Table 3). Other reasons appeared in the following order: "felt it was less important than other issues" (17.3%), "could not miss work or school" (12.7%), "fear of dental treatment" (9.5%), and "too far to travel" (3.3%).

3. Reasons for unmet dental needs experiences by age

With respect to the reasons for unmet dental needs experiences by the age of the member of a single-person household, differences were found between age groups (Table 4). Among people aged 20~29 years, the most common response was "felt it was less important than

other issues" (31.4%). Among people aged 30~39 years, "could not miss work or school" (36.6%) was the most common response. Among people aged 40~49, 50~59, 60~74, and ≥75 years, an "economic reason" was the most common response (42.9%, 58.2%, 66.3%, and 61.2%, respectively).

4. Factors associated with unmet dental needs experiences among single-person households

Among the predisposing, enabling, and need factors, differences in unmet dental needs experiences among single-person households were found based on smoking status, income level, regular oral health screening, subjective oral health status, toothache in the past year, speech impairment, chewing discomfort, permanent teeth dental caries experience, and activity limitation (Table 5).

Among the predisposing factors, only smoking status showed differences in unmet dental needs experiences. The percentage of smokers and non-smokers who

Table 3. Reason for Unmet Dental Needs of the Single-Person Householder

Variable	n	Weighted	%[a] (SE)
Financial burden	308	553,049	52.4 (2.8)
Too far to go	25	35,267	3.3 (0.8)
Busy with school or work	46	134,416	12.7 (2.0)
Poor mobility	20	26,990	2.6 (0.6)
No one help with their children	1	2,263	0.2 (0.2)
Lower on the priority scale	80	182,886	17.3 (2.4)
Fear of dental treatment	53	100,549	9.5 (1.4)
Other reasons	11	20,294	1.9 (0.7)
Total	544	1,055,715	100 (0.0)

SE: standard error.
[a]Percentage of weighted population.

Table 2. Status of Unmet Dental Needs of the Single-Person Householder

Year	Single-person householder			Unmet dental needs of the single-person householder		
	n	Weighted	%[a] (SE)	n	Weighted	%[a] (SE)
2013	531	1,003,292	31.3 (3.0)	176	342,537	32.4 (3.7)
2014	573	1,074,154	33.6 (3.1)	182	361,712	34.3 (3.6)
2015	600	1,124,048	35.1 (3.1)	186	351,466	33.3 (3.6)
Total	1,704	3,201,494	100 (0.0)	544	1,055,715	100 (0.0)

SE: standard error.
[a]Percentage of weighted population.

Table 4. Reason for Unmet Dental Needs of the Single-Person Householder by Age

Age group (y)	Financial burden			Too far to go			Busy with school or work			Poor mobility			No one help with their children			Lower on the priority scale			Fear of dental treatment			Other reasons		
	n	Weighted	%[a] (SE)	n	Weighted	%[a] (SE)	n	Weighted	%[a] (SE)	n	Weighted	%[a] (SE)	n	Weighted	%[a] (SE)	n	Weighted	%[a] (SE)	n	Weighted	%[a] (SE)	n	Weighted	%[a] (SE)
20~29	9	34,785	23.8 (7.5)	-	-	-	10	44,629	30.6 (8.2)	-	-	-	-	-	-	11	46,688	32.0 (9.2)	5	19,799	13.6 (6.0)	-	-	-
30~39	10	26,988	20.2 (6.1)	1	5,496	4.1 (4.0)	15	50,343	37.6 (7.0)	1	1,683	1.3 (1.3)	-	-	-	11	38,463	28.7 (6.8)	3	10,849	8.1 (4.7)	-	-	-
40~49	12	38,727	46.2 (10.1)	-	-	-	5	16,472	19.6 (8.2)	1	2,347	2.8 (2.8)	-	-	-	8	22,582	26.9 (8.8)	2	3,764	4.5 (3.2)	-	-	-
50~59	57	146,941	66.9 (5.4)	2	2,698	1.2 (0.9)	9	13,738	6.3 (2.3)	-	-	-	1	2,263	1.0 (1.0)	16	29,927	13.6 (3.6)	11	18,819	8.6 (2.6)	2	5,263	2.4 (2.2)
60~74	138	180,271	66.2 (3.3)	11	13,217	4.9 (1.7)	5	5,969	2.2 (10.)	8	10,377	3.8 (1.4)	-	-	-	22	26,402	9.7 (2.2)	22	32,185	11.8 (2.5)	2	3,801	1.4 (1.1)
≥75	82	125,336	62.6 (4.7)	11	13,857	6.9 (2.3)	2	3,264	1.6 (1.1)	10	12,538	6.3 (2.0)	-	-	-	12	18,825	9.4 (3.0)	10	15,133	7.6 (2.6)	7	11,230	5.6 (2.1)
Total	308	553,048	52.4 (2.8)	25	35,267	3.3 (0.8)	46	134,415	12.7 (2.0)	20	26,990	2.6 (0.6)	-	-	-	80	182,886	17.3 (2.4)	53	100,549	9.5 (1.4)	11	20,294	1.9 (0.7)

χ^2=185.354, p<0.001.

p-values were analyzed by Rao-Scott χ^2 test.

SE: standard error, -: no responders.

[a]Percentage of weighted population.

Table 5. Difference of Unmet Dental Needs by the Anderson Model

Variable	Yes			No			χ^2(p)
	n	Weighted	%[a] (SE)	n	Weighted	%[a] (SE)	
Sex							0.043(0.877)
Male	180	478,719	35.3 (2.7)	343	878,306	64.7 (2.7)	
Female	364	576,996	34.8 (1.7)	693	1,082,002	65.2 (1.7)	
Age group (y)							20.865(0.053)
20~29	35	145,901	33.4 (4.2)	70	290,782	66.6 (4.2)	
30~39	41	133,822	33.3 (4.6)	77	268,132	66.7 (4.6)	
40~49	28	83,892	27.4 (4.6)	82	222,112	72.6 (4.6)	
50~59	98	219,650	43.2 (3.9)	139	288,381	56.8 (3.9)	
60~74	124	176,182	39.8 (3.1)	214	266,650	60.2 (3.1)	
≥75	218	296,268	32.8 (1.9)	450	606,411	67.2 (1.9)	
Educational level							10.824(0.138)
≤Elementary school	286	425,557	38.3 (2.0)	504	686,769	61.7 (2.0)	
Middle school	51	81,200	29.1 (4.0)	111	197,704	70.9 (4.0)	
High school	100	263,227	34.8 (3.4)	201	493,831	65.2 (3.4)	
≥University	75	221,459	30.7 (3.4)	173	500,447	69.3 (3.4)	
No response	32	64,271	44.1 (6.6)	47	81,557	55.9 (6.6)	
Hypertension							0.170(0.920)
Yes	206	297,902	35.5 (2.3)	382	540,705	64.5 (2.3)	
No	7	11,402	31.4 (10.2)	16	27,897	68.6 (1.0)	
No response	331	746,410	34.9 (1.9)	638	1,394,706	65.1 (1.9)	
Diabetes mellitus							1.595(0.375)
Yes	80	130,749	38.3 (3.6)	149	210,716	61.7 (3.6)	
No	2	1,710	17.7 (12.1)	6	7,956	82.3 (12.1)	
No response	462	923,256	34.6 (1.6)	881	1,741,636	65.4 (1.6)	
Smoking							10.325(0.009)
Yes	134	347,607	41.2 (3.0)	193	496,316	58.8 (3.0)	
No	410	708,108	32.6 (1.5)	843	1,463,992	67.4 (1.6)	
Personal income level							10.873(0.033)
High	45	99,242	25.4 (4.0)	127	291,876	74.6 (4.0)	
Middle	257	494,810	35.0 (2.1)	504	917,429	65.0 (2.1)	
Low	238	451,140	38 (2.4)	398	735,229	62.0 (2.4)	
No response	4						
Type of medical insurance							10.705(0.056)
Community based	178	380,617	38.1 (2.6)	315	618,883	61.9 (2.6)	
Employed	249	467,710	31.3 (1.9)	535	1,028,667	68.7 (1.9)	
Medical aid	89	150,211	38.3 (4.1)	145	241,514	61.7 (4.1)	
No response	28	57,176	44.5 (7.4)	41	71,245	55.5 (7.4)	
Private health insurance							4.321(0.304)
Yes	237	502,139	32.9 (2.0)	457	1,025,756	67.1 (12.0)	
No	298	533,369	37.6 (2.1)	563	885,634	62.4 (2.1)	
No response	9	20,207	29.2 (11.4)	16	48,918	70.8 (11.4)	
Residence							0.000(0.995)
Dong	419	852,794	35 (1.7)	802	1,583,233	65 (1.7)	
Eup, myeon	125	202,921	35 (3.1)	234	377,075	65 (3.1)	
Regular oral check-ups							18.802(0.001)
Yes	84	182,971	26.1 (2.8)	245	518,346	73.9 (2.8)	
No	459	870,416	37.6 (1.7)	791	1,441,963	62.4 (1.7)	
No response	1	2,329	100 (0.0)				

Table 5. Continued

Variable	Yes			No			χ²(p)
	n	Weighted	%ᵃ (SE)	n	Weighted	%ᵃ (SE)	
Toothbrushing per day							0.073(0.799)
Yes	528	1,026,850	35.0 (1.5)	1,007	1,908,451	65.0 (1.5)	
No	16	288,645	37.0 (7.9)	28	49,097	63.0 (7.9)	
Economic activity							3.532(0.298)
Yes	239	518,214	33.9 (2.1)	436	1,011,234	66.1 (2.1)	
No	274	474,157	35.3 (2.1)	555	870,718	64.7 (2.1)	
No response	31	63,344	44.7 (6.8)	45	78,356	55.3 (6.8)	
Perceived oral health							129.878(<0.001)
Good	36	69,273	17.7 (3.2)	181	321,016	82.3 (3.2)	
Normal	115	239,942	22.2 (2.2)	404	838,748	77.8 (2.2)	
Poor	338	631,099	48.5 (2.5)	384	669,240	51.5 (2.5)	
No response	55	115,401	46.8 (4.6)	67	131,305	53.2 (4.6)	
Toothache within a year							47.806(<0.001)
Yes	252	488,327	43.4 (2.6)	322	635,702	56.6 (2.6)	
No	237	451,987	27.5 (1.8)	647	119,330	72.5 (1.8)	
No response	55	115,401	46.8 (4.6)	67	131,305	53.2 (4.6)	
Speaking difficulty							54.150(<0.001)
Comfortable	288	636,100	29.9 (1.8)	730	1,488,288	70.1 (1.8)	
Unawareness	83	145,890	38.6 (3.8)	147	231,681	61.4 (3.8)	
Uncomfortable	173	273,725	53.5 (3.1)	158	237,447	46.5 (3.1)	
Chewing difficulty							138.998(<0.001)
Yes	320	530,954	55.9 (2.3)	287	419,596	44.1 (2.3)	
No	224	524,760	25.4 (1.7)	749	1,540,722	74.6 (1.7)	
Periodontal disease							11.744(0.010)
Yes	215	386,822	39.6 (2.4)	330	588,815	60.4 (2.4)	
No	238	499,666	31.2 (2.0)	546	1,104,202	68.8 (2.0)	
No response	91	169,227	38.8 (3.4)	160	267,290	61.2 (3.4)	
Untreated dental caries							64.843(<0.001)
Yes	215	437,038	47.3 (2.8)	236	486,097	52.7 (2.8)	
No	275	505,555	27.3 (1.8)	734	1,344,111	72.7 (1.8)	
No response	54	113,122	46.5 (4.6)	66	130,099	53.5 (4.6)	
Limitation of activitiy							31.715(<0.001)
Yes	7	13,162	86.0 (13.1)	1	2,142	14.0 (13.1)	
No	114	206,097	48.9 (4.0)	134	215,773	51.1 (4.1)	
No response	423	836,456	32.4 (1.5)	901	1,742,393	67.6 (1.5)	

p-values were analyzed by Rao−Scott χ² test.
SE: standard error.
ᵃPercentage of weighted population.

experienced unmet dental needs was 41.2% and 32.6%, respectively, showing that smokers had greater unmet dental needs than non-smokers (p=0.009).

Among the enabling factors, income level and regular oral health screening showed differences in unmet dental needs experiences. The lower-income level group showed the highest rate of unmet dental needs experiences at 38% (p=0.033), while the group that did not receive regular oral

health screening showed a higher rate of unmet dental needs experiences at 37.6% (p=0.001).

Among the need factors, all factors, except periodontal disease, showed significant differences. The group with poor subjective oral health status showed the highest rate of unmet dental needs experiences at 48.5% (p<0.001); the group with experience of toothache in the past year showed a higher rate of unmet dental needs experiences at

43.4% (p＜0.001); the group with speech impairment showed a higher rate of unmet dental needs experiences at 53.5% (p＜0.001); the group with chewing discomfort showed a higher rate of unmet dental needs experiences at 55.9% (p＜0.001); the group with permanent teeth dental caries experience showed a higher rate of unmet dental needs experiences at 47.3% (p＜0.001); and in the group with activity limitations, those with limitations due to dental and oral issues showed the highest rate of unmet dental needs experiences at 86.0% (p＜0.001).

5. Influencing factors of unmet dental needs experiences among single-person households

The influencing factors of unmet dental needs experiences among single-person households were identified as smoking status, income level, chewing discomfort, and activity limitations (Table 6).

Smokers, the lower income level group, the group with chewing discomfort, and the group with activity limitations showed a higher rate of unmet dental needs experiences. Smokers showed a 2.75-fold higher rate of unmet dental needs experiences than non-smokers

Table 6. Factors Influencing the Unmet Dental Needs

Variable	B	SE	Adjusted OR	95% CI	p-value
Smoking					
Yes	−1.011	0.371	2.746	0.176～0.754	0.007
No (ref.)			1.000		
Personal income level					
Low	−1.324	0.806	3.759	0.055～1.297	0.101
Middle	−1.665	0.819	5.287	0.038～0.946	0.043
High (ref.)			1.000		
Regular oral check-ups					
No	0.379	0.445	1.505	0.608～3.504	0.396
Yes (ref.)			1.000		
Perceived oral health					
Poor	1.051	0.759	2.860	0.644～12.710	0.167
Normal	0.064	0.775	1.066	0.232～4.897	0.934
Good (ref.)			1.000		
Toothache within a year					
Yes	−0.351	0.378	1.420	0.335～1.480	0.354
No (ref.)			1.000		
Speaking difficulty					
Comfortable	−0.513	0.439	1.669	0.253～1.419	0.243
Unawareness	0.563	0.483	0.569	0.680～4.539	0.244
Uncomfortable (ref.)			1.000		
Chewing difficulty					
Yes	−1.183	0.441	3.269	0.129～0.729	0.008
No (ref.)			1.000		
Periodontal disease					
Yes	−0.136	0.366	1.146	0.425～1.791	0.709
No (ref.)			1.000		
Untreated dental caries					
Yes	−0.155	0.437	1.166	0.363～2.023	0.723
No (ref.)			1.000		
Limitation of activity					
Yes	−2.060	1.018	7.866	0.017～0.943	0.044
No (ref.)			1.000		

By complex samples regression adjusted for decayed, missing, filled tooth (DMFT) index.
SE: standard error, OR: odds ratio, CI: confidence interval, ref.: reference.

(p=0.007). The lower-income level group showed a 5.29-fold higher rate of unmet dental needs experiences than the middle-income level group (p=0.043), but no statistically significant differences compared to the upper-income level group. The group with chewing discomfort showed a 3.27-fold higher rate of unmet dental needs experiences than the group with no discomfort (p=0.008), while the group with activity limitations showed a 7.87-fold higher rate of unmet dental needs experiences than the group with no limitations (p=0.044).

Discussion

The rate of unmet dental needs experiences among single-person households decreased in the order of 2014, 2013, and 2015, showing an inconsistent pattern. Among the predisposing, enabling, and need factors, differences in unmet dental needs experiences among single-person households were found based on smoking status, income level, regular oral health screening, subjective oral health status, toothache in the past year, speech impairment, chewing discomfort, permanent teeth dental caries experience, and activity limitations. Smokers, the lower-income level group, the group with chewing discomfort, and the group with activity limitations showed a higher rate of unmet dental needs experiences, with these influencing factors appearing in the following order of importance: activity limitations, income level, chewing discomfort, and smoking status.

The groups with chewing discomfort and activity limitations showed a higher rate of unmet dental needs experiences, which is consistent with the findings in previous studies[1,9]. In particular, the group with chewing discomfort is meaning from the standpoint that it is an indicator that can be used to objectively measure the unmet dental needs experiences of the subjects. In Korea, dental services are usually performed in dental hospitals, and thus the group with activity limitations would inevitably have a high rate of unmet dental needs experiences. Given that 62.9% of the study subjects were elderly people aged 60 or older and that 90% of the subjects who gave "being frail/health issues" as the subjective reason for unmet dental needs were also elderly

people aged 60 or older, measures regarding accessibility to dental hospitals should focus especially on elderly people in single-person households.

With respect to income level, the lower-income group showed the highest rate of unmet dental needs experiences, with such experiences decreasing with increases in income level; this was consistent with the findings in previous studies[21-23]. Considering that 54% of the respondents stated that they did not receive the necessary dental care services due to economic reasons, the cost of dental care services seems to act as an impediment to meeting the needs for dental services. The goal of any public health care system is to guarantee the health and quality of life of its citizens by providing health care services based on the need for such services rather than the ability to pay[24]. Despite the fact that providing the right dental services at the right time is important, dental services can result in an 83.5% out-of-pocket cost due to many high-cost items that are not covered by insurance[24], which can cause a problem of impeding accessibility for those on a lower-income level. In particular, because people perceive oral diseases to be less life-threatening that other medical diseases, they tend to underestimate the urgency of oral diseases[1]. From preventive dental care, such as scaling, sealant treatment, and resin filling, to rehabilitative dental care, such as dentures and implants, the range of dental services covered by insurance is expected to continue to expand. In the future, if dental services are compared by the year of implementation, the effect may be greater accessibility.

The fact that smokers have a higher rate of unmet dental needs experiences than non-smokers is consistent with the results for members of all types of households. Among members of all types of households, smokers showed a 1.186-fold higher rate of unmet dental needs experiences than non-smokers[21], while among single-person households, smokers showed a 2.75-fold higher rate of unmet dental needs experiences than non-smokers, indicating that smokers from a single-person household are more likely to experience unmet dental needs than smokers from other types of households. Smokers are known to utilize outpatient services less frequently owing to psychological factors, such as subjective health status and stress[25].

Because smoking itself is a key factor that affects oral health[26], follow-up studies are needed with consideration for the mediating variables and psychological characteristics associated with the process by which smoking status affects unmet dental needs experiences.

In addition, regular oral health screening, subjective oral health status, toothache in the past year, speech impairment, and permanent dental care experience showed statistically significant differences in unmet dental needs as compared to their counterparts, but the logistic regression analysis did not show a statistically significant influence. Such findings contradicted the results from analyzing the factors associated with unmet dental needs experiences among all types of households[19], which may be attributable to the internal heterogeneity and the characteristics of single-person households. The demographic characteristics of single-person households have greater internal heterogeneity than those of other types of households[10]. The increased number of single-person households may be attributable to changes in social patterns, such as changes in household structure, late marriage, and an increase in the population of those who are single, as well as changes in the population structure, such as a low birth rate and population aging. Moreover, various differences in sex characteristics, marital status, and area of residence are found among different age groups[10,11]. Because the present study conducted the analyses without adjusting for factors that may cause internal heterogeneity, such as sex, age, area of residence, and income level of single-person household members, a follow-up study that considers these factors is recommended.

Various measures are needed to reduce the unmet dental needs experiences among single-person households. Specific strategies that include utilization of a part-time dentist system for long-term care facilities, home-visit oral hygiene services, and nearby dentist referral services should be devised to refer and provide dental services to single-person household members with activity limitations. In particular, the fact that most of the single-person household members with activity limitations are elderly people aged 60 or over should be taken into account. When a professional oral hygiene program was implemented for elderly residents in long-term care facilities, the program had the effect of reducing the dental plaque index, halitosis, and tongue coatings, while increasing saliva flow[27]. Moreover, health insurance coverage should be expanded to ensure equity in dental services for single-person household with a low-income level, while the reason for these same households having a high smoking rate should be analyzed from multiple perspectives; mediating variables associated with the process by which smoking status affects unmet dental needs experiences should also be analyzed to actively recommend policies that can ultimately reduce the smoking rate.

Because the present study analyzed data from the 6th KNHANES that used a self-reporting format, the dental services that medical professionals determine are needed could not be measured objectively. Moreover, because the questionnaire did not include questions on the experience of dental needs that the subjects wanted to meet but which could not be met, this aspect could not be measured. As a limitation inherent in regression analysis, influencing factors of unmet dental needs were analyzed cross-sectionally and individually. Accordingly, a follow-up study is needed to analyze the complex relationships between various factors with consideration of factors that cause internal heterogeneity, such as sex, age, area of residence, and income level. Despite these limitations, the significance of the present study can be found in the fact that it attempted to allow the results to be interpreted as results for all single-person households, such as accounting for weighted values; it also analyzed the influencing factors of the utilization of dental services according to the Anderson model, a typical socio-behavioral model used as an analytic framework for behavioral prediction and identification of the current status of unmet dental needs among single-person households to provide basic data on unmet dental needs among single-person households.

Notes

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Ethical approval

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