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# The Relationship Between Unmet Medical Needs Awareness and Health Care Utilization in Korean Adults with Social Activity Restriction: A Secondary Analysis Study Using Propensity Score Matching

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## Abstract

**Background:** This study aimed to analyze the relationship between unmet medical needs (UMN) awareness and health care utilization in Korean adults with social activity restriction (SAR).

**Method:** The 6~8th Korea National Health and Nutrition Examination Survey (KNHANES) was used to analyze 41,720 people among groups aged 19 or older by applying individual weights imposed from the raw data. Weighted logistic regression and Weighted zero-inflated Poisson regression analyzed the relationship. Additional analysis was performed using Propensity Score Matching (PSM) to equalize all variables except UMN.

**Results:** SAR due to health condition group (1.75 OR) had a higher UMN experience rate than the non-SAR group. The number of admissions (ADM) and outpatient department (OPD) in the SAR group was a higher than the non-SAR group. Analyzing the relationship between UMN and health care utilization according to the type of health problem using PSM showed that in the “Non-SAR” group, the number of ADM and OPD were higher in the UMN group than the met-medical-needs group. In the “SAR due to Physical health (PH)” group, ADM was lower, but OPD was higher than met-medical needs group. In the “SAR due to PMH (Physical and mental health)” group, ADM was higher, but OPD was lower than met-medical needs group.

**Conclusion:** Current UMN awareness can increase health care utilization and is necessary to strengthen the medical service screening policy to prevent the overuse of health care utilization.

**Keywords:** Health policy, Medical utilization, PSM, Social activity restriction, Unmet medical needs

## 1. Introduction

Social activity refers to any action that can form or maintain external relationships mentally and physically and is defined as not only economic activities but also activities with informal groups such as family, friends, and neighbors [1]. Social activities improve cognitive and physical functions through the effects of setting and achieving individual goals and sharing information [1,2]. Medical expenses can also be reduced by participating social activity [3]. However, according to the 2019 Korea Centers for Disease Control and Prevention (KCDC)

announcement [4], the Social activity restriction (SAR) rate is increasing rapidly with age in Korea. Furthermore, the SAR rate for adults 19 years and older in the US is 4.3%, whereas in Korea it is 8.3%, which is significantly higher than in the US [5,6].

Such SAR not only increases the socioeconomic burden by causing a decrease in income activity [7] but also deteriorates physical and mental health (PMH) [8]. Consequently, there is a social problem that the SAR group experiences unmet medical needs (UMN) because they do not receive treatment despite the urgent need for medical treatment [9–11]. A previous study in Korea reported that the

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experience rate of UMN in the SAR group was more than 5% higher than that of the non-SAR group [11]. In the US study, the results of analyzing the association between the SAR group and UMN of 282,768 adults found that the SAR group experienced UMN more frequently in medical services such as in an outpatient department (OPD), admission (ADM), and health care utilization [10].

UMN is a measure of access to medical care to determine whether individuals are using the necessary medical services punctually worldwide [12,13]. Although there is a desire for treatment, there is a characteristically high possibility of increasing the severity of the disease and causing complications because treatment is not received on time due to geographical and socioeconomic reasons [14]. Specifically, a study in China found that the UMN group had lower health than the met-medical-needs group but their health continued to deteriorate because they did not receive adequate medical services due to the burden of medical expenses [15]. A study in the US also found that medical use and medical expenses in the UMN group were generally lower than in the met-medical-needs group [16,17].

Unlike in other countries, the mandatory NHI program in Korea creates an environment where anyone can access universal medical care regardless of socioeconomic factors [18]. A study in Korea showed that due to the extensive insurance payment of health insurance subscribers [19], most citizens can receive medical services at a low cost [9,20]. Specifically, the socioeconomic burden is lower than other countries because the social vulnerable group with a high rate of UMN benefits from a lower medical payment rate [21]. Further, according to the Organization for Economic Cooperation and Development (OECD) announcement [22], hospital beds per 1000 people in Korea is 12.4, compared to 2.9 in the US, which is high in medical acceptance and access compared to other countries.

Therefore, in Korea, due to the high SAR rate, the physical and mental health deterioration and socioeconomic burden of individuals increase [4,5,7,8], resulting in a high level of UMN [22]. However, the statistics results [9,20] indicate that health care utilization in the UMN group was higher than that of the met-medical-needs group due to Korea's universal medical access and low self-pay rate. Therefore, this study aims to analyze the relationship between UMN and health care utilization among SAR in Korea. We intend to provide basic data for the overuse of medical care by UMN groups and

provide appropriate medical services at the right time to the group.

## 2. Methods

### 2.1. Data source and participants

This study used the 6-8th Korea National Health and Nutrition Examination Survey (KNHANES) surveyed by the Korea Ministry of Health and Welfare's Korea Disease Control and Prevention Agency (KDCA). It is a secondary analysis study that uses raw data from the Korea National Health and Nutrition Examination Survey and related pledges to investigate the relationship between UMN and health care utilization, living in Korea, and used them for analysis after approval of data requests. The KNHANES is a nationwide survey conducted every three years based on Article 16 of the National Health Promotion Act, which was enacted in 1995. In the first year, 8150 people from 3513 households participated, and 8127 people from 3580 households participated in the second year. The subjects in the study were extracted from the total census data of the population housing as the basic extraction frame by a two-stage stratification collection method consisting of survey districts and households as primary and secondary extraction units. Fig. 1 displays the procedures of this study.

This study analyzed the relationship between UMN and health care utilization by applying individual weights imposed on 41,720 people, excluding 12,524 people under 19 years of age, 7020 missing values for SAR due to health conditions, 666 missing values for medical unmet needs and medical

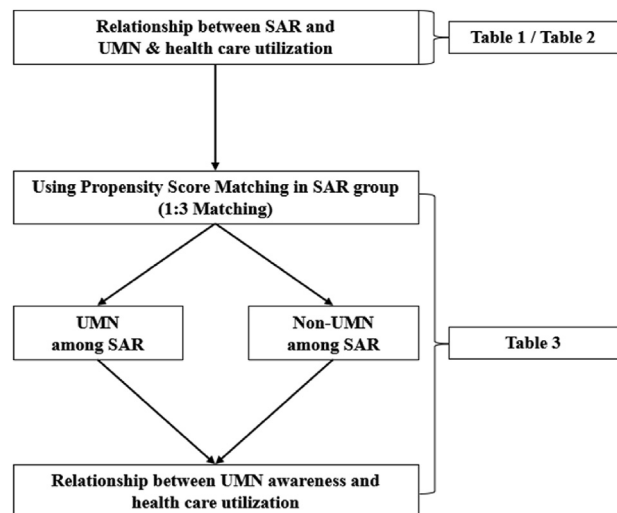


Fig. 1. Displays the procedures of this study.

utilization behaviors and 756 missing values for control variables.

## 2.2. Independent variables

Independent variables were 'SAR due to health conditions' (Table 1 and Table 2) and 'UMN awareness among SAR group (Table 3).

First, SAR due to health condition was assessed by a Yes/No response to the question: "Are you currently restricted in your social activity due to mental health conditions or physical health conditions?". The group that answered 'No' was classified as the 'Non-SAR', the activity restriction group due to physical problems was classified as 'SAR due to PH', and the activity restriction group due to physical and mental problems was classified as 'SAR due to PMH'.

Additionally, using the PSM method, only groups with similar socioeconomic and health variables were extracted from among SAR groups. UMN awareness among SAR' was identified by classifying whether or not there was unmet medical awareness.

## 2.3. Dependent variables

The dependent variables in this study were medical unmet needs awareness, the number of ADM, and the number of OPD. A medical unmet need were defined as 'Have you ever needed a hospital treatment but not received it in the past 12 months?'.

To assess the number of ADM and OPD, participants were asked respectively 'How many times have you been hospitalized in the past 12 months?' and 'How many times have you been treated at a hospital or a public health center or an oriental clinic for the past two weeks without hospitalization?'.

## 2.4. Control variables

### 2.4.1. Socioeconomic and demographic factors

'Sex' group was divided into two categories: male, and female. 'Age' group was divided into four categories: 19–29, 30–49, 50–64, and Over 65 years. 'Marital status' was divided into two categories: single (including separated, divorced), married. 'Education level' was divided into four categories: under elementary school, middle school, high school, college. 'Family income' was divided into four categories: low, middle-low, middle–high, and high. 'Residency region' was divided into three categories: capital area, metropolitan city, and rural area. 'Occupation' was divided into three categories: white-collar, blue-collar, and unemployment.

Table 1. General characteristics.

Variables	Total		UMN		Yes		No. ADM		No. OPD		p-value
	N	%*	No	N	%*	N	%*	M*	SD	M*	
Total	41,720	100.0	37,787	90.8	3933	9.2	1.18	0.01	1.87	0.02	<0.0001
SAR due to health condition	40,395	97.5	36,693	91.0	3702	9.0	1.16	0.01	1.84	0.02	<0.0001
No	1325	2.5	1094	83.7	231	16.3	1.62	0.11	2.64	0.11	0.232
Type of SAR	40,395	97.5	36,693	91.0	3702	9.0	1.16	0.01	1.84	0.02	0.003
Non-AR	1183	2.3	994	85.4	189	14.6	1.60	0.12	2.67	0.12	<0.0001
AR due to PH	142	0.3	100	70.3	42	29.7	1.75	0.28	2.45	0.29	<0.0001
AR due to PMH	5194	18.1	4692	90.7	502	9.3	1.11	0.02	1.55	0.03	<0.0001
Age (yrs)	14,350	39.1	13,020	90.7	1330	9.3	1.13	0.01	1.75	0.03	<0.0001
19–29	11,952	27.3	10,880	91.2	1072	8.8	1.24	0.03	1.92	0.03	<0.0001
30–49	10,224	15.5	9195	90.3	1029	9.7	1.25	0.02	2.19	0.04	<0.0001
50–64	18,051	49.1	16,788	92.8	1263	7.2	1.20	0.02	1.79	0.03	<0.0001
>65	23,669	50.9	20,999	88.9	2670	11.1	1.18	0.01	1.93	0.02	<0.0001
Sex	12,592	33.4	11,155	89.4	1437	10.6	1.19	0.02	1.86	0.03	0.004
Male	29,128	66.6	26,632	91.5	2496	8.5	1.18	0.01	1.88	0.02	<0.0001
Female											
Marital Status											
Single (including separated, divorced)											
Married											

<b>Education level</b>							<0.0001		0.857			<0.0001
≤ Elementary school	8324	13.9	7245	87.1	1079	12.9		1.22	0.02		2.19	0.04
Middle school	4209	8.5	3807	90.5	402	9.5		1.24	0.04		2.08	0.06
High school	13,968	36.8	12,749	91.1	1219	8.9		1.18	0.02		1.80	0.03
≥ College	15,219	40.8	13,986	91.8	1233	8.2		1.16	0.02		1.70	0.02
<b>Family Income</b>							<0.0001		0.957			0.000
Low	7432	14.2	6424	86.9	1008	13.1		1.24	0.03		2.19	0.04
Middle-low	10,333	23.9	9322	90.1	1011	9.9		1.20	0.02		1.87	0.03
Middle-high	11,533	29.6	10,521	91.1	1012	8.9		1.18	0.02		1.82	0.03
High	12,422	32.3	11,520	92.6	902	7.4		1.15	0.02		1.73	0.03
<b>Residency Region</b>							<0.0001		0.357			0.134
Capital area	15,925	38.8	14,584	91.8	1341	8.2		1.19	0.02		1.84	0.03
Metropolitan city	14,269	34.6	12,836	90.1	1433	9.9		1.19	0.02		1.90	0.03
Rural area	11,526	26.6	10,367	90.2	1159	9.8		1.16	0.01		1.88	0.03
<b>Occupation</b>							<0.0001		0.523			0.655
White Collar	16,873	43.1	15,485	91.6	1388	8.4		1.16	0.02		1.73	0.02
Blue Collar	23,284	53.4	20,861	90.0	2423	10.0		1.20	0.01		1.96	0.02
Unemployment	1563	3.4	1441	92.4	122	7.6		1.24	0.04		2.01	0.08
<b>National health Insurance type</b>							<0.0001		0.072			<0.0001
Health insurance beneficiary	40,322	97.2	36,625	91.0	3697	9.0		1.18	0.01		1.85	0.02
Medical aid beneficiary	1398	2.8	1162	83.9	236	16.1		1.37	0.06		2.42	0.11
<b>Smoking Status</b>							0.0002		0.591			0.160
Never	25,261	57.1	22,718	90.2	2543	9.8		1.17	0.01		1.90	0.02
Ever	16,459	42.9	15,069	91.5	1390	8.5		1.20	0.02		1.83	0.03
<b>Alcohol Status</b>							<0.0001		0.035			0.044
Never	4720	8.9	4166	88.5	554	11.5		1.29	0.04		2.02	0.05
Ever	37,000	91.1	33,621	91.0	3379	9.0		1.17	0.01		1.85	0.02
<b>Current Chronic Disease*</b>							<0.0001		<0.0001			<0.0001
0	25,155	67.8	22,931	91.2	2224	8.8		1.11	0.01		1.72	0.02
1	6630	14.0	6096	91.5	534	8.5		1.24	0.03		1.92	0.04
2	4762	9.3	4287	90.0	475	10.0		1.31	0.06		1.94	0.04
≥3	5173	8.8	4473	87.1	700	12.9		1.30	0.03		2.32	0.05
<b>Year</b>							<0.0001		0.975			0.629
2013	4759	11.4	4202	88.8	557	11.2		1.14	0.02		1.84	0.05
2014	4480	11.1	3994	89.2	486	10.8		1.17	0.03		1.78	0.04
2015	4485	11.3	3980	88.5	505	11.5		1.14	0.02		1.78	0.04
2016	5716	13.3	5189	91.3	527	8.7		1.19	0.03		1.97	0.05
2017	5513	12.7	4969	90.0	544	10.0		1.21	0.03		1.95	0.05
2018	5779	13.5	5273	91.2	506	8.8		1.17	0.04		1.92	0.05
2019	5794	13.5	5366	93.3	428	6.7		1.21	0.02		1.82	0.04
2020	5194	13.1	4814	93.0	380	7.0		1.22	0.04		1.90	0.04

SAR: Social Activity Restriction, UMN: Unmet Medical Needs, PH: Physical Health, PMH: Physical and Mental Health, ADM: Admission

OPD: Out Patient Department

\*: Weighted

No. ADM: experienced medical admission at least once in the past 1 year

No. OPD: experienced outpatient department at least once in the past 1 year

Current Chronic Disease\*: Hypertension, Dyslipidemia, Stroke, Cardiovascular disease, arthritis, osteoporosis, Pulmonary disease, Diabetes, Cancer

Table 2. Adjusted effect between SAR due to health condition and health care utilization.

Variables	UMN		No. ADM				No. OPD					
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	AOR <sup>a</sup>	P-value	IRR <sup>a</sup>	P-value	AOR <sup>a</sup>	P-value	IRR <sup>a</sup>	P-value	AOR <sup>a</sup>	P-value	IRR <sup>a</sup>	P-value
<b>SAR due to health condition</b>												
No	1.00				1.00				1.00			
Yes	1.75	<0.0001			2.10	<0.0001			1.20	0.0219		
<b>Type of SAR</b>												
Non-SAR			1.00				1.00				1.00	
SAR due to PH			1.58	<0.0001			2.48	<0.0001			1.48	<0.0001
SAR due to PMH			3.20	<0.0001			2.40	<0.0001			1.27	0.0025

SAR: Social Activity Restriction, UMN: Unmet Medical Needs, PH: Physical Health, PMH: Physical and Mental Health, ADM:

Admission, OPD: Outpatient Department PSM: Propensity Score Matching

Control Variables: Age, Sex, Marital Status, Education, Family Income, Residency Region, Occupation, National Health Insurance type, Current Chronic Disease, Smoking, Alcohol, Year

'National health insurance type' was divided into two categories: health insurance beneficiary, and medical aid beneficiary.

#### 2.4.2. Health status and behavioral factors

'Smoking status' group was categorized into two group: never, ever. Alcohol status was divided into two categories: never, ever. Finally, The number of current chronic diseases (Hypertension, Dyslipidemia, Stroke, Cardiovascular disease, arthritis, osteoporosis, Pulmonary Disease, Diabetes, Cancer) was included as a covariate in our analyses.

### 3. Analytical approach and statistics

In this study, To analyze the relationship between UMN and health care utilization, the age, sex, marital status, education level, family income,

residency region, occupation, national health insurance type, number of chronic diseases, smoking status, drinking status, and survey year variables of the study subjects were controlled.

In order to check the difference in the distribution of the dependent variable according to the independent variable the Rao-Scott Chi square test was used for the 'UMN' dependent variable, and the T-test and ANOVA were used for the 'the number of ADM and OPD. In addition, weighted logistic regression analysis was used to investigate the relationship between SAR due to health conditions and UMN, and weighted zero-inflated Poisson regression analysis was used to examine the relationship between SAR due to health conditions and the number of ADM, OPD.

Finally, in order to analyze in detail the relationship between UMN and health care utilization

Table 3. Adjusted effect between UMN and the health care utilization according to type of activity restriction after PSM.

Variables	No. ADM		No. OPD	
	IRR <sup>a</sup>	P-value	IRR <sup>a</sup>	95% CI
<b>UMN among Non-SAR</b>				
No	1.00		1.00	
Yes	1.15	<0.0001	1.15	<0.0001
<b>UMN among SAR due to PH</b>				
No	1.00		1.00	
Yes	0.46	<0.0001	1.27	<0.0001
<b>UMN among SAR due to PMH</b>				
No	1.00		1.00	
Yes	1.08	<0.0001	0.83	<0.0001

Control Variables: Age, Sex, Marital Status, Education, Family Income, Residency Region, Occupation, National Health Insurance type, Current Chronic Disease, Smoking, Alcohol

according to the type of SAR, Propensity Score Matching was used to control covariates in the experimental and control groups other than policy variables. In this study, using PSM, we identified the effect of unmet medical awareness on health care utilization within a group with the same socio-economic and health factors. For all analyses, the criterion for statistical significance was  $P \leq 0.05$ , two tailed. All analyses were carried out using the SAS statistical software package, version 9.4 (SAS Institute, Cary, NC, USA).

### 3.1. Propensity score matching

Propensity score matching (PSM) is a statistical matching technique that is used in observational studies to reduce bias. Socioeconomic factors (sex, age, household income, region of residence, education, etc.) and health factors (smoking, drinking, No. chronic diseases, etc.) were matched. Through this, it is possible to reduce the bias because there is simply a difference in whether or not there is UMN, and other factors are similar. We performed a 1:3 case–control match on the propensity score that made best matches first and next-best matches next, in a hierarchical sequence until no more matches could be made (nearest neighbor matching). SAS LOGISTIC procedure code was used to create the propensity score [23].

## 4. Data availability statement

Data are owned by and are available from the database of Korea National Health and Nutrition Examination Surveys (KNHNES) <https://knhanes.kdca.go.kr/knhanes/main.do>. KNHNES allows use of this data freely to any researcher agreeing to follow research ethics guidelines.

### 4.1. Ethical considerations

The data is an open access dataset and did not contain any personal information on patients, therefore no ethical approval was required.

## 5. Results

Table 1 shows the results of general characteristics of participants to determine the relationship between SAR and UMN and medical utilization behaviors. Of the 41,720 participants, 9.2% ( $n = 3933$ ) experienced UMN; the average number of ADM was 1.18 and OPD was 1.87. Of the total subjects, SAR due to health condition group was 2.5% ( $n = 1315$ ). In the corresponding group, the UMN

group was 16.3% ( $n = 231$ ), and the average number of ADM and OPD were 1.62 and 2.64.

Table 2 shows the results of adjusting the control variables to investigate the relationship between SAR and UMN and medical utilization behaviors. In the SAR group due to health conditions, compared to the “Non-SAR” group, the UMN experience rate was 1.75 OR (Odds Ratio [OR]: 1.75,  $p$ -value:  $<0.0001$ ) higher than the non-SAR group, and the number of ADM was 2.10 RR (Incidence Rate Ratio [IRR]: 2.10,  $p$ -value:  $<0.0001$ ), and the number of OPD was 1.20 RR (IRR: 1.20,  $p$ -value: 0.0219).

Table 3 shows the results of analyzing the relationship between UMN and health care utilization, assuming that all control variables have the same status using PSM. In the “Non-SAR” group, ADM and OPD were 1.15 RR and 1.15RR (IRR: 1.15,  $p$ -value:  $<0.0001$ ), respectively, higher in the UMN group than in the met-medical-needs group. Moreover, in the “SAR due to PH” group, ADM was lower at 0.46 RR (IRR: 0.46,  $p$ -value:  $<0.0001$ ) but, OPD was higher at 1.27 RR (IRR: 1.27,  $p$ -value:  $<0.0001$ ). In the “SAR due to PMH” group, the number of ADM was 1.08 RR (IRR: 1.08,  $p$ -value:  $<0.0001$ ), higher than in other groups, but OPD was 0.83 RR (IRR: 0.83,  $p$ -value:  $<0.0001$ ), lower than the met-medical-needs group.

Table 4 shows the PSM results. The non-SAR group totaled 14,808 people, of which 3702 (25.0%) were the UMN awareness group. The total number of SAR due to PH group was 708, of which 177 (25.0%) are UMN awareness groups. The SAR due to PMH group had a total of 124 people, of which 31 people (25.0%) had UMN awareness. The overall  $p$ -value of each variable was more than 0.05, so proper PSM matching was achieved. This result means that the case group and the control group have similar variables except for UMN awareness.

## 6. Discussion

We intend to provide basic data for the composition of an efficient and systematic medical care screening policy to prevent the overuse of medical care by UMN groups and to provide appropriate medical services to the groups by using PSM to analyze the relationship between UMN and the health care utilization according to the type of SAR.

The study results are summarized as follows. The SAR due to health conditions group had a higher rate of UMN experience and medical utilization than the non-SAR group. As a result of analyzing the relationship between UMN and the number of ADM and OPD according to the type of SAR using PSM, the experience of UMN in the non-SAR group

Table 4. General characteristics of subjects included for analysis after Propensity Score Matching.

Variables	Non-SAR				SAR due to PH					SAR due to PMH					
	Total		UMN		p-value	Total		UMN		p-value	Total		UMN		p-value
	N	%	N	%		N	%	N	%		N	%	N	%	
Total	14,808	100.0	3702	25.0		708	100.0	177	25.0		124	100.0	31	25.0	
Age (yrs)					0.505					0.652					0.728
19–29	2053	13.9	492	24.0		28	4.0	8	28.6		9	7.3	2	22.2	
30–49	5288	35.7	1307	24.7		78	11.0	18	23.1		15	12.1	5	33.3	
50–64	3950	26.7	1007	25.5		189	26.7	53	28.0		23	18.5	7	30.4	
>65	3517	23.8	896	25.5		413	58.3	98	23.7		77	62.1	17	22.1	
Sex					0.625					0.499					0.321
Male	4716	31.8	1191	25.3		259	36.6	61	23.6		41	33.1	8	19.5	
Female	10,092	68.2	2511	24.9		449	63.4	116	25.8		83	66.9	23	27.7	
Marital Status					0.551					0.827					0.468
Single (including separated, divorced)	5216	35.2	1319	25.3		317	44.8	78	24.6		61	49.2	17	27.9	
Married	9592	64.8	2383	24.8		391	55.2	99	25.3		63	50.8	14	22.2	
Education level					0.686					0.408					0.652
≤ Elementary school	3808	25.7	957	25.1		349	49.3	87	24.9		67	54.0	17	25.4	
Middle school	1426	9.6	371	26.0		99	14.0	26	26.3		8	6.5	2	25.0	
High school	4792	32.4	1174	24.5		165	23.3	35	21.2		29	23.4	9	31.0	
≥ College	4782	32.3	1200	25.1		95	13.4	29	30.5		20	16.1	3	15.0	
Family Income					0.190					0.666					0.795
Low	3326	22.5	875	26.3		355	50.1	92	25.9		69	55.6	19	27.5	
Middle-low	3999	27.0	965	24.1		179	25.3	39	21.8		27	21.8	7	25.9	
Middle-high	3952	26.7	988	25.0		78	11.0	22	28.2		12	9.7	2	16.7	
High	3531	23.8	874	24.8		96	13.6	24	25.0		16	12.9	3	18.8	
Residency Region					0.366					0.522					0.288
Capital area	5075	34.3	1287	25.4		163	23.0	43	26.4		41	33.1	7	17.1	
Metropolitan city	5365	36.2	1357	25.3		227	32.1	61	26.9		37	29.8	12	32.4	
Rural area	4368	29.5	1058	24.2		318	44.9	73	23.0		46	37.1	12	26.1	
Occupation					0.931					0.612					0.018
White Collar	5386	36.4	1356	25.2		117	16.5	27	23.1		26	21.0	3	11.5	
Blue Collar	8978	60.6	2235	24.9		542	76.6	140	25.8		88	71.0	28	31.8	
Unemployment	444	3.0	111	25.0		49	6.9	10	20.4		10	8.1	0	0.0	
National health Insurance type					0.040					0.213					1.000
Health insurance beneficiary	14,138	95.5	3512	24.8		608	85.9	147	24.2		108	87.1	27	25.0	
Medical aid beneficiary	670	4.5	190	28.4		100	14.1	30	30.0		16	12.9	4	25.0	
Smoking Status					0.473					0.621					0.454
Never	9652	65.2	2395	24.8		447	63.1	109	24.4		77	62.1	21	27.3	
Ever	5156	34.8	1307	25.3		261	36.9	68	26.1		47	37.9	10	21.3	
Alcohol Status					0.095					0.079					1.000
Never	1910	12.9	507	26.5		149	21.0	29	19.5		36	29.0	9	25.0	
Ever	12,898	87.1	3195	24.8		559	79.0	148	26.5		88	71.0	22	25.0	
Current Chronic Disease*					0.782					0.548					0.968
0	8811	59.5	2187	24.8		145	20.5	30	20.7		28	22.6	6	21.4	
1	2024	13.7	499	24.7		114	16.1	31	27.2		16	12.9	4	25.0	
2	1645	11.1	425	25.8		159	22.5	39	24.5		19	15.3	5	26.3	
≥3	2328	15.7	591	25.4		290	41.0	77	26.6		61	49.2	16	26.2	

increased the number of ADM, OPD and; in the SAR due to PH, the number of ADM decreased, while the number of OPD increased. The UMN in SAR due to PMH group decreased OPD but increased ADM.

The current findings indicate that the SAR due to health conditions group had a higher rate of UMN experience and a higher number of medical

utilization than the non-SAR group, consistent with extant literature [24–27]. In a study in Korea [24], the SAR group had lower educational status, occupational status, and health level than the non-SAR group, which resulted in lower-income levels, lack of time for treatment, and difficulty in mobility. Consequently, more medical unmet needs were experienced. Further, a study in Canada [25]



reported that due to economic difficulties, the SAR group was found to have more than thrice the experience rate of UMN compared to the non-SAR group. Contrary to the results of this study, the number of medical utilization was also low. However, in Korea's National Health Insurance (NHI) system, the low level of medical cost burden, high level of access to medical institutions, and the continuous expansion of NHI coverage resulted in more than twice as much medical service use in the UMN group compared to other groups [26,27].

The results of the study in which the SAR due to PMH group showed a higher rate of UMN than the group with only physical problems, but the number of medical use was lowered than the group with only physical problems [28]. According to Kim's previous study [28], when SAR due to PMH occurs, despite recognizing the need for immediate treatment for physical ill health, mental health also deteriorated. Additionally, low level of quality of life and self-esteem were reported, and the number of ADM and OPD visits decreased by adopting voluntary isolation.

According to the type of SAR in this study, the result of the factors of UMN experience increasing the number of medical utilization is consistent with previous studies [20,28–30]. First, the result that the group with physical problems had more outpatient use than hospitalization shows that, in the case of using medical services due to physical problems, the proportion of chronic diseases such as bronchitis, high blood pressure, and diabetes that require long-term treatment was high. However, these results are attributed to the fact that the health insurance system in Korea strengthens the coverage of medical expenses for outpatient visits for the treatment of chronic diseases. In particular, according to Lee's previous study [30], the number of hospitalizations decreased by 1.6 when physical problems such as chronic diseases and physical injuries occurred, but the number of outpatient visits at clinic medical institutions increased by 0.05. Moreover, in the group with both PMH, due to a decrease in quality of life and an increase in the feeling of isolation [28], the overall number of medical utilization decreased compared to the group with just PH. However, the combination of PMH accelerated the aggravation of the disease, leading to a tendency to receive treatment through hospitalization for long-term treatment rather than outpatient visits [28].

Nevertheless, even in the non-SAR group, it was found that UMN was a factor that increased the number of hospitalization and outpatient use. The follow-up of 2316 Korean adults for 5 years showed

that the average number of OPD and ADM in the met-medical-needs group were 23.42 and 0.17, whereas the average number of OPD and ADM in the UMN group were 27.29 and 0.25 [20]. Other studies of the follow-up of 5104 Korean adults for 9 years [29] reported that the number of OPD and ADM per year in the UMN group were 11.8 times and 3.1 times more.

For these reasons, the low-level socioeconomic groups experiencing UMN judged that the medical services provided by health care providers with different socioeconomic levels were less effective for themselves, so they used "Want" more often than "Need" [31,32]. In addition, financial barriers have been alleviated due to the expansion of coverage of NHI benefits in Korea and universal medical access, creating a medical environment where medical services can be used according to "Need" as well as "Want," thereby increasing the medical demand of unmet groups [33].

Accordingly, a high UMN experience rate—which is used as a pivotal indicator to measure medical accessibility between countries and regions—signifies the absence of essential medical services that require timely treatment; it is known to result in increased disease exacerbation and avoidable deaths [34]. However, the currently ubiquitous UMN measurement index defines the UMN group according to whether a person visits a medical institution when they simply want to go to one or when they think they need an examination or treatment [35]. Therefore, there are critical opinions on the following risk factors: (1) various information can be omitted due to simple measurement index, (2) conflicting mechanisms can be hidden within the presented simple figure, and (3) lack of medical resources increases unmet medical care [35].

Therefore, this study aimed to provide basic data for a medical service screening policy to provide essential medical services promptly, rather than excessive medical care, to the group experiencing UMN among the activity-restricted groups owing to health conditions. By improving the efficiency-emphasized measurement method to compensate for the systematic bias in the "UMN" indicator (used for equity and fairness of medical services between countries and regions), it may be possible to prevent the overuse of medical service by a group that has high medical usage but is simply classified as UMN groups.

This study has some limitations. First, we could not identify a causal relationship between SAR due to health conditions and UMN and medical utilization behaviors because the study was cross-

sectional. Second, owing to data limitations, we could not use an accurate measure of SAR due to health conditions. In addition, SAR due to health conditions was self-reported and, therefore, does not imply a diagnosis. Third, SAR due to health conditions measurement could result in greater bias when people are evaluating themselves subjectively. However, this study had several strengths. First, to the best of our knowledge, it was the first study to analyze the relationship between SAR due to health conditions and UMN and medical utilization behaviors. Second, it used the nationwide survey data as well as imposed weights on individuals in the population; thus, our results represent the entire Korean population among adults aged over 19 years. Third, our study investigated various variables, including socioeconomic characteristics, chronic diseases, perceived stress level, and health-related behaviors. Fourth, unlike prior studies focusing on the relationship between UMN and health status, this study focused on the relationship between the pure experience of medical unmet needs and medical utilization behaviors by using Propensity Score Matching.

## 7. Conclusion

This study investigated the effect of UMN perception on medical utilization behaviors among SAR due to health conditions group based on the 6th–8th Korean National Health and Nutrition Examination Survey conducted on adults 19 years of age or older. A detailed study was conducted on this relationship according to the type of SAR by using PSM. The UMN experience rate and the number of ADM and OPD were higher in the SAR group than in the non-SAR group, and according to the type of SAR, it was found that the experience of UMN increased the number of OPD and ADM. Therefore, the efficient distribution of medical service resources may be possible to prevent the overuse of medical care through the establishment and reinforcement of a medical service screening policy to provide appropriate medical services to the medical unsatisfied group, and to improve the UMN index used as a measurement index for medical access in a specific and systematic way.

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## Conflict of interest

The author declares no conflict of interest.

## References

- [1] Kim YB, Lee SH. Social participation and subjective well-being of elderly in Seoul and Chuncheon area. *J Kor Gerontol Soc* 2008;28(1):1–18.
- [2] Aida J, Kondo K, Hirai H, Subramanian SV, Murata C, Kondo N, et al. Assessing the association between all-cause mortality and multiple aspects of individual social capital among the older Japanese. *BMC Publ Health* 2011 Jun 25;11:499. <https://doi.org/10.1186/1471-2458-11-499>.
- [3] Yoshida H, Fujiwara Y, Amano H, Kumagai S, Watanabe N, Sangyoon L, et al. [Economic evaluation of disability prevention programs for community-dwelling elderly secular trend analyses of medical and care expenses comparing participants and non-participants in the programs]. *Nihon Koshu Eisei Zasshi* 2007 Mar;54(3):156–67 [Japanese].
- [4] Division of Chronic Disease Control, Korea Disease Control and Prevention Agency. Activity restriction rate trend, 2007–2019. *Week Health Illness* 2021;14(24):1731–2.
- [5] Korea Institute of Public Administration. The 2021 Korea social integration survey. Seoul: Korea Institute of Public Administration; 2021.
- [6] Korea, Ministry of Health and Welfare. The third Korea national health and nutrition examination survey (KNHANES III), 2005 : activity limitation and health-related quality of life. Seoul: KIHASA; 2006.
- [7] Bogaert P, Van Oyen H, Beluche I, Cambois E, Robine JM. The use of the global activity limitation Indicator and healthy life years by member states and the European Commission. *Arch Publ Health* 2018 Jun 28;76:30. <https://doi.org/10.1186/s13690-018-0279-z>.
- [8] Dwyer-Lindgren L, Mackenbach JP, van Lenthe FJ, Mokdad AH. Self-reported general health, physical distress, mental distress, and activity limitation by US county, 1995–2012. *Popul Health Metrics* 2017 Apr 26;15(1):16. <https://doi.org/10.1186/s12963-017-0133-5>.
- [9] Hwang B-D. The prevalence and association factors of unmet medical needs by age group in the elderly. *Korea Soc Health Serv Mang* 2015;9(1):81–93.
- [10] Xie Z, Tanner R, Striley CL, Marlow NM. Association of functional disability with mental health services use and perceived unmet needs for mental health care among adults with serious mental illness. *J Affect Disord* 2022 Feb 15;299:449–55. <https://doi.org/10.1016/j.jad.2021.12.040>.
- [11] Jeong YH. Activity restrictions and unmet healthcare needs based on Korea health panel data [Internet]. Health and Social Welfare issue & focus. Sejong: Korea Institute Health and Social Affairs. 2012 [cited 2022 Nov ]. Available from: [https://www.kihasa.re.kr/web/publication/periodical/issue\\_view.do?pageIndex=26&keyField=&searchStat=&menuId=50&key=&tid=38&bid=21&searchForm=&aid=120&ano=1](https://www.kihasa.re.kr/web/publication/periodical/issue_view.do?pageIndex=26&keyField=&searchStat=&menuId=50&key=&tid=38&bid=21&searchForm=&aid=120&ano=1).
- [12] Newacheck PW, Hughes DC, Hung YY, Wong S, Stoddard JJ. The unmet health needs of America's children. *Pediatrics* 2000 Apr;105(4 Pt 2):989–97.
- [13] Andersen R. Health status indices and access to medical care. *Am J Publ Health* 1978 May;68(5):458–63. <https://doi.org/10.2105/ajph.68.5.458>.
- [14] Diamant AL, Hays RD, Morales LS, Ford W, Calmes D, Asch S, et al. Delays and unmet need for health care among adult primary care patients in a restructured urban public health system. *Am J Publ Health* 2004 May;94(5):783–9. <https://doi.org/10.2105/ajph.94.5.783>.
- [15] Zhou S, Huang T, Li A, Wang Z. Does universal health insurance coverage reduce unmet healthcare needs in China? Evidence from the National Health Service Survey. *Int J Equity Health* 2021 Jan 21;20(1):43. <https://doi.org/10.1186/s12939-021-01385-7>.
- [16] Rockett IR, Putnam SL, Jia H, Chang CF, Smith GS. Unmet substance abuse treatment need, health services utilization, and cost: a population-based emergency department study. *Ann Emerg Med* 2005 Feb;45(2):118–27. <https://doi.org/10.1016/j.annemergmed.2004.08.003>.

- [17] Shi L, Stevens GD. Vulnerability and unmet health care needs. The influence of multiple risk factors. *J Gen Intern Med* 2005 Feb;20(2):148–54. <https://doi.org/10.1111/j.1525-1497.2005.40136.x>.
- [18] Ahn YH, Kim ES, Ham OK, Kim SH, Hwang SS, Chun SH, et al. Factors associated with the overuse or underuse of health care services among medical aid beneficiaries in Korea. *J Community Health Nurs* 2011 Oct;28(4):190–203. <https://doi.org/10.1080/07370016.2011.614837>.
- [19] Kang MS, Jang HS, Lee M, Park EC. Sustainability of Korean national health insurance. *J Kor Med Sci* 2012 May;27(Suppl):S21–4. <https://doi.org/10.3346/jkms.2012.27.S.S21>.
- [20] Kim JH, Lee KS, Yoo KB, Park EC. The differences in health care utilization between Medical Aid and health insurance: a longitudinal study using propensity score matching. *PLoS One* 2015 Mar 27;10(3):e0119939. <https://doi.org/10.1371/journal.pone.0119939>.
- [21] Jeong HS. Korea's National Health Insurance—lessons from the past three decades. *Health Aff* 2011 Jan;30(1):136–44. <https://doi.org/10.1377/hlthaff.2008.0816>.
- [22] Jeon CH, Kwak JW, Kwak MH, Kim JH, Park YS. Factors associated with unmet healthcare needs of the older Korean population: the seventh Korea national health and nutrition examination survey 2017. *Korean J Health Promot* 2019;19(2):84–90.
- [23] Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. *Biometrika* 1983;70(1):41–55.
- [24] Hwang B, Chun SM, Park JH, Shin HI. Unmet healthcare needs in people with disabilities: comparison with the general population in Korea. *Ann Rehabil Med* 2011 Oct;35(5):627–35. <https://doi.org/10.5535/arm.2011.35.5.627>.
- [25] McColl MA, Jarzynowska A, Shortt SED. Unmet health care needs of people with disabilities: population level evidence. *Disabil Soc* 2010;25(2):205–18.
- [26] Kim S, Kwon S. The effect of extension of benefit coverage for cancer patients on health care utilization across different income groups in South Korea. *Int J Health Care Finance Econ* 2014 Jun;14(2):161–77. <https://doi.org/10.1007/s10754-014-9144-y>.
- [27] Hwang J. Understanding reasons for unmet health care needs in Korea: what are health policy implications? *BMC Health Serv Res* 2018 Jul 16;18(1):557. <https://doi.org/10.1186/s12913-018-3369-2>.
- [28] Kim YR. A study on the factors related to unmet medical needs among some injury patient. *J Digital Converg* 2019;17(12):535–43.
- [29] Kim JH, Lee KS, Lee Y, Park EC. Association of occupational class with healthcare utilization among economically active Korean adults from 2006 to 2014: a repeated cross-sectional study of Koreans aged 19 Years and older. *Korean J Fam Med* 2017 Nov;38(6):365–71. <https://doi.org/10.4082/kjfm.2017.38.6.365>.
- [30] Lee HJ, Jang SI, Park EC. The effect of increasing the coinurance rate on outpatient utilization of healthcare services in South Korea. *BMC Health Serv Res* 2017 Feb 20;17(1):152. <https://doi.org/10.1186/s12913-017-2076-8>.
- [31] Balsa AI, McGuire TG. Statistical discrimination in health care. *J Health Econ* 2001 Nov;20(6):881–907. [https://doi.org/10.1016/s0167-6296\(01\)00101-1](https://doi.org/10.1016/s0167-6296(01)00101-1).
- [32] Balsa AI, McGuire TG. Prejudice, clinical uncertainty and stereotyping as sources of health disparities. *J Health Econ* 2003 Jan;22(1):89–116. [https://doi.org/10.1016/s0167-6296\(02\)00098-x](https://doi.org/10.1016/s0167-6296(02)00098-x).
- [33] Choi JW, Park EC, Yoo KB, Lee SG, Jang SI, Kim TH. The effect of high medical expenses on household income in South Korea: a longitudinal study using propensity score matching. *BMC Health Serv Res* 2015 Sep 10;15:369. <https://doi.org/10.1186/s12913-015-1035-5>.
- [34] Allin S, Grignon M, Le Grand J. Subjective unmet need and utilization of health care services in Canada: what are the equity implications? *Soc Sci Med* 2010 Feb;70(3):465–72. <https://doi.org/10.1016/j.socscimed.2009.10.027>.
- [35] Park YK, Kim JH, Kim S, Kim CY, Kim SR. Critical analysis of unmet healthcare needs index for addressing regional healthcare inequality. *Health Pol Manag* 2020;30(1):37–49. <https://doi.org/10.4332/KJHPA.2020.30.1.37>.