

## Impact of Changes in Medical Aid Status on Unmet Need and Catastrophic Health Expenditure: Data from the Korea Health Panel

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**Purpose:** To investigate whether changes in Medical Aid (MA) status are associated with unmet need and catastrophic health expenditure (CHE).

**Methods:** Data from the 2010 to 2014 Korea Health Panel (KHP) were used. The impact of changes in annual MA status ('MA to MA,' 'MA to MA Exit,' 'MA Exit to MA,' and 'MA Exit to MA Exit') on unmet need (all-cause and financial) and CHE (10% and 40% of household capacity to pay) were examined using the generalized estimating equation (GEE) model. Analysis was conducted separately for MA type I and II individuals.

**Results:** In 1,164 Medical Aid type I individuals, compared to the 'MA to MA' group, the 'MA to MA Exit' group had increased likelihoods of all-cause and financial unmet need. This group also showed higher likelihoods of CHE at the 10% standard. The 'MA Exit to MA Exit' group showed increased likelihoods at the 10% and 40% CHE standards. In 852 type II recipients, the 'MA to MA Exit' group had higher likelihoods of CHE at the 10% standard.

**Conclusions:** Type 1 MA exit beneficiaries had higher likelihoods of all-cause and financial unmet need, along CHE at the 10% standard. Type I 'MA Exit to MA Exit' beneficiaries also showed higher likelihoods of CHE at the 10% and 40% standards. In type II recipients, MA exit beneficiaries had higher likelihoods of CHE at the 10% standard. The results infer the importance of monitoring MA exit beneficiaries as they may be vulnerable to unmet need and CHE.

**Key words:** Medical insurance, Social welfare, Health care utilization, Health service, Health care cost

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## 1. Introduction

South Korea operates a Medical Aid (MA) program guaranteeing the provision of appropriate health care services to selected low-income individuals to [1]. In contrast to the National Health Insurance (NHI) system that covers around 97% of the population funded through income level insurance premium contributions, the MA program is a public medical assistance program funded entirely by the government under the National Basic Livelihood Security Act [2]. In Korea, MA beneficiaries are classified into types I and II based on work capacity. Specifically, the type I category encompasses individuals or households without labor capability and other specific cases whereas the type II category embraces households with work-capable individuals [3]. Unsurprisingly, recipient copayment levels differ between type I and II individuals, with type II beneficiaries being subject to higher amounts of copayment for outpatient and inpatient services. In brief, type I individuals are not subject to paying for inpatient services while type II individuals are responsible for 10% of the total costs. Regarding outpatient services, type I individuals are required to pay between 1,000 and 2,000 Korean Won (KRW) depending on the level of medical institution, and are provided a monthly health maintenance fee of 6,000 KRW to support copayments, with a maximum ceiling being applied to limit out-of-pocket expenditure. In contrast, type II individuals pay 1,000 KRW for outpatient services at primary clinics and 10% of the total costs for services at secondary or tertiary hospitals.

Public assistance is important to ensure that socially vulnerable individuals maintain adequate living stan-

dards. Concurrently, social security systems need to prevent individuals from falling into poverty traps, which requires the implementation of self-sufficiency rather than income transfer programs under necessary conditions [4]. Similarly, the MA system aims to guarantee appropriate access to health care services and assist needy individuals to attain economic independence [5]. In fact, a self-sufficiency program largely targeting MA individuals, particularly those with work capacity, is currently operated by the government to decrease welfare dependency [6-7]. The government aims to decrease welfare expenditure, promote better use of health care services, and alleviate welfare dependency of work-capable beneficiaries by pursuing appropriate MA exits.

Under such circumstances, health care utilization of MA beneficiaries has been of concern as beneficiaries are reported to be utilizing higher amounts of health care services than NHI covered individuals, even after adjustment for health-related characteristics [8]. It is known that certain characteristics are shared by the MA group, including old age, low education level, higher likelihood of disability, and poor health partially impacted by low health literacy and management skills [9]. However, the fact that beneficiaries have been reported to utilize around three times higher medical costs than their NHI counterparts, along with the increasing trends in total expenditure, has led to concerns for moral hazard [10]. This is because recipients can use medical services by paying only a part of the total medical costs, which can result in unnecessary medical overuse [11].

Simultaneously, the likelihood of increased unmet needs and mild catastrophic health expenditure (CHE) also needs to be considered because the NHI program is operated under a low cost - low benefit

policy, which may lead to high out-of-pocket costs [12–13]. Health care spending is regarded as being catastrophic when the amount exceeds a certain percentage of a household's capacity to pay [14]. As the MA benefit package is fundamentally identical to that of the NHI, lower income individuals, including type II recipients subject to higher co-payments, may face higher levels of barriers in accessing medical care [12]. However, few studies have investigated the effect of MA beneficiary exits on unmet need and CHE using longitudinal, nationally representative data. Therefore, the aim of this study was to investigate whether transitions in MA status among beneficiaries were associated with higher likelihood of unmet need and CHE.

## II. Materials and Methods

### 1. Study population and design

This study used data from the Korea Health Panel (KHP) from 2011 to 2014. The KHP is provided by the Korea Institute for Health and Social Affairs (KIHA-SA) and the Korea National Health Insurance Service (KNHIS). The 2008 to 2014 KHP data selected nationally representative sample households using a two-stage cluster method [15]. All members of the selected households were interviewed by researcher using a Computer Assisted Personal Interviewing (CAPI) technique to record information on health care utilization, health expenditure, socioeconomic characteristics, demographic characteristics, and other health-related behavior [15].

Information on unmet need and CHE was available from 2011 to 2014 in the KHP data. As this study aimed to investigate the effect of MA status change

on health care utilization, unmet need, and CHE, data from 2010 to 2014 were utilized. Of the 17,035 individuals recorded in 2010, 443 had MA type I status and 415 type II status. Among type I individuals, 421 were followed up until 2011, of which 331 were aged 20 years or above. Similarly, among type II individuals, 402 were followed up until 2011, of which 222 were aged 20 years or above.

### 2. Outcome variable

The outcome variables of this study were unmet need and CHE. Unmet need was further categorized into unmet need due to all causes and unmet need due to financial reasons. Unmet need was measured based on self-reports to the question “Did you experience unmet need?” If individuals responded “yes” to the question, they were further asked about reasons behind their experience of unmet need. Available options included finance-, access-, health-, and time-related responses. Individuals who reported an experience of unmet need were classified into the “yes” unmet need category, and those who responded with having unmet need due to financial reasons were categorized into the “yes” unmet need due to financial reasons category. CHE was measured using the Xu method proposed by the World Health Organization (WHO), and calculated based on the percentage of health spending over a household's capacity to pay [14]. Two different standards were used as thresholds for CHE—10% and 40% of a household's capacity to pay. The 40% standard was applied as proposed by the WHO [16]. The 10% criteria was additionally considered to denote mild CHE based on previous Korean studies that identified health care spending exceeding 10% of the effective household's income as an overburden [17].

### 3. Interesting variable

The interesting variable of this study was annual MA transition status. MA beneficiaries at the 2010 baseline were identified. Beneficiaries were then followed up in the subsequent year to check whether they remained as beneficiaries or lost their beneficiary status (“MA to MA” or “MA to MA Exit”). In other words, as the baseline consisted of only MA beneficiaries, participants were only classified into the “MA to MA” or “MA to MA Exit” groups at the first year of follow-up. Afterward, individuals who were followed up could be categorized into four groups depending on the transition status (“MA to MA,” “MA to MA Exit,” “MA Exit to MA,” and “MA Exit to MA Exit” groups [Figure 1]).

### 4. Covariates

The covariates of this study were sex (male or female), age (20-29, 30-39, 40-49, 50-59, 60-64, 65-74, 75-84, or 85+), region (Seoul, metropolitan, or rural), disability status (no or yes), number of chron-

ic diseases (none, one to three, or four or above), rare disease status (no or yes), Charlson Comorbidity Index (CCI) (zero, one, two, three, four, or above), admission status (no or yes), year (2008 to 2015), education level (high school or below, or university or above), and household size (one to four or above).

### 5. Statistical analysis

The general characteristics of the study population were examined using chi-square test to examine differences between groups. In studying the effect of MA status change on occurrences of unmet need or CHE, logistic regression models were fitted using the generalized estimating equation model with log link function with calculations expressed as odds ratio (OR) and 95% CI (Confidence Interval). Analysis was adjusted for covariates, and all calculated *p-values* were two-sided, considered significant at *p-values* <.05 or if the 95% CIs of risk point estimates excluded one. Analysis was performed using the SAS software, version 9.4 (SAS Institute, Cary, NC, USA).

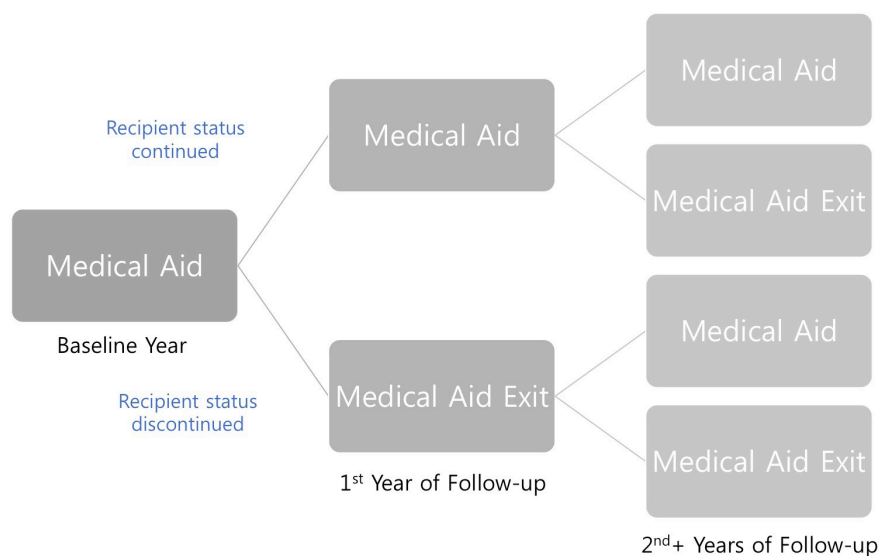


Figure 1. Categorization of the interesting variable.

### III. Results

The general characteristics of MA type I study subjects are shown in Table 1. A total of 1,164 subjects were analyzed, of which 305 (26.2%) expe-

rienced unmet need and 188 (16.2%) experienced unmet need due to financial reasons. In the case of CHE, 284 (24.4%) subjects reported CHE at the 10% standard of a household's capacity to pay and 58 (5.0%) subjects reported CHE at the 40% standard.

Table 1. General characteristics of study observations in medical aid type 1

	N	Unmet Need	p-value	Financial unmet need	p-value	CHE 10%	p-value	CHE 40%	p-value	N (%)
<b>Medical Aid Status</b>										
MA → MA	1049	265 (25.3)	.069	162 (15.4)	.090	233 (22.2)	<.001	47 (4.5)	.001	
MA → MA Exit	53	21 (39.6)		14 (26.4)		23 (43.4)		2 (3.8)		
MA Exit → MA	9	4 (44.4)		3 (33.3)		0 (0.0)		0 (0.0)		
MA Exit → MA Exit	53	15 (28.3)		9 (17.0)		28 (52.8)		9 (17.0)		
<b>Sex</b>										
Male	464	100 (21.6)	.003	63 (13.6)	.052	108 (23.3)	.468	26 (5.6)	.428	
Female	700	205 (29.3)		125 (17.9)		176 (25.1)		32 (4.6)		
<b>Age</b>										
20-29	45	8 (17.8)	.015	7 (15.6)	.753	14 (31.1)	.226	2 (4.4)	.385	
30-39	22	3 (13.6)		2 (9.1)		3 (13.6)		0 (0.0)		
40-49	118	38 (32.2)		24 (20.3)		30 (25.4)		4 (3.4)		
50-59	142	34 (23.9)		25 (17.6)		43 (30.3)		12 (8.5)		
60-69	175	34 (19.4)		25 (14.3)		33 (18.9)		6 (3.4)		
70-79	469	123 (26.2)		77 (16.4)		113 (24.1)		24 (5.1)		
80+	193	65 (33.7)		28 (14.5)		48 (24.9)		10 (5.2)		
<b>Region</b>										
Seoul	150	35 (23.3)	.238	26 (17.3)	.481	51 (34.0)	.001	14 (9.3)	.013	
Metropolitan	294	69 (23.5)		53 (18.0)		82 (27.9)		17 (5.8)		
Rural	720	201 (27.9)		109 (15.1)		151 (21.0)		27 (3.8)		
<b>Education level</b>										
High school or below	1060	286 (27.0)	.054	171 (16.1)	.955	251 (23.7)	.068	52 (4.9)	.699	
University or above	104	19 (18.3)		17 (16.4)		33 (31.7)		6 (5.8)		
<b>Household size</b>										
1	442	136 (30.8)	.036	78 (17.7)	.459	91 (20.6)	.024	19 (4.3)	.062	
2	438	104 (23.7)		65 (14.8)		115 (26.3)		31 (7.1)		
3	167	35 (21.0)		23 (13.8)		39 (23.4)		5 (3.0)		
4+	117	30 (25.6)		22 (18.8)		39 (33.3)		3 (2.6)		
<b>Disability</b>										
No	725	196 (27.0)	.407	128 (17.7)	.073	191 (26.3)	.047	39 (5.4)	.424	
Yes	439	109 (24.8)		60 (13.7)		93 (21.2)		19 (4.3)		
<b>Chronic Disease</b>										
0	351	101 (28.8)	.282	63 (18.0)	.504	89 (25.4)	.025	18 (5.1)	.936	
1	508	122 (24.0)		76 (15.0)		106 (20.9)		24 (4.7)		
2+	305	82 (26.9)		49 (16.1)		89 (29.2)		16 (5.3)		
<b>Rare Disease</b>										
No	1132	297 (26.2)	.875	181 (16.0)	.372	275 (24.3)	.619	58 (5.1)	.189	
Yes	32	8 (25.0)		7 (21.9)		9 (28.1)		0 (0.0)		
<b>Charlson Comorbidity Index</b>										
0	804	209 (26.0)	.391	129 (16.0)	.408	169 (21.0)	<.001	35 (4.4)	.023	
1	175	46 (26.3)		28 (16.0)		47 (26.9)		9 (5.1)		
2	125	29 (23.2)		17 (13.6)		43 (34.4)		6 (4.8)		
3+	60	21 (35.0)		14 (23.3)		25 (41.7)		8 (13.3)		
<b>Outpatient visits</b>										
None	67	19 (28.4)	.239	9 (13.4)	.274	9 (13.4)	.000	4 (6.0)	.522	
Q1	219	53 (24.2)		32 (14.6)		49 (22.4)		9 (4.1)		
Q2	285	63 (22.1)		40 (14.0)		60 (21.1)		12 (4.2)		
Q3	300	82 (27.3)		48 (16.0)		67 (22.3)		13 (4.3)		
Q4	293	88 (30.0)		59 (20.1)		99 (33.8)		20 (6.8)		
<b>Admission status</b>										
No	843	220 (26.1)	.895	130 (15.4)	.273	142 (16.8)	<.001	29 (3.4)	<.001	
Yes	321	85 (26.5)		58 (18.1)		142 (44.2)		29 (9.0)		
<b>Year</b>										
2011	331	67 (20.2)	.028	52 (15.7)	.954	88 (26.6)	.122	21 (6.3)	.177	
2012	303	82 (27.1)		51 (16.8)		80 (26.4)		9 (3.0)		
2013	273	80 (29.3)		42 (15.4)		52 (19.1)		12 (4.4)		
2014	257	76 (29.6)		43 (16.7)		64 (24.9)		16 (6.2)		
<b>Total</b>	1164	305 (26.2)		188 (16.2)		284 (24.4)		58 (5.0)		

\*MA=Medical Aid

Admission status refers to admission at corresponding year

Similarly, Table 2 presents the general characteristics of MA type II individuals. A total of 852 subjects were included in the analysis, of which 217 (25.5%) reported unmet need and 154 (18.1%) reported unmet need

due to financial reasons. Additionally, 188 (22.1%) individuals had experiences of CHE at the 10% standard of a household's capacity to pay and 35 (4.1%) individuals had experiences of CHE at the 40% standard.

Table 2. General characteristics of study observations in medical aid type 2

	N	Unmet Need	<i>p-value</i>	Financial unmet need	<i>p-value</i>	CHE 10%	<i>p-value</i>	CHE 40%	<i>p-value</i>	N (%)
<b>Medical Aid Status</b>										
MA → MA	564	160 (28.4)	.035	115 (20.4)	.081	106 (18.8)	.003	19 (3.4)		.062
MA → MA Exit	116	27 (23.3)		18 (15.5)		39 (33.6)		10 (8.6)		
MA Exit → MA	12	2 (16.7)		2 (16.7)		2 (16.7)		0 (0.0)		
MA Exit → MA Exit	160	28 (17.5)		19 (11.9)		41 (25.6)		6 (3.8)		
<b>Sex</b>										
Male	378	91 (24.1)	.404	70 (18.5)	.764	91 (24.0)	.213	17 (4.5)		.609
Female	474	126 (26.6)		84 (17.7)		97 (20.5)		18 (3.8)		
<b>Age</b>										
20-29	189	18 (9.5)	<.001	12 (6.4)	<.001	45 (23.7)	.033	8 (4.2)		.115
30-39	72	20 (27.8)		11 (15.3)		9 (12.7)		0 (0.0)		
40-49	169	49 (29.0)		39 (23.1)		30 (17.8)		3 (1.8)		
50-59	167	66 (39.5)		42 (25.2)		35 (21.0)		7 (4.2)		
60-69	132	34 (25.8)		27 (20.5)		29 (22.0)		10 (7.6)		
70-79	89	23 (25.8)		21 (23.6)		29 (32.6)		5 (5.6)		
80+	34	7 (20.6)		2 (5.9)		11 (32.4)		2 (5.9)		
<b>Region</b>										
Seoul	108	32 (29.6)	.377	21 (19.4)	.446	34 (31.2)	<.001	9 (8.3)		.042
Metropolitan	198	54 (27.3)		41 (20.7)		22 (11.1)		9 (4.6)		
Rural	546	131 (24.0)		92 (16.9)		132 (24.2)		17 (3.1)		
<b>Education level</b>										
High school or below	649	183 (28.2)	.001	130 (20.0)	.008	143 (22.0)	.976	27 (4.2)		.891
University or above	203	34 (16.8)		24 (11.8)		45 (22.2)		8 (3.9)		
<b>Household size</b>										
1	68	12 (17.7)	.340	7 (10.3)	.341	11 (15.9)	.001	4 (5.9)		.073
2	212	59 (27.8)		41 (19.3)		67 (31.6)		14 (6.6)		
3	250	60 (24.0)		44 (17.6)		51 (20.4)		10 (4.0)		
4+	322	86 (26.7)		62 (19.3)		59 (18.4)		7 (2.2)		
<b>Disability</b>										
No	649	154 (23.7)	.037	113 (17.4)	.368	147 (22.7)	.456	24 (3.7)		.281
Yes	203	63 (31.0)		41 (20.2)		41 (20.2)		11 (5.4)		
<b>Chronic Disease</b>										
0	514	117 (22.8)	.071	81 (15.8)	.065	106 (20.6)	.002	20 (3.9)		.081
1	240	69 (28.8)		49 (20.4)		47 (19.6)		7 (2.9)		
2+	98	31 (31.6)		24 (24.5)		35 (35.7)		8 (8.2)		
<b>Rare Disease</b>										
No	821	205 (25.0)	.085	146 (17.8)	.255	179 (21.8)	.343	34 (4.1)		.801
Yes	31	12 (38.7)		8 (25.8)		9 (29.0)		1 (3.2)		
<b>Charlson Comorbidity Index</b>										
0	727	187 (25.7)	.975	132 (18.2)	.753	152 (20.9)	.002	28 (3.9)		<.001
1	73	17 (23.3)		13 (17.8)		15 (20.5)		0 (0.0)		
2	32	8 (25.0)		7 (21.9)		10 (31.3)		2 (6.3)		
3+	20	5 (25.0)		2 (10.0)		11 (55.0)		5 (25.0)		
<b>Outpatient visits</b>										
None	142	21 (14.8)	.002	16 (11.3)	.019	23 (16.1)	<.001	4 (2.8)		.352
Q1	65	14 (21.5)		11 (16.9)		12 (18.5)		1 (1.5)		
Q2	218	61 (28.0)		35 (16.1)		41 (18.9)		7 (3.2)		
Q3	213	71 (33.3)		53 (24.9)		38 (17.8)		10 (4.7)		
Q4	214	50 (23.4)		39 (18.2)		74 (34.6)		13 (6.1)		
<b>Admission status</b>										
No	726	185 (25.5)	.984	130 (17.9)	.759	127 (17.5)	<.001	20 (2.8)		<.001
Yes	126	32 (25.4)		24 (19.1)		61 (48.8)		15 (11.9)		
<b>Year</b>										
2011	222	60 (27.0)	.355	43 (19.4)	.053	40 (17.9)	.165	5 (2.3)		.440
2012	218	59 (27.1)		46 (21.1)		48 (22.0)		11 (5.1)		
2013	213	57 (26.8)		42 (19.7)		46 (21.7)		10 (4.7)		
2014	199	41 (20.6)		23 (11.6)		54 (27.1)		9 (4.5)		
<b>Total</b>	<b>852</b>	<b>217 (25.5)</b>		<b>154 (18.1)</b>		<b>188 (22.1)</b>		<b>35 (4.1)</b>		

\*MA=Medical Aid

Admission status refers to admission at corresponding year



Table 3. Results of the GEE analyzing the effect of medical aid status on unmet need and CHE in medical aid type 1

	Unmet Need		Financial unmet need		CHE 10%		CHE 40%	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Medical Aid Status</b>								
MA → MA	1.00		1.00		1.00		1.00	
MA → MA Exit	2.43	(1.21 - 4.85)	2.26	(1.29 - 3.99)	1.22	(1.07 - 1.40)	0.99	(0.93 - 1.05)
MA Exit → MA	4.11	(0.84 - 20.05)	2.42	(0.58 - 10.07)	0.89	(0.82 - 0.97)	1.00	(0.97 - 1.03)
MA Exit → MA Exit	1.02	(0.42 - 2.45)	0.96	(0.51 - 1.81)	1.33	(1.13 - 1.57)	1.13	(1.02 - 1.26)
<b>Sex</b>								
Male	1.00		1.00		1.00		1.00	
Female	1.38	(0.87 - 2.19)	1.55	(1.03 - 2.34)	1.02	(0.96 - 1.09)	0.99	(0.96 - 1.02)
<b>Age</b>								
20-29	1.00		1.00		1.00		1.00	
30-39	0.77	(0.13 - 4.63)	0.87	(0.18 - 4.25)	0.87	(0.72 - 1.05)	0.97	(0.89 - 1.05)
40-49	1.83	(0.59 - 5.71)	2.82	(0.97 - 8.17)	1.01	(0.85 - 1.20)	1.02	(0.93 - 1.11)
50-59	1.30	(0.40 - 4.26)	1.42	(0.50 - 4.02)	1.05	(0.88 - 1.25)	1.07	(0.98 - 1.17)
60-69	0.89	(0.26 - 3.05)	0.99	(0.33 - 2.95)	0.96	(0.81 - 1.14)	1.01	(0.92 - 1.10)
70-79	0.90	(0.29 - 2.83)	1.36	(0.48 - 3.83)	0.96	(0.81 - 1.13)	1.01	(0.94 - 1.10)
80+	0.79	(0.25 - 2.55)	1.91	(0.67 - 5.45)	0.96	(0.81 - 1.15)	1.02	(0.93 - 1.10)
<b>Region</b>								
Seoul	1.00		1.00		1.00		1.00	
Metropolitan	1.02	(0.56 - 1.86)	1.15	(0.63 - 2.10)	0.92	(0.84 - 1.01)	0.95	(0.90 - 1.00)
Rural	0.80	(0.48 - 1.36)	1.36	(0.79 - 2.32)	0.87	(0.80 - 0.94)	0.94	(0.89 - 0.99)
<b>Education level</b>								
High school or below	1.00		1.00		1.00		1.00	
University or above	1.08	(0.53 - 2.22)	0.74	(0.38 - 1.44)	1.10	(0.99 - 1.22)	1.02	(0.97 - 1.07)
<b>Household size</b>								
1	1.00		1.00		1.00		1.00	
2	0.86	(0.56 - 1.35)	0.85	(0.58 - 1.25)	1.05	(0.98 - 1.11)	1.02	(0.99 - 1.06)
3	0.68	(0.38 - 1.22)	0.64	(0.39 - 1.06)	1.02	(0.94 - 1.11)	0.99	(0.95 - 1.03)
4+	0.88	(0.45 - 1.70)	0.81	(0.41 - 1.59)	1.10	(0.99 - 1.22)	0.97	(0.93 - 1.01)
<b>Disability</b>								
No	1.00		1.00		1.00		1.00	
Yes	0.76	(0.50 - 1.17)	1.02	(0.70 - 1.49)	0.94	(0.88 - 1.00)	0.98	(0.95 - 1.01)
<b>Chronic Disease</b>								
0	1.00		1.00		1.00		1.00	
1	0.76	(0.49 - 1.17)	0.67	(0.46 - 0.99)	0.95	(0.89 - 1.01)	1.00	(0.97 - 1.04)
2+	0.77	(0.45 - 1.34)	0.77	(0.48 - 1.24)	0.99	(0.91 - 1.08)	1.00	(0.96 - 1.04)
<b>Rare Disease</b>								
No	1.00		1.00		1.00		1.00	
Yes	1.36	(0.48 - 3.84)	0.81	(0.31 - 2.16)	1.01	(0.86 - 1.20)	0.94	(0.90 - 0.98)
<b>Charlson Comorbidity Index</b>								
0	1.00		1.00		1.00		1.00	
1	0.99	(0.56 - 1.74)	1.04	(0.66 - 1.64)	0.99	(0.92 - 1.06)	1.00	(0.96 - 1.03)
2	0.63	(0.34 - 1.18)	0.66	(0.40 - 1.08)	1.04	(0.95 - 1.13)	0.98	(0.94 - 1.02)
3+	1.66	(0.88 - 3.14)	1.84	(0.99 - 3.44)	1.06	(0.94 - 1.21)	1.06	(0.97 - 1.17)
<b>Outpatient visits</b>								
None	1.00		1.00		1.00		1.00	
Q1	1.32	(0.63 - 2.75)	1.03	(0.52 - 2.04)	1.10	(0.98 - 1.23)	0.97	(0.91 - 1.04)
Q2	1.26	(0.56 - 2.81)	0.80	(0.38 - 1.67)	1.12	(1.00 - 1.25)	0.97	(0.90 - 1.04)
Q3	1.55	(0.68 - 3.50)	1.07	(0.50 - 2.33)	1.13	(1.00 - 1.27)	0.97	(0.91 - 1.04)
Q4	1.99	(0.85 - 4.70)	1.22	(0.56 - 2.67)	1.20	(1.06 - 1.37)	0.99	(0.93 - 1.06)
<b>Admission status</b>								
No	1.00		1.00		1.00		1.00	
Yes	1.08	(0.75 - 1.56)	0.88	(0.64 - 1.22)	1.29	(1.20 - 1.38)	1.05	(1.01 - 1.09)
<b>Year</b>								
2011	1.00		1.00		1.00		1.00	-
2012	1.16	(0.78 - 1.73)	1.62	(1.14 - 2.29)	0.99	(0.94 - 1.05)	0.96	(0.94 - 0.99)
2013	1.06	(0.68 - 1.65)	1.81	(1.25 - 2.62)	0.92	(0.87 - 0.97)	0.98	(0.95 - 1.01)
2014	1.21	(0.75 - 1.95)	1.88	(1.27 - 2.77)	0.96	(0.90 - 1.02)	0.99	(0.94 - 1.03)

\*OR=Odds Ratio, CI=Confidence Interval  
 MA=Medical Aid, CHE=Catastrophic Health Expenditure  
 Admission status refers to admission at corresponding year

Table 4. Results of the GEE analyzing the effect of medical aid status on unmet need in medical aid type 2

	Unmet Need		Financial unmet need		CHE 10%		CHE 40%	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Medical Aid Status</b>								
MA -> MA	1.00		1.00		1.00		1.00	
MA -> MA Exit	0.98	(0.54 - 1.76)	1.09	(0.65 - 1.85)	1.14	(1.05 - 1.24)	1.06	(1.00 - 1.12)
MA Exit -> MA	0.81	(0.16 - 3.95)	0.62	(0.14 - 2.76)	0.91	(0.71 - 1.15)	0.96	(0.93 - 1.00)
MA Exit -> MA Exit	0.67	(0.33 - 1.34)	0.73	(0.42 - 1.26)	1.05	(0.97 - 1.15)	1.01	(0.97 - 1.05)
<b>Sex</b>								
Male	1.00		1.00		1.00		1.00	
Female	0.86	(0.52 - 1.42)	1.12	(0.73 - 1.72)	0.95	(0.89 - 1.01)	1.00	(0.97 - 1.03)
<b>Age</b>								
20-29	1.00		1.00		1.00		1.00	
30-39	3.07	(1.00 - 9.36)	3.60	(1.42 - 9.14)	0.88	(0.78 - 1.00)	0.97	(0.93 - 1.01)
40-49	5.12	(1.88 - 13.89)	3.60	(1.57 - 8.27)	0.94	(0.84 - 1.05)	0.99	(0.94 - 1.04)
50-59	6.50	(2.34 - 18.07)	6.33	(2.76 - 14.52)	0.93	(0.82 - 1.05)	1.00	(0.93 - 1.07)
60-69	7.57	(2.48 - 23.14)	4.55	(1.75 - 11.81)	0.89	(0.77 - 1.02)	1.02	(0.94 - 1.09)
70-79	8.63	(2.32 - 32.11)	3.85	(1.25 - 11.87)	0.94	(0.81 - 1.09)	0.99	(0.92 - 1.07)
80+	1.69	(0.35 - 8.10)	3.03	(1.03 - 8.97)	0.94	(0.78 - 1.13)	1.01	(0.93 - 1.11)
<b>Region</b>								
Seoul	1.00		1.00		1.00		1.00	
Metropolitan	1.21	(0.54 - 2.74)	0.93	(0.45 - 1.94)	0.77	(0.69 - 0.87)	0.95	(0.89 - 1.01)
Rural	1.02	(0.48 - 2.19)	0.86	(0.45 - 1.66)	0.87	(0.78 - 0.97)	0.93	(0.88 - 0.98)
<b>Education level</b>								
High school or below	1.00		1.00		1.00		1.00	
University or above	1.11	(0.52 - 2.39)	1.13	(0.60 - 2.11)	1.00	(0.92 - 1.09)	1.01	(0.97 - 1.05)
<b>Household size</b>								
1	1.00		1.00		1.00		1.00	
2	1.96	(0.76 - 5.08)	1.90	(0.82 - 4.41)	1.13	(1.01 - 1.26)	1.00	(0.93 - 1.07)
3	2.21	(0.88 - 5.56)	1.66	(0.70 - 3.94)	1.01	(0.90 - 1.13)	0.98	(0.91 - 1.06)
4+	2.95	(1.14 - 7.64)	2.10	(0.85 - 5.19)	0.98	(0.87 - 1.09)	0.96	(0.89 - 1.03)
<b>Disability</b>								
No	1.00		1.00		1.00		1.00	
Yes	0.74	(0.41 - 1.36)	1.07	(0.65 - 1.77)	0.96	(0.89 - 1.05)	1.01	(0.97 - 1.06)
<b>Chronic Disease</b>								
0	1.00		1.00		1.00		1.00	
1	0.95	(0.56 - 1.62)	1.02	(0.64 - 1.64)	0.94	(0.87 - 1.01)	0.97	(0.93 - 1.01)
2+	1.28	(0.60 - 2.73)	1.42	(0.73 - 2.74)	1.04	(0.93 - 1.17)	1.01	(0.95 - 1.07)
<b>Rare Disease</b>								
No	1.00		1.00		1.00		1.00	
Yes	2.51	(1.11 - 5.66)	1.93	(0.85 - 4.41)	1.10	(0.94 - 1.29)	1.00	(0.92 - 1.07)
<b>Charlson Comorbidity Index</b>								
0	1.00		1.00		1.00		1.00	
1	0.81	(0.42 - 1.57)	0.83	(0.44 - 1.58)	0.94	(0.86 - 1.04)	0.95	(0.92 - 0.98)
2	1.35	(0.52 - 3.49)	1.11	(0.49 - 2.51)	0.98	(0.84 - 1.14)	0.98	(0.91 - 1.06)
3+	0.43	(0.09 - 1.95)	0.88	(0.26 - 3.05)	1.14	(0.94 - 1.39)	1.17	(0.99 - 1.38)
<b>Outpatient visits</b>								
None	1.00		1.00		1.00		1.00	
Q1	1.23	(0.49 - 3.05)	1.34	(0.60 - 2.97)	1.05	(0.94 - 1.17)	0.98	(0.94 - 1.03)
Q2	0.78	(0.34 - 1.81)	1.34	(0.70 - 2.56)	1.07	(0.98 - 1.17)	1.00	(0.97 - 1.04)
Q3	1.01	(0.43 - 2.33)	1.37	(0.67 - 2.82)	1.06	(0.96 - 1.18)	1.01	(0.95 - 1.08)
Q4	0.62	(0.26 - 1.50)	0.76	(0.35 - 1.62)	1.17	(1.05 - 1.32)	1.01	(0.95 - 1.07)
<b>Admission status</b>								
No	1.00		1.00		1.00		1.00	
Yes	1.02	(0.58 - 1.79)	0.92	(0.55 - 1.51)	1.32	(1.20 - 1.45)	1.09	(1.03 - 1.15)
<b>Year</b>								
2011	1.00		1.00		1.00		1.00	-
2012	1.20	(0.80 - 1.78)	1.10	(0.76 - 1.60)	1.03	(0.97 - 1.10)	1.03	(0.99 - 1.06)
2013	1.16	(0.73 - 1.83)	1.14	(0.75 - 1.75)	0.99	(0.92 - 1.07)	1.01	(0.98 - 1.05)
2014	0.65	(0.39 - 1.09)	0.84	(0.54 - 1.32)	1.04	(0.96 - 1.13)	1.01	(0.96 - 1.05)

\*OR=Odds Ratio, CI=Confidence Interval

MA=Medical Aid, CHE=Catastrophic Health Expenditure

Admission status refers to admission at corresponding year



The association between MA alteration status and unmet need and CHE in MA type I beneficiaries is presented in Table 3. In terms of unmet need, compared to the “MA to MA” reference group, subjects in the “MA to MA Exit” group showed increased likelihood of unmet need (OR: 2.43, 95% CI: 1.21-4.85) and unmet need due to financial reasons (OR: 2.26, 95% CI: 1.29-3.99). Regarding CHE, the “MA to MA Exit” (OR: 1.22, 95% CI: 1.07-1.40) and “MA Exit to MA Exit” (OR: 1.33, 95% CI: 1.13-1.57) groups showed increased likelihood of CHE set at the 10% standard of a household’s capacity to pay whereas the “MA Exit to MA” group (OR: 0.89, 95% CI: 0.82-0.97) showed decreased occurrences compared to the “MA to MA” group. Moreover, the “MA Exit to MA Exit” group (OR: 1.13, 95% CI: 1.02-1.26) showed increased occurrences of CHE set at the 40% standard of a household’s capacity to pay.

Lastly, the relationship between MA alteration status and unmet need and CHE in MA type II is shown in Table 4. No statistical significance was found between the four MA status groups regarding unmet need. However, compared to the “MA to MA” group, the “MA to MA Exit” group (OR: 1.14, 95% CI: 1.05-1.24) demonstrated increased likelihood of CHE set at the 10% standard of a household’s capacity to pay.

## IV. Discussion

In MA type I individuals, higher likelihood of unmet need and unmet need due to financial constraints was present in individuals who exited MA beneficiary status compared to those with continuous MA coverage. In contrast, such tendencies were

not found among MA type II beneficiaries. The findings are generally in accordance with previous studies in Korea which have demonstrated that the near poor groups show higher levels of unmet need due to financial constraints [18]. A study specifically focusing on the elderly also analyzed that the near poor elderly groups experience higher risks of unmet need due to both financial and non-financial constraints [19]. The results of this study add further insights by specifically showing that MA exits are associated with increased likelihood of unmet need and unmet need resulting from financial reasons. Furthermore, by distinguishing between MA type I and II beneficiaries, the findings reveal that such increased likelihood affects only the MA type I group consisting of individuals without work capability.

The findings on unmet need are comprehensible considering that MA exits can increase the level of financial burden experienced by formal recipients using health care services as individuals are no longer provided with the benefit of low-cost sharing. Furthermore, the increased odds of unmet need found only in type I individuals can be interpreted in the following way. Successful welfare exits of work-capable individuals, referring to exits following enhanced self-sufficiency, are promoted by the government which aims to prevent social exclusion and alleviate welfare dependency so that individuals take are able to carry responsibility and participate in the labor market [6,20]. Accordingly, individuals exiting MA as a result of increased income, who constitute around 50% of all exits, are reported to have average earnings at around 176% of the minimum costs of living [21-22]. However, not all MA exits are a result of improved individual

economic sustainability, but they are also a consequence of administrative changes. This includes exits resulting from policy modifications and exposure of previously unreported wealth, income, or direct family support members. Individuals experiencing such coerced exits may experience financial difficulties afterward. As type I beneficiaries are evaluated to be devoid of work capability, exits from this group may largely be a result of administrative changes. Under such circumstances, type I exit group may be most vulnerable to financial and non-financial unmet health care needs, inferring that a particular emphasis should be put on alleviating occurrences of unmet need after welfare exits in this particular identified group.

Regarding CHE, type I and II individuals in the “MA to MA Exit” group showed higher likelihood of CHE set at the 10% standard of a household’s capacity to pay than those with continuous MA coverage. This suggests that MA exits may be interrelated with mild levels of CHE in which households experience modest levels of financial burden in utilizing health care services. The propensities found are plausible because MA exits do not always infer non-poverty, and studies have reported that low-income individuals without MA coverage often experience higher levels of health care costs and barriers to health care services [23]. Catastrophe has also been identified to positively correlate with out-of-pocket spending on health care [24]. Additionally, type I “MA Exit to MA Exit” group showed higher odds of CHE set at both the 10% and 40% standards of a household’s capacity to pay. Such trends were only found in MA type I individuals, inferring that individuals exiting MA without sufficient work capability may be particularly vulnera-

ble to financial difficulties in receiving health care. Since the Korean health care system may function to induce relatively high individual cost sharing levels, the inclinations directed toward CHE in MA exit individuals are noteworthy.

This study has some limitations. First, as the KHP collect information based on surveyor visits, individuals with comparatively severe diseases are often unavailable or opt to not participate. Second, the KHP gather information on health care utilization through self-reports in which surveyors collect data retrospectively based on receipts. These two factors may distort information on health care utilization. Third, disease classification in the KHP 2010 to 2011 data was conducted by surveyors, which may have resulted in bias. However, starting from 2012, classification was conducted twice by surveyors and experts to enhance accuracy. Lastly, time dependent confounders were not taken into consideration. Future studies accounting for time varying covariates may be beneficial in further enhancing the understanding of this subject.

## V. Conclusion

The findings demonstrate that MA exits are related to higher likelihood of all-cause and financial unmet need in the MA type I group. Both type I and II MA beneficiaries exiting MA status were more likely to experience mild levels of CHE. Together, the results suggest that type I individuals exiting MA status may be at a particular risk of unmet need and CHE. Considering that MA beneficiaries are known to utilize noticeably higher levels of health care services and that most of the beneficiaries are socially vulnerable individuals often of

poorer health status, individuals with experiences of receiving benefits should be closely monitored so that appropriate use of health care services is promoted while occurrences of unmet need and CHE are reduced.

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