Brief Report

J Prev Med Public Health 2023;56:475-480 • https://doi.org/10.3961/jpmph.23.270

pISSN 1975-8375 eISSN 2233-4521

Journal of Preventive Medicine & Public Health

Characteristics and Health Care Spending of Persistently and Transiently High-cost Older Adults in Korea

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Objectives: This study examined differences in health care spending and characteristics among older adults in Korea by high-cost status (persistently, transiently, and never high-cost).

Methods: We identified 1 364 119 older adults using data from the Korean National Insurance Claims Database for 2017-2019. Outcomes included average annual total health care spending and high-cost status for 2017-2019. Linear regression was used to estimate differences in the outcomes while adjusting for individual-level characteristics.

Results: Persistently and transiently high-cost older adults had higher health care spending than never high-cost older adults, but the difference in health care spending was greater among persistently high-cost older adults than among transiently high-cost older adults (US$20 437 vs. 5486). Despite demographic and socioeconomic differences between transiently high-cost and never high-cost older adults, the presence of comorbid conditions remained the most significant factor. However, there were no or small differences in the prevalence of comorbid conditions between persistently high-cost and transiently high-cost older adults. Rather, notable differences were observed in socioeconomic status, including disability and receipt of Medical Aid.

Conclusions: Medical risk factors contribute to high health care spending to some extent, but social risk factors may be a source of persistent high-cost status among older adults in Korea.

Key words: Cost and cost analysis, Social determinants of health, Comorbidity, Korea

INTRODUCTION

Health care spending is concentrated in a small group of high-cost patients, but high-cost patients are heterogeneous [1]. A systematic review found that 28-45% of high-cost patients in the United States were persistently high-cost over time, while the rest were high-cost for only 1 year or 2 years. Persistently high-cost patients have ongoing, expensive medical care needs due to chronic conditions or complex health issues, while transiently high-cost patients require expensive medical care for a sudden, unexpected need such as a serious injury or acute illness. From a policy perspective, a better understanding of high-cost patients is important to enable us to identify more targeted interventions and provide insights into effective policy recommendations [2-4].

Understanding the characteristics and health care spending of high-cost older adults is particularly relevant to Korea. Korea has a universal health care system administered by the government, but has been experiencing an annual growth in health care spending of almost 8%. This is more than twice the

Received: June 12, 2023 Accepted: August 28, 2023

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average annual growth rate of countries in the Organization for Economic Cooperation and Development (3.6%) [5]. Korea's high health care spending may pose a substantial financial burden to the government. However, developing effective policies aimed at addressing the issue is challenging due to limited available evidence. To fill the gaps in the literature, we examined differences in health care spending and sample characteristics among older adults in Korea by high-cost status.

We focused on older adults for 2 reasons. First, older adults are a critical population to study in the context of health care spending. Older adults are more likely to have significantly higher health care spending than younger adults, in part due to more chronic conditions. Second, the number of older adults in Korea is expected to grow significantly in the coming years. Korea is projected to have the highest proportion of people aged 65 years or older in the world by 2045 (37.0% of the total population) [5]. The findings from this research may help inform evidence-based policy-making to develop targeted interventions that can effectively manage costs and improve health outcomes, particularly to curb health care spending for the older adult population.

METHODS

Sample

We employed a retrospective cohort study design using data from the Korean National Insurance Claims Database for 2017-2019. We used a random 10% sample of older adults (ages 65 years and over) in Korea. We then excluded those who died, had incomplete information, or were not continuously enrolled in 2017-2019.

Variables

Our outcome variables were health care spending and high-cost status for 2017-2019. Specifically, health care spending was defined as the average annual total health care spending for 2017-2019, adjusted for inflation to 2019 US dollars based on the Korea Consumer Price Index. This included spending on inpatient, outpatient, and prescription drugs as covered by both the Korean National Insurance System and paid out-of-pocket. However, due to limited data availability, we did not include spending on long-term care and services not covered by the Korean National Insurance System. Following methodology from prior research [6,7], we defined high-cost status as three categories: "persistently high-cost" (those in the top 10% of annual total health care spending in 3 consecutive years), "transiently high-cost" (those in the top 10% for at least 1 year but less than 3 consecutive years), and "never high-cost" (those not high-cost in any of the 3 years). We used high-cost status as an outcome as well as a key independent variable.

For independent variables, we included the following individual-level characteristics: age (65-69, 70-74, 75-79, or ≥80), sex (male or female), health insurance status (National Health Insurance or Medical Aid), household income (quantile 1, quantile 2, quantile 3, quantile 4, quantile 5, or missing), comorbid conditions (acute myocardial infarction, ischemic heart disease, chronic kidney disease, congestive heart failure, diabetes, dementia, lung disease, psychiatric disease, specified heart arrhythmias, stroke, acquired hypothyroidism, anemia, benign prostatic hyperplasia, cancer, cataract, glaucoma, hip or pelvic fracture, hyperlipidemia, hypertension, osteoporosis, and rheumatoid arthritis/osteoarthritis), and residential area (metropolitan, non-metropolitan, or rural residence).

Statistical Analysis

We conducted 2 main analyses. To examine the differences in health care spending by high-cost status, we performed linear regression models before and after adjusting for the individual-level characteristics described above. This method allowed us to quantify the differences in health care spending between the 3 groups of older adults: persistently high-cost, transiently high-cost, and never high-cost. We reported spending differences in dollar terms to enhance the interpretation. To identify the differences in sample characteristics by high-cost status, we conducted linear probability models while accounting for the characteristics described above. Specifically, we used 2 separate models: one to compare the transiently high-cost group to the never high-cost group and another to compare the persistently high-cost group to the transiently high-cost group. For each analysis, the outcome was a binary measure of high-cost status. This analysis allowed us to identify the main differences in individual-level characteristics that might lead to higher health care spending. We presented the results in terms of percentage points (%p), which indicate differences in proportions between the 2 groups. We conducted sensitivity analyses using alternative models (generalized linear models for health care spending and logistic regression models for high-cost status). All p-values were from 2-sided tests, and results were deemed significant at $p<0.05$. All analyses were conducted us-

ing SAS Enterprise Guide version 7.1 (SAS Institute Inc., Cary, NC, USA).

Ethics Statement

This study was approved by the Institutional Review Board of Korea University, which waived the requirement for informed consent due to the use of secondary data (IRB-2023-0091).

RESULTS

Of 1 364 119 older adults in Korea, 3.0%, 17.2%, and 79.7% were persistently, transiently, and never high-cost older adults, respectively (Table 1). There were differences in sample characteristics by high-cost status. Both the persistently high-cost and transiently high-cost groups were more likely to be older, be female, and have Medical Aid than never high-cost older adults, but this finding was more pronounced among the persistently high-cost group. There were only small differences in income and metropolitan residence.

Before adjusting for individual-level characteristics, we found that persistently and transiently high-cost older adults had higher average annual health care spending than never high-cost older adults, but the difference in the average annual health care spending was greater among persistently high-cost older adults than transiently high-cost older adults (US$20 437; 95% CI, 20 409 to 20 465 vs. US$5486; 95% CI, 5473 to 5499) (Table 2). The results remained robust even after adjusting for individual-level characteristics (US$19 528; 95% CI, 19 500 to 19 556 vs. US$4827; 95% CI, 4814 to 4840).

Compared to never high-cost older adults, transiently high-cost older adults were more likely to be older and female and to have Medical Aid and disability. The most notable differences were observed in the prevalence of comorbid conditions, including hip or pelvic fracture (46.01%p; 95% CI, 45.22 to 46.80), cancer (16.22%p; 95% CI, 15.97 to 16.48), and acute myocardial infarction (15.12%p; 95% CI, 14.61 to 15.62) (Table 3). However, there were no or small differences in the prevalence of comorbid conditions between persistently and transiently high-cost older adults. The prevalence of some conditions was lower among persistently high-cost older adults than transiently high-cost older adults, including rheumatoid or osteoarthritis arthritis (-7.70%p; 95% CI, -7.98 to -7.41), osteoporosis (-5.64%p; 95% CI, -7.62 to -3.67), lung disease (-4.26%p; 95% CI, -4.52 to -4.00), and cataract (-3.44%p; 95% CI, -3.74 to -3.14).

Table 1. Sample characteristics by high-cost status[1] among older adults in Korea

Characteristics[2]	Never high-cost (n=1 087 203)	Transiently high-cost (n=234 628)	Persistently high-cost (n=40 924)
Age (y)			
65-69	36.0	25.1	20.3
70-74	25.5	25.0	19.6
75-79	20.7	25.8	23.4
≥80	17.8	24.1	36.7
Sex			
Male	42.7	40.5	37.2
Female	57.3	59.5	62.8
Health insurance			
National Health Insurance	94.4	89.7	80.5
Medical Aid	5.6	10.3	19.5
Income			
Quantile 1 (lowest)	15.3	13.9	14.8
Quantile 2	9.4	8.0	7.1
Quantile 3	12.9	12.1	10.6
Quantile 4	19.3	18.2	15.4
Quantile 5 (highest)	36.1	36.0	31.3
Missing	7.0	11.7	20.9
Metropolitan residence			
Metropolitan	42.0	40.3	42.7
Non-metropolitan urban	44.4	43.9	42.7
Rural	13.6	15.8	14.6
Average health care spending for 2017-2019 (US$)[3]	1925.20	7252.40	21 771.30

[1]High-cost status was identified using data from 3 consecutive years (2017-2019); Specifically, we defined "persistently high-cost" as those in the top 10% of annual total health care spending in 3 consecutive years, "transiently high-cost" as those in the top 10% of annual total health care spending for at least 1 year but less than 3 consecutive years, and "never high-cost" as those who were not high-cost in any of the 3 years.
[2]Sample characteristics were estimated using baseline year data (2017).
[3]Health care spending was measured as average annual total health care spending for 2017-2019 (inflation adjusted to 2019 US dollars based on the Korea Consumer Price Index).

More importantly, notable differences in socioeconomic status were observed between persistently and transiently high-cost older adults. Compared to transiently high-cost older adults, persistently high-cost older adults were more likely to have Medical Aid (7.56%p; 95% CI, 6.44 to 8.68) and a disability (4.71%p; 95% CI, 4.36 to 5.06, and 29.11%p; 95% CI, 28.63 to 29.59 for moderate and severe disability).

DISCUSSION

Our analysis of data from a nationally representative sample of older adults in Korea revealed 2 main findings. First, both

Table 2. Differences in health care spending by high-cost status[1] among older adults in Korea

Characteristics[3]	Health care spending[2]	
	Without adjusting for individual-level characteristics	With adjusting for individual-level characteristics
High-cost status		
Never high-cost	Reference	Reference
Transiently high-cost	5486 (5473, 5499)	4827 (4814, 4840)
Persistently high-cost	20 437 (20 409, 20 465)	19 528 (19 500, 19 556)
Age (y)		
65-69		Reference
70-74		56 (44, 68)
75-79		122 (109, 135)
≥80		108 (94, 121)
Sex		
Male		Reference
Female		229 (217, 241)
Health insurance		
National Health Insurance		Reference
Medical Aid		-40 (-83, 2)
Income		
Quantile 1 (lowest)		Reference
Quantile 2		-2 (-22, 17)
Quantile 3		17 (0, 35)
Quantile 4		30 (14, 46)
Quantile 5 (highest)		55 (41, 69)
Missing		38 (-3, 78)
Disability status[4]		
None		Reference
Moderate		154 (139, 169)
Severe		1111 (1087, 1135)
Chronic conditions[5]		
Acute myocardial infarction		182 (144, 220)
Ischemic heart disease		187 (175, 200)
Chronic kidney disease		520 (504, 535)
Congestive heart failure		261 (243, 279)
Diabetes		358 (349, 368)
Dementia		162 (146, 177)
Lung disease		146 (137, 156)
Psychiatric disease		278 (266, 291)
Specified heart arrhythmias		572 (547, 597)
Stroke		804 (791, 818)
Acquired hypothyroidism		123 (107, 140)
Anemia		369 (357, 382)
Benign prostatic hyperplasia		308 (293, 323)
Cancer		433 (414, 453)
Cataract		176 (164, 188)
Glaucoma		220 (194, 247)
Hip or pelvic fracture		878 (821, 935)
Hypertension		151 (135, 167)
Osteoporosis		34 (-50, 118)
Rheumatoid or osteoarthritis arthritis		191 (181, 201)
Metropolitan residence		
Metropolitan		Reference
Non-metropolitan urban		-64 (-106, -22)
Rural		-93 (-138, -48)

Values are presented as US dollar (95% confidence interval).
[1]High-cost status was identified using data from 3 consecutive years (2017-2019); Specifically, we defined "persistently high-cost" as those in the top 10% of annual total health care spending in 3 consecutive years, "transiently high-cost" as those in the top 10% of annual total health care spending for at least 1 year, but less than 3 consecutive years, and "never high-cost" as those who were not high-cost in any of the 3 years.
[2]Health care spending was measured as average annual total health care spending for 2017-2019 (inflation adjusted to 2019 US dollars based on the Korea Consumer Price Index).
[3]Sample characteristics were estimated using baseline year data (2017).
[4]Disability status was identified based on the Korean government's assessment system.
[5]Presence of comorbid conditions was identified based on definitions provided by the Centers for Medicare & Medicaid Services Chronic Conditions Data Warehouse.

persistently and transiently high-cost older adults had higher health care spending than never high-cost older adults, and the magnitude of the difference in health care spending between persistently and transiently high-cost older adults was substantial. Second, there were differences in demographic and socioeconomic status among the 3 groups. Transiently high-cost older adults had more comorbidities than never high-cost older adults. Further, transiently high-cost and persistently high-cost older adults did not necessarily differ in their number of comorbid conditions; however, persistently high-cost older adults had worse socioeconomic status, especially for disability and receipt of Medical Aid. This is consistent with findings from prior research from the United States that poor socioeconomic status is associated with persistently high-cost status [6].

Our findings suggest that medical risk factors contribute to

Table 3. Differences in sample characteristics by high-cost status[1] among older adults in Korea

Characteristics[2]	Estimate	
	Transiently vs. never high-cost	Persistently vs. transiently high-cost
Age (y)		
65-69	Reference	Reference
70-74	1.11 (0.95, 1.27)	0.30 (-0.06, 0.66)
75-79	2.21 (2.04, 2.38)	1.77 (1.41, 2.13)
≥80	2.09 (1.91, 2.27)	7.60 (7.23, 7.97)
Sex		
Male	Reference	Reference
Female	1.45 (1.30, 1.61)	2.24 (1.86, 2.61)
Health insurance		
National Health Insurance	Reference	Reference
Medical Aid	4.99 (4.44, 5.55)	7.56 (6.44, 8.68)
Income		
Quantile 1 (lowest)	Reference	Reference
Quantile 2	-0.08 (-0.34, 0.17)	-1.28 (-1.84, -0.72)
Quantile 3	0.37 (0.14, 0.60)	-1.71 (-2.20, -1.21)
Quantile 4	0.33 (0.12, 0.54)	-1.87 (-2.32, -1.42)
Quantile 5 (highest)	0.05 (-0.13, 0.24)	-2.06 (-2.46, -1.66)
Missing	0.50 (-0.02, 1.03)	-0.77 (-1.88, 0.34)
Disability[3]		
None	Reference	Reference
Moderate	4.28 (4.08, 4.47)	4.71 (4.36, 5.06)
Severe	4.84 (4.51, 5.17)	29.11 (28.63, 29.59)
Comorbid conditions[4]		
Acute myocardial infarction	15.12 (14.61, 15.62)	-0.62 (-1.30, 0.07)
Ischemic heart disease	6.73 (6.57, 6.90)	-1.52 (-1.82, -1.23)
Chronic kidney disease	6.36 (6.15, 6.57)	5.41 (5.07, 5.74)
Congestive heart failure	9.99 (9.76, 10.23)	-0.18 (-0.54, 0.18)
Diabetes	4.56 (4.43, 4.69)	-0.57 (-0.83, -0.32)
Dementia	3.74 (3.53, 3.95)	-1.36 (-1.72, -1.00)
Lung disease	3.76 (3.64, 3.89)	-4.26 (-4.52, -4.00)
Psychiatric disease	7.35 (7.19, 7.51)	1.07 (0.79, 1.34)
Specified heart arrhythmias	8.62 (8.29, 8.95)	-0.40 (-0.88, 0.09)
Stroke	9.54 (9.36, 9.71)	2.14 (1.85, 2.42)
Acquired hypothyroidism	1.19 (0.97, 1.41)	-0.30 (-0.70, 0.11)
Anemia	12.03 (11.87, 12.19)	1.33 (1.06, 1.60)
Benign prostatic hyperplasia	2.65 (2.46, 2.84)	-0.67 (-1.09, -0.25)
Cancer	16.22 (15.97, 16.48)	-1.55 (-1.95, -1.16)
Cataract	2.36 (2.21, 2.52)	-3.44 (-3.74, -3.14)
Glaucoma	3.77 (3.43, 4.11)	-0.04 (-0.65, 0.57)
Hip or pelvic fracture	46.01 (45.22, 46.80)	1.94 (1.13, 2.74)
Hypertension	4.20 (4.00, 4.41)	0.05 (-0.29, 0.39)
Osteoporosis	5.80 (4.71, 6.89)	-5.64 (-7.62, -3.67)
Rheumatoid or osteoarthritis arthritis	5.56 (5.43, 5.69)	-7.70 (-7.98, -7.41)
Metropolitan residence		
Metropolitan	Reference	Reference
Non-metropolitan urban	0.33 (-0.22, 0.88)	0.41 (-0.76, 1.57)
Rural	0.67 (0.08, 1.26)	-0.53 (-1.76, 0.70)

Values are presented as percentage points (95% confidence interval).
[1]High-cost status was identified using data from 3 consecutive years (2017-2019); Specifically, we defined "persistently high-cost" as those in the top 10% of annual total health care spending in 3 consecutive years, "transiently high-cost" as those in the top 10% of annual total health care spending for at least 1 year, but less than three consecutive years, and "never high-cost" as those who were not high-cost in any of the 3 years.
[2]Sample characteristics were estimated using baseline year data (2017).
[3]Disability status was identified based on the Korean government's assessment system.
[4]Presence of comorbid conditions was identified based on definitions provided by the Centers for Medicare & Medicaid Services Chronic Conditions Data Warehouse.

high health care spending to some extent, but social risk factors may be a significant source of persistent high-cost status among older adults in Korea. As evidence suggests that medical care is necessary but not sufficient to improve population health [8], there is growing recognition that social risk factors play a key role in improving health. Older adults who face persistent high health care costs are particularly vulnerable to social risk factors [4], which can exacerbate medical conditions and lead to frequent hospitalizations and emergency room visits. Therefore, integrating both medical and social risk factors into a comprehensive approach is crucial for improving health outcomes and reducing health care spending among older adults [9]. This can be achieved through collaboration between health care providers, community organizations, and policymakers to address the social determinants of health that contribute to high health care costs.

Our study has several limitations. First, our sample only included older adults in Korea, and this may limit the generalizability of our findings to other populations. Second, our measure of health care spending may have been underestimated, as we did not include spending on long-term care and services not covered by the National Health Insurance System. Third, we adjusted for various individual-level characteristics, but there may have been other unmeasured factors that could in-

fluence high-cost status and health care spending. Finally, we incorporated individuals who were newly high-cost into our classification of transiently high-cost older adults, but it is possible that the newly high-cost population may have distinct characteristics from the pre-existing high-cost population.

Our findings suggest that although medical risk factors account for high health care spending to some extent, social risk factors may contribute to persistent high-cost status. Therefore, there is a need for targeted interventions that address the unique needs of persistently and transiently high-cost older adults in Korea. Crafting more focused policies aimed at meeting the specific needs of older adults who experience persistent or temporary high-cost status could yield greater effectiveness in efficiently controlling expenses and enhancing health outcomes. Our study emphasizes the importance of a holistic and inclusive approach to health care that recognizes the range of factors that influence health outcomes beyond medical care alone.

CONFLICT OF INTEREST

The authors have no conflicts of interest associated with the material presented in this paper.

FUNDING

This study was supported by a Korea University grant (K2224171 and K2303021).

ACKNOWLEDGEMENTS

None.

AUTHOR CONTRIBUTIONS

Both authors contributed equally to conceiving the study, analyzing the data, and writing this paper.

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REFERENCES

1. Wammes JJ, van der Wees PJ, Tanke MA, Westert GP, Jeurissen PP. Systematic review of high-cost patients' characteristics and healthcare utilisation. BMJ Open 2018;8(9):e023113.
2. Long P, Abrams M, Milstein A, Anderson G, Apton KL, Dahlberg M, et al. Effective care for high-need patients: opportunities for improving outcomes, value, and health. Washington, DC: National Academy of Medicine; 2017.
3. Park S, Park G, Chung W. Variations in healthcare spending, care access, and health status by care need: evidence from South Korea: care need in South Korea. J Gen Intern Med 2023; 38(11):2623-2625.
4. Joynt KE, Figueroa JF, Beaulieu N, Wild RC, Orav EJ, Jha AK. Segmenting high-cost Medicare patients into potentially actionable cohorts. Healthc (Amst) 2017;5(1-2):62-67.
5. Organization for Economic Cooperation and Development (OECD). OECD reviews of public health: Korea; 2020 [cited 2023 Apr 18]. Available from: https://www.oecd.org/health/oecd-reviews-of-public-health-korea-be2b7063-en.htm.
6. Figueroa JF, Zhou X, Jha AK. Characteristics and spending patterns of persistently high-cost Medicare patients. Health Aff (Millwood) 2019;38(1):107-114.
7. Ng SH, Rahman N, Ang IY, Sridharan S, Ramachandran S, Wang DD, et al. Characterising and predicting persistent high-cost utilisers in healthcare: a retrospective cohort study in Singapore. BMJ Open 2020;10(1):e031622.
8. Woolf SH. Necessary but not sufficient: why health care alone cannot improve population health and reduce health inequities. Ann Fam Med 2019;17(3):196-199.
9. Woolf SH, Braveman P. Where health disparities begin: the role of social and economic determinants--and why current policies may make matters worse. Health Aff (Millwood) 2011; 30(10):1852-1859.