Identifying Patients with Persistent Preventable Utilization Offers an Opportunity to Reduce Unnecessary Spending

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BACKGROUND: Improving care for high-cost patients is increasingly important for improving the value of healthcare. Most prior research has focused on identifying patients with high costs, but the extent to which these costs are potentially preventable remains unclear.

OBJECTIVE: To identify patients with persistent preventable utilization and compare their characteristics with high-cost patients.

DESIGN: Descriptive analysis using Medicare claims data from 2013 to 2014.

PARTICIPANTS: Medicare fee-for-service and dual-eligible beneficiaries ($N = 515,689$) from the New York metropolitan area who were continuously enrolled in Medicare Parts A and B in 2013 and 2014.

MAIN MEASURES: The primary analysis focuses on patients with persistent preventable utilization (at least one preventable emergency department visit, hospitalization, or 30-day readmission in both 2013 and 2014) and high-cost patients in 2014 (top 10% of total annual spending). We compared demographic, medical, behavioral, and social characteristics and total and preventable healthcare utilization between these two groups.

KEY RESULTS: Patients with persistent preventable utilization accounted for 4.8% of the overall patient population, 13.4% of overall costs, but 46.2% of preventable costs among all Medicare patients. Compared with high-cost patients, patients with persistent preventable utilization had lower median healthcare costs ($33,383 vs. $56,552), but their median potentially preventable costs were seven times higher ($7151 vs. $928). We also found that 1.9% of patients could be categorized in both the persistent preventable utilization group and the high-cost group. This subset of patients had the highest median Medicare costs and preventable costs and represented over 30% of total preventable spending and 9.4% of overall costs among all Medicare patients.

CONCLUSION: Designing and targeting interventions for patients with persistent preventable utilization may offer an important opportunity to reduce unnecessary utilization and promote high-value care.

INTRODUCTION

Health systems, payers, and policymakers are seeking strategies to slow the growth of costs while improving the quality of care, and many recent population health efforts have focused on high-cost patients—often defined as patients with the highest 10% of spending.[1, 2] The per capita health cost was $5006 in 2016 in the USA. However, high-cost patients cost at least $12,024 with the average cost of $33,053.[3] Recently, there has been growing interest in identifying persistently high-cost patients (those who are high cost in each of two or more consecutive years). Previous studies suggest that 2.8% of Medicare patients and 5.5% of dually eligible patients have persistently high costs over 3 years.[4, 5] Developing interventions for these patients may be an effective strategy to curb the growth of healthcare spending and to improve the value of care. However, the extent to which these costs are potentially preventable remains unclear. High-cost patients comprise the most medically and socially complex populations,[6] and their high level of healthcare utilization may be due to long-standing chronic illnesses, behavioral issues, disabilities, or social vulnerability that are difficult for health systems to prevent or modify.[1]

Many new care delivery and payment models, such as accountable care organizations (ACOs) and the Hospital Readmission Reduction Program (HRRP), focus on reducing potentially preventable healthcare utilization. Therefore, understanding the characteristics of patients who have persistent *preventable* utilization, not just high overall utilization, may be important for improving the quality and value of care. It is not clear how patients with persistent preventable utilization differ from other high-cost patients, how best their needs can be addressed, and what effect doing so might have on overall healthcare spending.

Using a sample of Medicare fee-for-service (FFS) and dual-eligible patients from the New York metropolitan area during 2013–2014, we identified patients with persistent potentially

preventable utilization—hereafter referred to as "patients with persistent preventable utilization"—and compared them with high-cost patients (regardless of whether the high-cost patients had potentially preventable utilization). We aimed to answer four questions: (1) What proportion of Medicare fee-for-service and dual-eligible patients have persistent preventable utilization? (2) What proportion of total costs and preventable costs do these patients account for? (3) To what extent do these patients overlap with high-cost patients overall (i.e., are they a distinct population)? (4) How do healthcare costs, utilization, and patient characteristics differ between these patients and high-cost patients?

METHODS

Study Sample

We identified patients enrolled in the Medicare FFS program, including patients dually enrolled in Medicare and Medicaid who had at least one encounter from major health systems in the New York metropolitan area in 2013 and 2014. These health systems include Mount Sinai Health System, Montefiore Medical Center, New York University Langone Medical Center, New York-Presbyterian Hospital/Columbia (NYP West), and New York-Presbyterian Hospital/Cornell (NYP East).[7] Patients were excluded if they (1) had any Medicare Advantage enrollment in 2013 or 2014, as Medicare FFS data do not capture the entirety of their utilization and characteristics; (2) died during the study period, as shorter duration of enrollment may artificially lower costs; (3) were partially enrolled in Medicare Part A or Part B, as their utilization and other characteristics are incomplete in Medicare claims data; or (4) had invalid or missing zip codes and were therefore not linkable to social determinants of health data. Our final study sample included 515,689 patients.

Data

We used the following Medicare FFS claims files for the period of 2013 and 2014: Carrier, Outpatient, MedPAR for inpatient care, Skilled Nursing Facility, Home Health Agency, Hospice, Durable Medical Equipment, Part D Drug Event, and Master Beneficiary Summary. We extracted social determinants of health data at the zip-code level from the American Community Survey and linked these data with Medicare claims data based on zip codes in the Medicare Beneficiary Summary file.

Potentially Preventable Utilization and Costs

We defined patients with persistent preventable utilization as those who experienced at least one preventable ED visit, preventable hospitalization, or unplanned 30-day readmission in both 2013 and 2014. These three utilization measures are used in the ACO program, the Hospital Readmission Reduction program, and other pay-for-performance programs.[8–10]

To identify potentially preventable ED visits, we used an algorithm created by Billings and colleagues.[11] This algorithm classifies each ED visit into one of four categories based on the discharge diagnosis code: nonemergent; emergent but primary care treatable; emergent, ED care needed but preventable; emergent, ED care needed, and not preventable. The algorithm assigns a probability estimating the likelihood that the discharge diagnosis falls into each of the four categories. Consistent with previous studies, we defined an ED visit as preventable if the combined probabilities of "nonemergent," "emergent but primary care treatable," and "emergent, ED care needed but preventable" was 75% or higher.[12] We included only ED visits not resulting in hospitalization.[13] Preventable ED visits followed by hospitalizations were defined as a preventable hospitalization. We used the latest ICD-9 version of this algorithm updated in 2015.

To identify preventable hospitalizations, we used an algorithm from the AHRQ's Prevention Quality Indicators (PQIs).[14] The PQIs include measures to identify hospitalizations for ambulatory care-sensitive conditions (ACSCs) that could potentially have been prevented with appropriate outpatient care. To identify unplanned 30-day readmissions, we used an algorithm for 30-day all-cause unplanned readmissions from the Centers for Medicare and Medicaid Services (CMS).[15]

Because simply cataloging the frequency of each type of preventable utilization may obscure cost variation and downstream costs associated with these services, we calculated geographically standardized costs for each potentially preventable encounter. This included costs for all services during a preventable encounter (e.g., a preventable ED visit) and all other services delivered within 30 days after the encounter.[13, 16]

High-Cost Patients

We calculated the geographically standardized total annual Medicare costs from 2013 to 2014 for each patient using a previously described method.[16] This method accounts for cost variation across patients due to differences in geographic input costs. Consistent with prior literature, we defined high-cost patients as those in the top 10% of total annual costs. We identified three high-cost patient groups: (1) high-cost patients in 2013, (2) high-cost patients in 2014, and (3) persistently high-cost in both 2013 and 2014 (top 10% in both 2013 and 2014).

Patient Characteristics

We examined patients' demographic, medical, behavioral, and social characteristics. Demographic characteristics included age, gender, and race. Medical characteristics included having three or more chronic conditions, end-stage renal disease (ESRD), and seven indicators representing conditions associated with high costs and preventable utilization identified in the literature: serious medical illness, frailty, chronic pain,

serious mental illness, single condition with high pharmacy costs, single high-cost chronic condition, and opioid use disorder.[2, 13] We used the Chronic Condition Warehouse-defined conditions to identify the number of chronic conditions for each patient. Serious illness, frailty, chronic pain, and opioid use disorder were defined using previously developed algorithms.[17–21] Single conditions with high pharmacy costs were defined as having one of several conditions, including rheumatoid arthritis, multiple sclerosis, and Crohn's disease. Single high-cost chronic conditions included HIV, hepatitis C, or sickle cell disease. Using data from the American Community Survey, we generated the zip-code level Area Deprivation Index to characterize patients' social conditions (ESM Appendix A).[22] Finally, we examined dual-eligible status and Medicare Part D coverage.

Statistical Analyses

Our primary analysis compared patients with persistent preventable utilization (i.e., preventable utilization in both 2013 and 2014) to high-cost patients in 2014. We first identified patients with persistent preventable utilization, patients with high costs, and patients in both groups. We then compared total health costs, preventable utilization and associated costs, and demographic, social, and medical characteristics across these three groups.

For sensitivity analyses, we compared patients with persistent preventable utilization to high-cost patients in 2013 and to persistently high-cost patients. We also examined whether persistent preventable utilization at baseline was associated with future preventable costs. We used 2013 data to identify patients with multiple preventable encounters (at least two) as a proxy for persistent preventable utilization and compared their preventable costs in 2014 with 2013 high-cost patients. Health spending was inflation-adjusted using the medical care Consumer Price Index from the Bureau of Labor Statistics and presented in 2014 dollars.

RESULTS

Our study included 515,689 patients continuously enrolled in Medicare Parts A and B in 2013 and 2014. Of these patients, 13.5% ($n = 69,560$) had at least one preventable encounter in 2013 and 14.5% ($n = 76,188$) experienced at least one in 2014; 4.8% ($n = 24,981$) of patients in our sample experienced preventable utilization in both 2013 and 2014, while 76.6% ($n = 394,922$) had no preventable utilization in either year. Among patients with persistent preventable utilization, 38.8% ($n = 9693$) were also classified as high-cost patients in 2014 (Fig. 1).

Patient Characteristics

Patient characteristics differed greatly across patient groups (Table 1). Compared with high-cost patients, patients with

persistent preventable utilization were more likely to be female (61.2% vs. 52.7%); black or Hispanic (30.4% vs. 20.2%); have high-cost conditions, such as serious medical illness (38.8% vs. 32.9%), frailty (32.3% vs. 28.1%), and serious mental illness (39.6% vs. 30.8%); and live in an area with the highest Area Deprivation Index score (27.7% vs. 23.6%). They were less likely to have ESRD (6.5% vs. 12.7%), single chronic condition with high pharmacy costs (11.0% vs. 12.9%), and single high-cost chronic condition (6.6% vs. 8.0%).

Patients who had both high costs and persistent preventable utilization differed in their characteristics relative to patients in either group alone. Patients with both high costs and persistent preventable utilization were more likely to be under 65, black, and dually eligible for Medicare and Medicaid. These patients were also more likely to have ESRD, a serious medical illness, and other high-cost conditions. For example, 57.7% of patients with both persistent preventable utilization *and* high cost had a serious medical illness, compared with 38.8% of patients with only persistent preventable utilization and 32.9% of patients with only high costs.

Supplemental analyses also found distinct patient characteristics by subgroups (ESM Appendices B and C).

Total and Preventable Costs

Compared with high-cost patients, patients with persistent preventable utilization had lower median healthcare costs (e.g., $33,383 vs. $56,552). Due to their higher per patient cost and larger group size, high-cost patients accounted for a greater proportion of overall costs among all Medicare patients relative to patients with persistent preventable utilization (39.6% vs. 13.4%) (Table 2). However, patients with persistent preventable utilization had more than seven times higher median *preventable* costs ($7151 vs. $928). Overall, patients with persistent preventable utilization accounted for 46.2% of all preventable costs and high-cost patients accounted for 59.3%, although there were 2.1 times as many high-cost patients (Table 2).

Among all patients, preventable utilization accounted for 8.5% of total healthcare costs across 2 years (Table 2). Among patients with persistent preventable utilization, preventable costs accounted for 29.3% of total health costs; eliminating these costs would reduce overall spending by 4.0%. Among high-cost patients, preventable utilization accounted for 12.7% of total healthcare costs; eliminating these costs would reduce overall spending by 5.0% but would require interventions for a much larger number of patients.

Preventable Utilization

Compared with high-cost patients, patients with persistent preventable utilization had substantially higher rates of potentially preventable ED visits and ambulatory care-sensitive
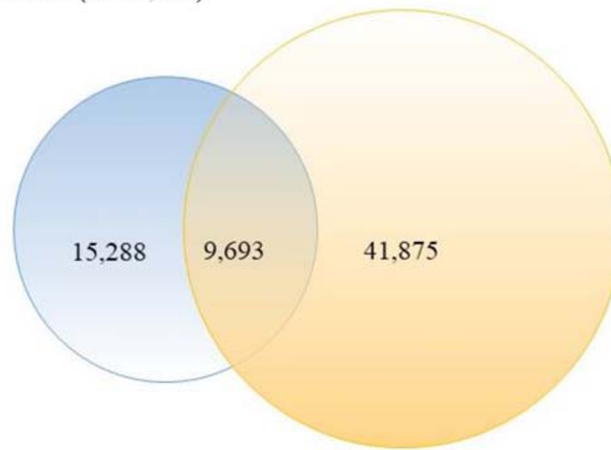
Figure 1 Overlapping between patients with persistent preventable utilization and the high-cost patients. Notes: Patients with persistent preventable utilization were those who experienced at least one preventable emergency department visit, preventable hospitalization, or 30-day readmission in each year of 2013 and 2014. High-cost patients were patients in the top 10% of total annual Medicare costs in 2014.

hospitalizations and moderately higher rates for readmissions (Table 2). For example, patients with persistent preventable utilization had more than three times as many preventable ED visits per patient as high-cost patients (71.8% vs. 20.1%) and nearly twice as many ambulatory care-sensitive admissions per patient (31.9% vs. 15.0%).

Patients with Both Persistent Preventable Utilization and High Costs

Patients with both persistent preventable utilization and high costs had the highest median preventable costs ($18,708) and total healthcare costs per patient ($72,799). Median preventable costs for these patients were more than two times higher than

Table 1 Baseline Patient Characteristics, by Patient Groups, 2013

Patient characteristics	All (N = 515,689)	All patients with persistent preventable utilization (N = 24,981)	All high-cost patients (N = 51,568)	Patients with both persistent preventable utilization and high costs (N = 9693)
Average age (SD)	73.4 (11.1)	70.0 (15.9)	71.6 (13.6)	69.3 (15.7)
Age < 65 (%)	12.0	28.8	22.6	31.5
Female (%)	58.0	61.2	52.7	56.2
Race (%)				
Non-Hispanic white	80.2	64.9	72.8	64.4
Black	9.9	22.2	15.5	23.7
Hispanic	3.4	8.2	4.7	7.3
Other	6.5	4.8	7.0	4.6
Dual-eligible (%)	21.4	47.2	38.6	52.0
Part D coverage (%)	75.7	84.2	84.3	86.9
Average number of chronic conditions	5.5	7.7	7.3	8.9
ESRD (%)	1.6	6.5	12.7	15.8
High-cost indicators (%)				
Serious medical illness	11.8	38.8	32.9	57.7
Frail	11.9	32.3	28.1	45.6
Serious mental illness	17.3	39.6	30.8	46.8
Chronic pain	3.2	13.5	8.5	18.5
Single chronic condition with high pharmacy costs	7.2	11.0	12.9	13.9
Single high-cost chronic condition	2.3	6.6	8.0	10.3
Opioid use disorder	0.8	4.2	2.5	6.2
Quintiles of Area Deprivation Index (%)				
Median and IQR	52.6 (24.1–72.2)	62.0 (38.4–78.7)	57.0 (35.2–76.0)	62.7 (40.1–78.7)
Quintile 1	20.1	12.9	14.4	11.0
Quintile 2	20.0	17.1	18.9	17.3
Quintile 3	19.9	17.6	20.2	18.3
Quintile 4	20.0	24.7	22.9	25.5
Quintile 5 (the most vulnerable)	20.0	27.7	23.6	27.9

Statistical tests for differences were not conducted, as these are partially overlapping groups. Patients with persistent preventable utilization were those who experienced at least one preventable emergency department visit, preventable hospitalization, or 30-day readmission in each year of 2013 and 2014. High-cost patients were patients in the top 10% of total annual Medicare costs in 2014
SD, standard deviation; IQR, interquartile range; ESRD, end-stage renal disease

Table 2 Preventable Utilization and Costs by Patient Groups, 2013 and 2014

	All (N = 515,689)	All patients with persistent preventable utilization (N = 24,981)	All high-cost patients (N = 51,568)	Patients with both persistent preventable utilization and high costs (N = 9693)
% of patients	100.0	4.8	10.0	1.9
Median total costs and IQR ($)				
2013	7629 (3462–17,555)	27,943 (12,607–58,136)	36,170 (13,155–67,914)	56,893 (30,784–94,403)
2014	8058 (3609–19,693)	32,757 (14,126–69,450)	70,428 (55,645–99,080)	82,951 (61,190–120,351)
Average	8944 (4212–20,202)	33,383 (16,143–63,762)	56,552 (41,043–80,954)	72,799 (52,669–105,125)
% of total health costs				
2013	100.0	13.2	30.5	8.3
2014	100.0	13.5	47.7	10.4
Average	100.0	13.4	39.6	9.4
Median potentially preventable cost and IQR ($)				
2013	0 (0–0)	5281 (1406–14,572)	0 (0–1683)	11,221 (3661–26,162)
2014	0 (0–0)	6265 (1563–17,652)	0 (0–14,539)	20,905 (8861–39,776)
Average	0 (0–0)	7151 (2430–17,181)	928 (0–11,156)	18,708 (9480–32,977)
% of overall potentially preventable costs				
2013	100.0	47.8	44.4	30.9
2014	100.0	44.9	71.1	35.4
Average	100.0	46.2	59.3	33.4
% of total costs that are potentially preventable				
2013	8.0	29.0	11.6	29.7
2014	8.9	29.5	13.3	30.4
Average	8.5	29.3	12.7	30.1
% of patients with preventable ED visits				
2013	9.7	71.8	18.2	61.5
2014	10.5	71.7	22.0	56.1
Average	10.1	71.8	20.1	58.8
% of patients with ACSC admissions				
2013	3.5	31.3	11.3	42.2
2014	4.0	32.5	18.6	47.3
Average	3.8	31.9	15.0	44.8
% of patients with unplanned 30-day readmissions				
2013	2.5	23.2	10.6	37.6
2014	3.0	24.8	22.2	52.2
Average	2.8	24.0	16.4	44.9

Statistical tests for differences were not conducted, as these are partially overlapping groups. Patients with persistent preventable utilization were those who experienced at least one preventable emergency department visit, preventable hospitalization, or 30-day readmission in each year of 2013 and 2014. High-cost patients were those in the top 10% of total annual Medicare costs in 2014
IQR, interquartile ranges; ED, emergency department; ACSC, ambulatory care-sensitive condition

for the persistent preventable utilization group and almost twenty times higher than the high-cost group. Although these patients accounted for only 1.9% of the overall patient population and 9.4% of total costs, they represented 33.4% of preventable costs among all Medicare patients. Eliminating preventable costs among this small patient population could reduce total spending by 2.8%. In addition, patients with both persistent preventable utilization and high costs had the highest ACSC admission rate and 30-day readmission rates (Table 2).

Variation of Preventable Health Costs Within Patient Groups

The magnitude of potentially preventable costs varied across patient groups (Fig. 2): 21.2% of patients with persistent preventable utilization had more than $20,000 in potentially preventable costs, and 4.9% had over $50,000. By comparison, 13.9% of high-cost patients had more than $20,000 in potentially preventable costs and 2.8% had over $50,000. Patients with both persistent preventable utilization and high costs had the highest preventable costs: 12.2% experienced more than $50,000 in preventable spending. The full distribution of total and preventable costs across patient groups was described using kernel density plots (ESM Appendix D).

Sensitivity Analyses

We conducted sensitivity analyses by changing the definition of high-cost patients to patients in the top 10% of total Medicare costs in 2013 or patients who had high costs in both 2013 and 2014. We found similar results with regard to patient characteristics and healthcare utilization and costs (ESM Appendices E and F). We also conducted a sensitivity analysis by excluding Part D costs to calculate total healthcare costs and to redefine the high-cost patient group. Results were also consistent with the primary analysis. Finally, we found that patients with multiple preventable encounters in 2013 had the highest preventable costs in 2014 when compared with other patient groups (ESM Appendix G).

DISCUSSION

We found that 4.8% of Medicare patients had preventable utilization in both 2013 and 2014. Although these patients accounted for 13.4% of total health costs, they represented over 46% of all preventable costs. Compared with high-cost patients, patients with persistent preventable utilization accounted for lower median healthcare costs (e.g., $33,383
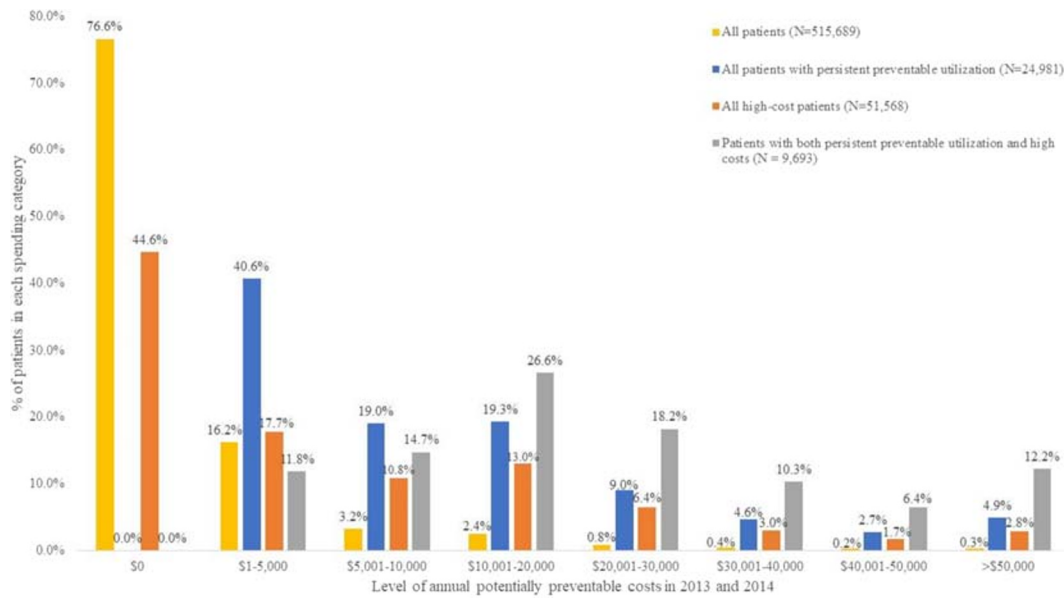
Figure 2 Variation in potentially preventable cost in 2013 and 2014 across patient groups. Notes: Patients with persistent preventable utilization were those who experienced at least one preventable emergency department visit, preventable hospitalization, or 30-day readmission in each year of 2013 and 2014. High-cost patients were those in the top 10% of total annual Medicare costs in 2014.

vs. $56,552), but had seven times higher median preventable costs ($7151 vs. $928). Furthermore, we found that 1.9% of patients could be categorized into both the persistent preventable utilization group and the high-cost group. This subset of patients had the highest median total costs and preventable costs, representing 9.4% of overall Medicare costs and over 30% of total preventable Medicare spending.

To our knowledge, this is among the first papers to identify patients with persistent preventable utilization and compare them with high-cost patients. These findings may be of interest to payers and healthcare organizations considering how to allocate resources and target interventions to specific patient groups.

Prior research has found that high costs in the previous year is among the most important predictors for future high costs.[23] Because high-cost patients have higher costs per clinical encounter, it is thought that preventable costs may be concentrated among high-cost patients,[1, 4, 5] and interventions targeting these patients have the potential to lower preventable and overall spending. Our study extends this work by identifying patients with persistent preventable utilization and comparing them with high-cost patients overall. Our results suggest that an effective strategy for reducing preventable costs may be to focus not only on patients with high overall costs (e.g., top 10%), but also on patients with persistent preventable utilization, who we find have much higher median preventable spending and small overlap with high-cost patients. Reducing preventable utilization for patients with persistent preventable utilization could lead to a 4% decrease in overall medical spending.

Health systems participating in pay-for-performance and global payment programs are incentivized to control costs while improving quality. Nearly 40% of Medicare Shared Savings Program ACOs have fewer than 10,000 attributed patients and 70% have fewer than 20,000.[24] For these ACOs, focusing on patients with persistent preventable utilization would mean targeting 500 to 1000 patients and could, if the interventions were effective, reduce preventable spending by nearly half in a given year. This presents an important opportunity for organizations with limited resources. Future studies to develop predictive algorithms for patients with persistent preventable utilization would help health systems to proactively identify these patients to target interventions.

Patients with persistent preventable utilization have different medical, behavioral, and social characteristics compared with high-cost patients overall, suggesting they may require different interventions to reduce preventable utilization. Patients with persistent preventable utilization had higher medical and social complexity compared with high-cost patients. Integrating social and medical services may be particularly important for this subset of patients. Patients who fell into both the persistent preventable utilization and high-cost group accounted for a small number of patients (1.9% of all patients) but have the greatest medical, behavioral, and social complexity. These patients experienced the highest rates of preventable utilization, and developing interventions to address their needs may be particularly important.

The characteristics of patients with persistent preventable utilization and high overall costs identified in this study may help organizations design care management and quality improvement programs. Patients with serious medical illness, for example, may benefit from palliative care,[6, 25, 26] while frail patients may benefit from integrated medical and social services (e.g., nutrition and transportation).[6, 27, 28] We found that patients with persistent preventable utilization are more likely to have vulnerable social circumstances. This is consistent

with previous research that suggests socially vulnerable patients have limited access to quality primary care or care management programs, resulting in a higher preventable acute care utilization. Our findings further support the need for health systems, community organizations, and local governments to collaborate to address the social risk factors to improve the value of healthcare.[29, 30]

This study has several limitations. First, we examined the persistence of preventable utilization and high costs over only 2 years. Patterns of overall and preventable utilization may differ over longer periods. Second, although the definitions of the three types of preventable utilization have been widely used in the literature and in many pay-for-performance programs, they may not encompass all preventable utilization. Alternatively, in some cases, they may overestimate preventable utilization. For example, not all hospitalizations for "ambulatory-sensitive" conditions may in fact be preventable. In addition, ED diagnoses may have a high clinical uncertainty and diagnosis codes encompass conditions with varying severity; therefore, the Billings algorithm may misclassify some ED visits as potentially preventable. Third, as in other studies of high-cost patients, we were not able to incorporate Medicaid spending for dual-eligible patients. Furthermore, not all patients had Part D prescription drug coverage, which may have led to misclassification of some high-cost patients. However, sensitivity analyses excluding Part D costs had similar results with our primary analysis. Fourth, our study focused on Medicare FFS and dual-eligible patients in the New York metropolitan area and findings may not be generalizable to patients enrolled in Medicare Advantage, Medicaid managed care, commercial insurance, or patients in other regions of the country.

We found that the 4.8% of Medicare patients with persistent preventable utilization accounted for more than 46% of potentially preventable costs among all Medicare patients. Less than 40% of these patients would be identified through traditional definitions of high-cost patients. Understanding and addressing their needs may help clinicians and health systems reduce unnecessary spending and increasing healthcare value.

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Compliance with Ethical Standards:

This study was approved by the Institutional Review Board of the Weill Cornell Medicine.

Conflict of Interest: *The authors report no conflicts of interest.*

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