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ORIGINAL ARTICLE

Impact of Changes in Medical Aid Status on Health Care Utilization

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Background: South Korea operates a Medical Aid (MA) program targeting selected low-income individuals to ensure medical service delivery to the disadvantaged while enhancing self-sufficiency of work-capable beneficiaries. However, as reasons behind welfare exits are diverse and do not always infer poverty relief or the provision of appropriate levels of health care services, this study aimed to investigate the association between changes in MA status and health care utilization.

Methods: This study used the 2006 to 2015 National Health Insurance claims data. The impact of changes in annual MA status on health care utilization (yearly number of outpatient visits, inpatient visits, length of stay, and emergency department [ED] visits) was investigated using the generalized estimating equation model.

Results: In 117,943 adult subjects aged 20 to 64, compared to the 'MA to MA' group, the 'MA to MA exit' group showed general decreases in utilization (outpatient visits: β=-3.93, p<0.0001; hospital admissions: relative risk [RR], 0.87; 95% confidence interval [CI], 0.83-0.91; length of stay: β=-3.64, p<0.0001; ED visits: RR, 0.83; 95% CI, 0.77-0.90). Similar patterns were found in the 'MA exit to MA exit' group (outpatient visits: β=-5.72, p<0.0001; admissions: RR, 0.91; 95% CI, 0.87-0.94; length of stay: β=-5.87; p<0.0001; ED visits: RR, 0.81; 95% CI, 0.75-0.88). Likewise, in 74,747 older adult subjects aged 65 or above, the 'MA to MA exit' group showed reduced levels of utilization (outpatient visits: β=-1.51; p=0.0020), as well as the 'MA exit to MA exit' group (admissions: RR, 0.92; 95% CI, 0.89-0.95; length of stay: β, -5.45; p<0.0001; ED visits: RR, 0.90; 95% CI, 0.83-0.97).

Conclusion: MA exit was associated with general decreases in health care utilization. Utilization patterns of individuals with experiences of receiving MA benefits should be monitored to promote the ideal use of health care services while preventing potential financial barriers present in accessing medical care.

Keywords: Medical Aid; Medical Aid alteration status; Welfare exit; Health care utilization; Medical utilization

INTRODUCTION

The health care system of South Korea is built and operated under two systems, the national health insurance (NHI) and Medical Aid (MA). The NHI is a universal social insurance program covering approximately 97% of the entire population, funded through income level insurance premium contributions [1]. In contrast, the MA program was introduced in 1977 as a public medical assistance program, currently operated under the National Basic Livelihood Security Act and funded entirely by the government to guarantee the provision of medical services to defined low-income level individuals [2]. A notable feature of the South Korea MA system is that recipients are categorized into types I or II based on the capacity to work. Despite co-payment rates remaining comparatively low, the amount of specified co-payments differs between MA type I and II, with type II individuals being required to pay higher amounts [3].

The MA group is known to share specific characteristics, including old age, low education level, higher likelihoods of disability, and poor health, partially resulting from low health literacy and management skills [4]. With the influence of the stated characteristics, MA recipients often show higher rates of health care utilization patterns compared to their NHI counterparts, even after adjustment for

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health-related factors [5]. In fact, compared to NHI covered individuals, MA beneficiaries have been presented to use around 3 times higher medical costs, with total expenditure showing an increasing trend [6]. There are two main explanations regarding such tendencies of health care utilization. First, there exists a concern for moral hazard because recipients can use medical services by paying only a part of total medical costs, which care result in unnecessary medical overuse [7]. At the same time, likelihoods for increased unmet need and mild catastrophic health expenditure (CHE) have also been highlighted because the Korea NHI program offers a low benefit coverage, promoting the provision of non-covered medical services that can result in high out-of-pocket costs [8,9]. 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 [8].

The provision of public assistance is essential to ensure that socially unstable individuals attain adequate standards of living. At the same time, social security systems need to focus on supporting poverty exit so that individuals are prevented from falling into poverty traps, which require the appropriate implementation of self-sufficiency rather than income transfer programs under necessary conditions [10]. The same lies true for the MA system, which aims to guarantee early access to medical services and assist economic independence [11]. Correspondingly, the government operates a self-sufficiency program to decrease welfare dependency, composed of compulsory and non-compulsory participation by the MA and near-poor groups [12]. The self-sufficiency program particularly focuses on type II beneficiaries as these individuals are assessed to have workforce status capacity [12,13]. Studies have shown that individuals experiencing MA exit were more likely to have higher income, attain regular employment, be middle-aged, and to be without disabilities [14]. Appropriate exits are to be pursued by the individual and the welfare state as it can decrease welfare expenditures, enhance optimal use of medical services, and alleviate individual welfare dependency. However, because reasons behind welfare exits are diverse, it is significant to compare medical utilization patterns between individuals remaining as beneficiaries and experiencing exits. However, most previous studies on this topic did not exploit long-term follow-up data or had foundations in panel data with a limited number of study subjects. Therefore, this study aimed to understand whether changes in MA status were associated with differences in patterns of health care utilization using NHI data, which encompasses all medical claims filed during the study period. Analysis was separated for age groups 20 to 64 years and 65 years or above to better recognize utilization patterns specific to the adult and elderly recipients.

METHODS

1. Study population

This study used data from the South Korea National Health Insurance Service national sample cohort 2006 to 2015, provided by the Korea National Health Insurance Service. The NHI cohort data consists of a nationally representative sample of around 2.1% of the entire population [15]. As all medical claims for the sampled individuals were recorded from 2006 to 2015, this data can reveal a comparatively accurate picture of medical utilization patterns made by the study participants. The NHI cohort 2006 baseline data consisted of 1,011,638 individuals randomly sampled from 48,222,537 individuals who maintained NHI or MA status for the entire baseline year [15]. A total of 2,142 strata were considered in the sampling process based on sex, age, region, and income [15]. This study was approved by the Institutional Review Board of Yonsei University Health System (IRB approbal no., Y-2017-0114).

This study aimed to analyze the effect of medical coverage status change on health care utilization in MA individuals. Hence, of the 1,011,638 individuals recorded at the baseline, 11,638 individuals with missing information on NHI or MA status were excluded. Of the remaining 1,000,000 individuals, 35,298 individuals were identified to have MA in which 24,588 were aged 20 or above. The final study population was composed of a total of 23,821 of the 24,588 individuals who were followed up and recorded in data at 2007. The included individuals were investigated separately based on age group (20 to 64 versus 65 or above) as adults and older aged individuals may exhibit different utilization patterns. This resulted in 14,975 individuals aged 20 to 64 and 8,846 individuals aged 60 or above being included for analysis.

2. Outcome and independent variables

The dependent variables of this study was health care utilization, which included the yearly number of outpatient visits, inpatient visits, emergency department (ED) visits, and length of stay. The interesting variable of this study was annual MA alteration status. All recorded MA individuals at baseline were followed, with annual recordings of medical coverage change status categorized into the 'MA to MA,' 'MA to MA exit,' 'MA exit to MA,' and 'MA exit to MA exit' groups. As all individuals were MA beneficiaries at baseline, individuals could only be categorized into the 'MA to MA' or 'MA to MA exit' group at the first follow-up year. From the second year of follow-up, individuals were classified into all four categories based on alteration status.

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 years), region (Seoul, metropolitan, or rural), disability status (no or yes), number of chronic diseases (none, 1–3, ≥4), rare disease status (no or yes), Charlson Comorbidity Index (CCI; 0, 1, 2, 3, ≥4), continuity of care (quintiles), admission status (no or yes), and year (2007 to 2015). Chronic diseases included mental and behavioral disorders, nervous system diseases, hypertension, liver diseases, diabetes, chronic obstructive pulmonary disease, cerebrovascular diseases, intracranial injury, thyroid diseases, and cardiac disorders notified by the government. These diseases are subject to an extension from the 365-day limit for coverage of medical services in MA beneficiaries. Similarly, rare diseases included the 144 rare conditions also subjected to an extension of coverage benefit days. Continuity of care was calculated using the usual provider of care (UPC) index. The UPC index is based on density type and is defined as the number of outpatient visits to the most frequently seen physician divided by the total number of outpatient visits [16]. Continuity of care was only considered in analyzing the number of outpatient visits. Admission status was only incorporated in examining the number of outpatient and ED visits.

3. Statistical analysis

The analysis was stratified by age group, classified into the ages 20 to 64 years old adult group and the ages 65 years or above elderly group. The general characteristics of the study population were investigated using *t*-tests and analysis of variance to compare mean utilization rates and standard deviations. To study the relationship between MA alteration status and the number of annual outpatient visits and length of stay, linear regression analysis based on the generalized estimating equation (GEE) model, an extension of the quasi-likelihood approach used to analyze longitudinal correlated data, was used [17]. The GEE model accounts for time variation and correlations among repeated measurements present in longitudinal study designs [18]. Similarly, the GEE model with Poisson distribution and log link function was utilized in examining the relationship between MA alteration status and the number of inpatient and ED visits. Multi-collinearity was considered using a variance inflation factor, which provides a measurement of the amount of increase in the variance of an estimated regression coefficient due to collinearity. Calculations were expressed as relative risk (RR) and their 95% confidence interval (CI).

RESULTS

The general characteristics of the study subjects aged 20 to 64 years are depicted in Table 1. Of a total of 117,943 subjects, 76,908 subjects (65.2%) were in the 'MA to MA' group ('MA to MA'), 7,561 (6.4%) in the 'MA to MA exit' group ('MA to MA exit'), 849 (0.7%) in the 'MA exit to MA' group ('MA exit to MA'), and 32,625 (27.7%) in the 'MA exit to MA exit' group ('MA exit to MA exit'). The mean number of annual outpatient visits was 21.63±31.06, the mean number of inpatient visits 0.27±0.52, the mean length of stay 23.24±77.85 days, and the mean number of ED visits 0.35±1.52.

Likewise, the general characteristics of study subjects aged 65 years or above are presented in Table 2. Of a total of 74,747 subjects, 60,614 subjects (81.1%) were in the 'MA to MA' group, 2,783 (3.7%) in the 'MA to MA exit' group, 378 (0.5%) in the 'MA exit to MA' group, and 10,972 (14.7%) in the 'MA exit to MA exit' group. The mean number of annual outpatient visits was 34.76±34.96, the mean number of inpatient visits 0.40±0.59, the mean length of stay 25.19±75.16 days, and the mean number of ED visits 0.42±1.61.

The association between MA alteration status and health care utilization in subjects aged 20 to 64 years are shown in Table 3. In the number of annual outpatient visits, the 'MA to MA exit' group (β =-3.93, p<0.0001) and the 'MA exit to MA exit' group (β=-5.72, p<0.0001) showed decreases. In the case of hospital admissions,

Table 1. General characteristics of study subjects aged 20–64 years (per year)

Characteristic	No. (%)	Outpatient visits		Admissions		Length of stay (day)		Emergency department visits	
		Mean±SD	*p*-value	Mean±SD	*p*-value	Mean±SD	*p*-value	Mean±SD	*p*-value
MA status			<0.0001		<0.0001		<0.0001		<0.0001
MA → MA	76,908 (65.2)	24.94±33.71		0.31±0.56		31.83±90.71		0.42±1.76	
MA → MA exit	7,561 (6.4)	14.75±22.82		0.17±0.42		7.87±41.98		0.22±0.76	
MA exit → MA	849 (0.7)	25.27±33.04		0.36±0.59		29.31±83.74		0.53±1.85	
MA exit → MA exit	32,625 (27.7)	15.33±24.15		0.17±0.41		6.41±37.53		0.23±0.92	
Sex			<0.0001		<0.0001		<0.0001		<0.0001
Male	56,183 (47.6)	19.26±32.00		0.31±0.56		32.77±92.08		0.46±1.87	
Female	61,760 (52.4)	23.79±30.02		0.23±0.47		14.57±60.85		0.26±1.11	
Age (yr)			<0.0001		<0.0001		<0.0001		<0.0001
20–29	14,179 (12.0)	8.09±12.16		0.12±0.35		5.37±37.25		0.18±0.75	
30–39	15,896 (13.5)	15.00±24.35		0.21±0.46		16.25±65.54		0.30±1.48	
40–49	35,198 (29.8)	20.34±28.93		0.26±0.51		23.79±78.34		0.34±1.41	
50–59	39,252 (33.3)	26.58±34.52		0.32±0.56		29.83±87.59		0.44±1.79	
60–64	13,418 (11.4)	32.75±38.65		0.35±0.57		29.71±87.19		0.41±1.58	
Region			<0.0001		<0.0001		<0.0001		<0.0001
Seoul	16,103 (13.7)	20.28±27.93		0.21±0.47		16.17±64.55		0.33±1.47	
Metropolitan	33,360 (28.3)	22.91±32.84		0.26±0.51		22.01±75.97		0.31±1.32	
Rural	68,480 (58.1)	21.33±30.84		0.28±0.53		25.50±81.41		0.38±1.62	
Disability			<0.0001		<0.0001		<0.0001		<0.0001
No	73,678 (62.5)	18.72±25.29		0.20±0.46		11.63±52.74		0.28±1.25	
Yes	44,265 (37.5)	26.48±38.32		0.37±0.59		42.57±104.49		0.47±1.89	
Chronic disease			<0.0001		<0.0001		<0.0001		<0.0001
0	72,015 (61.1)	14.07±22.97		0.19±0.44		19.13±73.53		0.20±0.89	
1–3	31,884 (27.0)	28.51±32.55		0.33±0.56		28.75±85.53		0.46±1.71	
≥4	14,044 (11.9)	44.83±45.30		0.52±0.67		31.82±79.54		0.90±2.89	
Rare disease			<0.0001		<0.0001		<0.0001		<0.0001
No	114,827 (97.4)	21.18±30.39		0.26±0.51		22.93±77.57		0.34±1.44	
Yes	3,116 (2.6)	38.54±46.83		0.51±0.64		34.58±86.64		0.89±3.28	
Charlson Comorbidity Index			<0.0001		<0.0001		<0.0001		<0.0001
0	67,773 (57.5)	12.78±19.31		0.18±0.43		21.00±77.77		0.20±1.06	
1	21,355 (18.1)	25.60±30.07		0.30±0.54		25.97±81.85		0.41±1.67	
2	14,721 (12.5)	32.89±37.62		0.32±0.56		20.76±69.78		0.46±1.59	
3	8,152 (6.9)	39.98±41.09		0.45±0.64		30.52±82.40		0.64±1.99	
4+	5,942 (5.0)	55.36±54.41		0.69±0.71		35.16±74.45		1.23±3.20	
Continuity of care			<0.0001						
0 (Not applicable)	11,150 (9.5)	0.00±0.00		-		-		-	
Q1	26,686 (22.6)	27.37±27.71							
Q2	26,628 (22.6)	24.03±28.74							
Q3	26,779 (22.7)	25.17±33.02							
Q4	26700 (22.6)	19.00±36.38							
Admission status			<0.0001						<0.0001
No	90,960 (77.1)	19.58±28.66		-		-		0.13±0.87	
Yes	26,983 (22.9)	28.57±37.21						1.10±2.62	
Year			<0.0001		<0.0001		<0.0001		<0.0001
2007	14,975 (12.7)	15.59±19.48		0.25±0.51		20.75±70.83		0.27±1.24	
2008	14,393 (12.2)	19.75±27.63		0.25±0.51		21.80±74.31		0.26±1.00	
2009	13,938 (11.8)	21.23±30.35		0.26±0.52		22.46±75.85		0.35±1.31	
2010	13,492 (11.4)	21.68±31.11		0.27±0.52		23.09±77.03		0.37±1.34	
2011	13,069 (11.1)	22.23±31.20		0.28±0.53		23.76±78.74		0.40±1.55	
2012	12,634 (10.7)	23.86±34.19		0.27±0.52		24.00±79.53		0.40±1.82	
2013	12,220 (10.4)	24.33±34.87		0.27±0.52		24.72±81.75		0.39±1.81	
2014	11,825 (10.0)	24.14±34.44		0.27±0.52		25.03±82.30		0.39±1.70	
2015	11,397 (9.7)	23.76±35.01		0.27±0.51		24.58±82.21		0.38±1.85	
Total	117,943 (100.0)	21.63±31.06		0.27±0.52		23.24±77.85		0.35±1.52	

Admission status refers to admission at corresponding year.
SD, standard deviation; MA, Medical Aid.

Table 2. General characteristics of study subjects aged ≥65 years (per year)

Characteristic	No. (%)	Outpatient visits		Admissions		Length of stay (day)		Emergency department visits	
		Mean±SD	*p*-value	Mean±SD	*p*-value	Mean±SD	*p*-value	Mean±SD	*p*-value
MA status			<0.0001		<0.0001		0.0001		<0.0001
MA → MA	60,614 (81.1)	34.52±34.22		0.40±0.60		25.77±75.70		0.43±1.71	
MA → MA exit	2,783 (3.7)	33.45±34.73		0.37±0.58		22.42±72.30		0.36±1.02	
MA exit → MA	378 (0.5)	40.17±36.75		0.40±0.59		25.08±70.61		0.38±1.11	
MA exit → MA exit	10,972 (14.7)	36.22±38.73		0.37±0.58		22.65±72.90		0.36±1.12	
Sex			<0.0001		<0.0001		0.0136		<0.0001
Male	20,300 (27.2)	31.32±34.08		0.42±0.61		26.28±75.42		0.51±1.43	
Female	54,447 (72.8)	36.05±35.19		0.39±0.59		24.78±75.05		0.38±1.67	
Age (yr)			<0.0001		<0.0001		<0.0001		<0.0001
65–74	33,742 (45.1)	36.60±35.51		0.34±0.56		19.24±65.52		0.37±1.38	
75–84	33,441 (44.7)	34.70±34.98		0.43±0.61		27.37±77.63		0.44±1.85	
≥85	7,564 (10.1)	26.84±31.08		0.50±0.64		42.06±97.78		0.50±1.41	
Region			<0.0001		<0.0001		<0.0001		<0.0001
Seoul	9,291 (12.4)	34.76±33.38		0.31±0.54		15.64±57.08		0.40±1.45	
Metropolitan	16,588 (22.2)	36.34±35.85		0.40±0.60		28.70±81.86		0.35±1.04	
Rural	48,868 (65.4)	34.23±34.93		0.41±0.60		25.81±75.66		0.44±1.79	
Disability			0.1622		<0.0001		<0.0001		<0.0001
No	54,106 (72.4)	34.67±33.97		0.36±0.58		21.48±68.64		0.37±1.66	
Yes	20,641 (27.6)	35.01±37.44		0.48±0.63		34.91±89.31		0.53±1.47	
Chronic disease			<0.0001		<0.0001		<0.0001		<0.0001
0	18,394 (24.6)	22.66±30.58		0.29±0.53		28.81±87.70		0.26±1.06	
1–3	32,335 (43.3)	33.00±31.83		0.34±0.56		23.91±75.84		0.31±1.23	
≥4	24,018 (32.1)	46.41±38.36		0.55±0.65		24.13±62.71		0.68±2.25	
Rare disease			<0.0001		<0.0001		<0.0001		<0.0001
No	71,393 (95.5)	34.35±34.55		0.38±0.59		24.17±73.90		0.40±1.60	
Yes	3,354 (4.5)	43.46±41.82		0.68±0.69		46.77±95.63		0.80±1.76	
Charlson Comorbidity Index			<0.0001		<0.0001		<0.0001		<0.0001
0	22,955 (30.7)	23.30±27.41		0.23±0.47		22.42±78.81		0.18±0.86	
1	20,421 (27.3)	32.23±31.09		0.37±0.57		26.19±79.39		0.35±1.15	
2	13,157 (17.6)	39.60±35.63		0.42±0.60		21.18±64.74		0.47±2.16	
3	9,343 (12.5)	43.56±37.95		0.52±0.64		29.76±77.60		0.54±1.69	
4+	8,871 (11.9)	53.79±43.54		0.71±0.69		31.16±65.97		0.95±2.55	
Continuity of care			<0.0001						
0 (Not applicable)	4,006 (5.4)	0.00±0.00		-		-		-	
Q1	17,685 (23.7)	45.18±30.47							
Q2	17,685 (23.7)	37.04±30.83							
Q3	17,310 (23.2)	36.32±35.22							
Q4	18,061 (24.2)	28.54±40.11							
Admission status			<0.0001						<0.0001
No	49,416 (66.1)	33.78±33.01		-		-		0.11±0.86	
Yes	25,331 (33.9)	36.68±38.41						1.01±2.38	
Year			<0.0001		<0.0001		<0.0001		<0.0001
2007	8,846 (11.8)	26.27±22.98		0.33±0.55		15.05±52.64		0.31±0.99	
2008	8,768 (11.7)	33.76±33.70		0.36±0.57		18.58±60.86		0.34±1.32	
2009	8,639 (11.6)	35.30±35.13		0.38±0.58		20.65±64.57		0.39±1.42	
2010	8,531 (11.4)	35.38±35.39		0.40±0.60		24.24±72.52		0.43±1.67	
2011	8,299 (11.1)	35.41±35.01		0.40±0.60		26.70±77.44		0.47±1.83	
2012	8,175 (10.9)	36.44±36.26		0.42±0.61		27.96±79.90		0.45±1.83	
2013	7,982 (10.7)	36.92±37.06		0.42±0.60		29.90±84.03		0.45±1.72	
2014	7,809 (10.5)	37.59±38.56		0.44±0.61		32.43±87.62		0.47±1.97	
2015	7,698 (10.3)	36.78±37.94		0.43±0.61		33.68±90.76		0.44±1.56	
Total	74,747 (100.0)	34.76±34.96		0.40±0.59		25.19±75.16		0.42±1.61	

Admission status refers to admission at corresponding year.
SD, standard deviation; MA, Medical Aid.

Table 3. Results of the generalized estimating equation analyzing the effect of MA status on health care utilization in subjects aged 20–64 years

Variable	Outpatient visits			Admissions	Length of stay			Emergency department visits
	β	SE	*p*-value	RR (95% CI)	*β*	SE	*p*-value	RR (95% CI)
MA status								
MA → MA	Ref			1.00	Ref			1.00
MA → MA exit	-3.93	0.24	<0.0001	0.87 (0.83–0.91)	-3.64	0.47	<0.0001	0.83 (0.77–0.90)
MA exit → MA	0.17	0.73	0.8169	1.07 (0.97–1.18)	3.93	1.87	0.0360	1.04 (0.82–1.31)
MA exit → MA exit	-5.72	0.31	<0.0001	0.91 (0.87–0.94)	-5.87	0.64	<0.0001	0.81 (0.75–0.88)
Sex								
Male	Ref			1.00	Ref			1.00
Female	5.35	0.38	<0.0001	0.76 (0.73–0.79)	-16.13	1.18	<0.0001	0.68 (0.63–0.74)
Age (yr)								
20–29	Ref			1.00	Ref			1.00
30–39	0.44	0.26	0.086	1.21 (1.13–1.29)	-0.78	0.63	0.2127	1.05 (0.92–1.19)
40–49	1.63	0.36	<0.0001	1.31 (1.22–1.40)	-1.45	0.95	0.1244	0.99 (0.88–1.11)
50–59	3.69	0.40	<0.0001	1.37 (1.28–1.47)	0.65	1.10	0.5567	0.95 (0.84–1.07)
60–64	6.58	0.54	<0.0001	1.42 (1.32–1.53)	5.17	1.39	0.0002	0.84 (0.74–0.96)
Region								
Seoul	Ref			1.00	Ref			1.00
Metropolitan	0.63	0.44	0.1580	1.12 (1.05–1.19)	3.15	1.47	0.0328	0.86 (0.75–0.99)
Rural	-0.25	0.39	0.5304	1.19 (1.12–1.25)	2.26	1.17	0.0523	0.94 (0.82–1.06)
Disability								
No	Ref			1.00	Ref			1.00
Yes	3.88	0.53	<0.0001	1.30 (1.25–1.35)	12.39	1.70	<0.0001	1.08 (1.00–1.17)
Chronic disease								
0	Ref			1.00	Ref			1.00
1	4.25	0.21	<0.0001	1.36 (1.32–1.40)	3.29	0.48	<0.0001	1.39 (1.30–1.49)
≥2	9.88	0.41	<0.0001	1.67 (1.61–1.73)	4.57	0.76	<0.0001	1.69 (1.55–1.85)
Rare disease								
No	Ref			1.00	Ref			1.00
Yes	5.50	0.96	<0.0001	1.38 (1.30–1.46)	9.49	1.63	<0.0001	1.35 (1.14–1.61)
Charlson Comorbidity Index								
0	Ref			1.00	Ref			1.00
1	7.42	0.24	<0.0001	1.23 (1.19–1.27)	1.10	0.42	0.0091	1.26 (1.18–1.35)
2	6.69	0.20	<0.0001	1.37 (1.32–1.41)	1.61	0.49	0.0009	1.30 (1.21–1.40)
3	7.18	0.20	<0.0001	1.63 (1.57–1.70)	5.44	0.78	<0.0001	1.44 (1.30–1.58)
4+	5.82	0.18	<0.0001	2.10 (2.01–2.19)	9.19	0.99	<0.0001	1.81 (1.65–2.00)
Continuity of care								
0 (Not applicable)	Ref			-	-			-
Q1	7.25	0.23	<0.0001					
Q2	6.39	0.20	<0.0001					
Q3	6.92	0.20	<0.0001					
Q4	5.57	0.18	<0.0001					
Admission status								
No	Ref			-	-			1.00
Yes	1.74	0.22	<0.0001					4.49 (4.16–4.84)
Year								
2007	Ref			1.00	Ref			1.00
2008	4.29	0.14	<0.0001	1.01 (0.98–1.05)	1.39	0.33	<0.0001	0.96 (0.89–1.03)
2009	5.74	0.19	<0.0001	1.05 (1.01–1.08)	2.42	0.43	<0.0001	1.29 (1.19–1.40)
2010	6.41	0.22	<0.0001	1.09 (1.05–1.13)	3.53	0.50	<0.0001	1.35 (1.25–1.47)
2011	7.05	0.23	<0.0001	1.12 (1.07–1.16)	4.45	0.57	<0.0001	1.52 (1.39–1.67)
2012	8.85	0.27	<0.0001	1.10 (1.06–1.14)	5.21	0.62	<0.0001	1.57 (1.41–1.73)
2013	9.56	0.30	<0.0001	1.12 (1.08–1.17)	6.39	0.68	<0.0001	1.54 (1.38–1.72)
2014	9.59	0.32	<0.0001	1.14 (1.09–1.18)	6.89	0.73	<0.0001	1.55 (1.40–1.72)
2015	9.43	0.34	<0.0001	1.12 (1.07–1.17)	7.03	0.78	<0.0001	1.56 (1.40–1.75)

Admission status refers to admission at corresponding year.
MA, Medical Aid; SE, standard error; RR, relative risk; CI, confidence interval; Ref, reference.

Table 4. Results of the generalized estimating equation analyzing the effect of MA status on health care utilization in subjects aged ≥65 years

Variable	Outpatient visits			Admissions	Length of stay			Emergency department visits
	β	SE	*p*-value	RR (95% CI)	β	SE	*p*-value	RR (95% CI)
MA status								
MA → MA	Ref			1.00	Ref			1.00
MA → MA exit	-1.51	0.49	0.0020	0.96 (0.91–1.01)	-0.93	1.23	0.4500	0.97 (0.88–1.06)
MA exit → MA	2.04	1.22	0.0939	0.97 (0.85–1.10)	-2.67	2.89	0.3563	0.90 (0.71–1.14)
MA exit → MA exit	-0.04	0.58	0.9398	0.92 (0.89–0.95)	-5.45	1.37	<0.0001	0.90 (0.83–0.97)
Sex								
Male	Ref			1.00	Ref			1.00
Female	4.35	0.55	<0.0001	0.88 (0.85–0.91)	-2.16	1.36	0.1113	0.79 (0.74–0.85)
Age (yr)								
65–74	Ref			1.00	Ref			1.00
75–84	-0.70	0.37	0.0626	1.24 (1.20–1.27)	3.90	0.80	<0.0001	1.13 (1.06–1.19)
≥85	-6.07	0.63	<0.0001	1.54 (1.48–1.61)	17.02	1.76	<0.0001	1.21 (1.08–1.35)
Region								
Seoul	Ref			1.00	Ref			1.00
Metropolitan	0.20	0.85	0.8194	1.29 (1.21–1.36)	12.49	2.02	<0.0001	0.80 (0.70–0.90)
Rural	-0.11	0.73	0.8794	1.30 (1.24–1.37)	7.74	1.69	<0.0001	0.91 (0.81–1.01)
Disability								
No	Ref			1.00	Ref			1.00
Yes	-0.34	0.66	0.6075	1.16 (1.13–1.20)	10.66	1.54	<0.0001	1.11 (1.03–1.19)
Chronic disease								
0	Ref			1.00	Ref			1.00
1	4.54	0.31	<0.0001	1.04 (1.00–1.08)	-6.40	0.98	<0.0001	1.11 (1.02–1.20)
≥2	9.69	0.38	<0.0001	1.31 (1.26–1.36)	-7.74	1.08	<0.0001	1.44 (1.32–1.57)
Rare disease								
No	Ref			1.00	Ref			1.00
Yes	3.15	0.76	<0.0001	1.35 (1.29–1.41)	12.22	1.94	<0.0001	1.14 (1.04–1.24)
Charlson Comorbidity Index								
0	Ref			1.00	Ref			1.00
1	1.73	0.27	<0.0001	1.45 (1.40–1.51)	2.84	0.85	0.0008	1.23 (1.15–1.33)
2	4.16	0.32	<0.0001	1.66 (1.59–1.72)	1.47	0.87	0.0894	1.40 (1.30–1.51)
3	6.43	0.39	<0.0001	1.94 (1.87–2.02)	6.60	1.01	<0.0001	1.40 (1.29–1.53)
4+	11.29	0.50	<0.0001	2.47 (2.37–2.57)	9.25	1.10	<0.0001	1.80 (1.66–1.96)
Continuity of care								
0 (Not applicable)	Ref			-	-	-		-
Q1	22.98	0.59	<0.0001					
Q2	19.65	0.57	<0.0001					
Q3	19.87	0.58	<0.0001					
Q4	16.77	0.59	<0.0001					
Admission status								
No	Ref			-	-	-		1.00
Yes	-1.29	0.24	<0.0001					5.42 (4.97–5.91)
Year								
2007	Ref			1.00	Ref			1.00
2008	7.05	0.23	<0.0001	1.08 (1.04–1.13)	3.80	0.47	<0.0001	1.06 (0.99–1.14)
2009	8.13	0.29	<0.0001	1.16 (1.11–1.21)	6.86	0.63	<0.0001	1.20 (1.10–1.30)
2010	8.08	0.32	<0.0001	1.24 (1.19–1.29)	11.28	0.77	<0.0001	1.25 (1.16–1.36)
2011	7.70	0.34	<0.0001	1.27 (1.22–1.32)	15.07	0.88	<0.0001	1.44 (1.32–1.57)
2012	8.66	0.37	<0.0001	1.32 (1.27–1.38)	16.99	0.96	<0.0001	1.40 (1.28–1.52)
2013	9.10	0.39	<0.0001	1.34 (1.29–1.40)	19.94	1.05	<0.0001	1.43 (1.30–1.57)
2014	9.71	0.43	<0.0001	1.43 (1.37–1.49)	23.61	1.13	<0.0001	1.46 (1.33–1.59)
2015	9.14	0.44	<0.0001	1.42 (1.36–1.49)	25.29	1.20	<0.0001	1.37 (1.26–1.50)

Admission status refers to admission at corresponding year.

MA, Medical Aid; SE, standard error; RR, relative risk; CI, confidence interval; Ref, reference.

compared to the 'MA to MA' group, the 'MA to MA exit' group (RR, 0.87; 95% CI, 0.83–0.91) and the 'MA exit to MA exit' group (RR, 0.91; 95% CI, 0.87–0.94) showed reduced numbers of admission. Regarding length of stay, the 'MA to MA exit' group (β=-3.64, p<0.0001) and 'MA exit to MA exit' group (β=-5.87, p<0.0001) showed decreases whereas the 'MA exit to MA' group (β=3.93, p=0.0360) showed increases. Similarly, in the number of ED visits, the 'MA to MA exit' group (RR, 0.83; 95% CI, 0.77–0.90) and the 'MA exit to MA exit' group (RR, 0.81; 95% CI, 0.75–0.88) showed reduced numbers of admissions.

The association between MA alteration status and health care utilization in study subjects aged 65 years or above are displayed in Table 4. In the number of annual outpatient visits, compared to the 'MA to MA' reference group, the 'MA to MA exit' group (β=-1.51, p=0.0020) showed decreases. For hospital admissions, the 'MA exit to MA exit' group (RR, 0.92; 95% CI, 0.89–0.95) showed reduced numbers of admissions. Regarding length of stay, the 'MA exit to MA exit' group (β=-5.45, p<0.0001) showed decreases. In the number of ED visits, the 'MA exit to MA exit' group (RR, 0.90; 95% CI, 0.83–0.97) showed decreases.

DISCUSSION

The findings of this study confirm an association between changes in MA status and health care utilization. First, health care utilization was analyzed in the NHI cohort stratified by age group, categorized into the ages 20 to 64 adults and ages 65 or above elderly groups. In general, individuals in the 'MA to MA exit' and 'MA exit to MA exit' groups showed reductions in the number of annual number of outpatient visits, inpatient visits, length of stay, and ED visits in adults. Contrastingly, the 'MA exit to MA' group showed increases in length of stay. In the elderly, the 'MA to MA exit' group showed reductions in the number of outpatient visits and the 'MA exit to MA exit' group in number of admissions, length of stay, and ED visits. The presented results are in accordance with previous findings which report higher levels of medical utilization in MA beneficiaries compared to NHI covered individuals [19]. Studies have presented that MA exit is related to decreased use of health care services [20]. At the same time, this study is unique as it is the first to use the NHI cohort data with a long follow-up period, hence including all information on medical claims filed in between. As it also stratified individuals into the adult and elderly age groups, it provides a comparatively realistic picture of health care utilization patterns made by MA beneficiaries.

Variances in the number of outpatient visits between the continuously MA and the MA exit groups may have resulted due to the low copayment levels applied to MA beneficiaries and the lack of a primary care physician system in Korea. Both factors tend to promote recipients and providers to lean towards more frequent utilization and excessive treatment [21]. Higher overuse may have also been influenced by a common phenomenon known as medical shopping in Korea, which refers to individuals visiting many different institutions in the search of famous physicians or better care [21]. The findings of this study also present that differences in the number of outpatient visits between the continuously MA group and the MA exit group are reduced in older adults aged 65 years or above. Findings are understandable considering that individuals aged 65 years or above are eligible to receive outpatient care in clinics at a flat rate of 1,500 Korean won (KRW) for services costing below KRW 15,000. This policy may have reduced the level of cost constraints possibly experienced by MA exit individuals in accessing clinics for relatively mild symptoms [22]. At the same time, it must also be taken into account that older aged individuals exhibit higher disease prevalence and severity, implying that this group may have been comparatively indifferent to outpatient care but more to inpatient care services.

Decreased levels of inpatient service use were also found in individuals experiencing MA exits. Results are in accordance with previous studies which report that unnecessary long-term admissions are commonly present among MA beneficiaries [23]. Longer admissions may be a result of ineffective cost containment methods, particularly as long-term admissions are often common in type I beneficiaries entitled to zero copayment levels [23]. At the same time, longer admissions may also result due to the higher levels of access barriers experienced by MA beneficiaries as care in higher-level institutions is generally associated with the more frequent provision of non-covered services that require higher out-of-pocket costs [24]. MA recipients are reported to receive most inpatient care at hospital and clinic level facilities where out-of-pocket costs are kept low due to fewer provision of non-covered services [24]. In fact, a qualitative study revealed that MA beneficiaries tend to refrain from using

higher-level hospitals due to the burden of financing for non-covered services [25]. Thus, a need exists to reduce unnecessary long-term admissions but also to monitor beneficiaries with severe illnesses who may require improved access to higher-level institutions so that inpatient care services utilized by MA beneficiaries can be appropriately managed.

In the case of ED visits, analysis revealed that individuals exiting MA utilize EDs less. In Korea, around 30% of frequent ED users were MA recipients because beneficiaries often face difficulties in effectively managing their diseases, which reflects the need to strengthen public health policies that can enhance health management skills and reduce unnecessary ED visits [26]. On the other side, MA exit individuals, in particular those remaining at the near poverty line after exits, may involuntarily visit EDs more frequently as they experience financial difficulties in receiving timely medical care. However, as the results show that ED visits have decreased among MA exit individuals, the general decreases in health care utilization, in particular ED visits, may suggest possibilities for moral hazard.

This study was not without its limitations. First, due to data limitation, the analysis could not incorporate several factors that may affect health care utilization, including education level, household size, and health literacy rates. However, this study did take into consideration demographic and health related factors known to affect health care utilization in individuals experiencing changes in health coverage status. For instance, chronic disease and rare disease status subject to an extension from the 365-day limit for health care coverage in MA beneficiaries were considered in the analysis. Second, type I and II beneficiaries cannot be distinguished in the NHI data. To partially overcome this limitation, analysis was stratified by age group. Third, increased household income resulting from improved health in a household member can lead to welfare exits. Hence, improved health may have acted as a confounder in this study. Fourth, eligibility for assistance programs apart from MA and the exact timing of welfare exit could not be considered due to data limitation. Last, time dependent confounders were not taken into consideration. Future studies accounting for time varying covariates may be beneficial. Overall, although the findings should be interpreted with caution, this study was the first to investigate the relationship between MA status change and health care utilization using NHI claims data with a long follow-up period.

In conclusion, the findings of this study present that MA exit is associated with general decreases in outpatient, inpatient, and ED service use. MA beneficiaries are known to utilize noticeably higher levels of health care services than their NHI covered counterparts, while at the same time being largely composed of socially vulnerable individuals often of poorer health status. Therefore, health care utilization patterns of individuals with experiences of receiving MA benefits should be closely monitored so that appropriate use of health care services are promoted while occurrences of unmet need and CHE are reduced.

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