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For Many Patients Who Use Large Amounts Of Health Care Services, The Need Is Intense Yet Temporary

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ABSTRACT Patients who accumulate multiple emergency department visits and hospital admissions, known as super-utilizers, have become the focus of policy initiatives aimed at preventing such costly use of the health care system through less expensive community- and primary care–based interventions. We conducted cross-sectional and longitudinal analyses of 4,774 publicly insured or uninsured super-utilizers in an urban safety-net integrated delivery system for the period May 1, 2011–April 30, 2013. Our analysis found that consistently 3 percent of adult patients met super-utilizer criteria and accounted for 30 percent of adult charges. Fewer than half of super-utilizers identified as such on May 1, 2011, remained in the category seven months later, and only 28 percent remained at the end of a year. This finding has important implications for program design and for policy makers because previous studies may have obscured this instability at the individual level. Our study also identified clinically relevant subgroups amenable to different interventions, along with their per capita utilization and costs before and after being identified as super-utilizers. Future solutions include improving predictive modeling to identify individuals likely to experience sustained levels of avoidable utilization, better classifying subgroups for whom interventions are needed, and implementing stronger program evaluation designs.

Atul Gawande's 2011 *New Yorker* article "The Hot Spotters" captured the imagination of health care leaders with its promise of reducing health spending and improving health outcomes by targeting individuals who use an unusually high volume of health care services.[1] Gawande chronicled an extensive data-mining exercise in Camden, New Jersey, that identified geographic areas where individuals were using extreme amounts of health care services. Known as super-utilizers, these patients are described in more detail below. The Camden exercise was intended to target a community program designed to reduce unnecessary utilization.

Previous work has documented that 5–10 percent of Medicaid and Medicare patients account for 50 percent or more of total spending.[2–4] Acute care utilization accounts for a significant proportion of this outlier spending, a portion of which may be avoidable.[4–6]

Health spending accounts for 18 percent of the US gross domestic product; this spending level places stress on federal, state, and individual budgets.[7,8] Even though the United States has higher expenditures than its international counterparts, US health care persistently ranks below that of other developed countries on quality measures.[9] The passage of the Affordable Care Act (ACA) in 2010 and the ensuing expansion of

coverage to millions of uninsured individuals have further heightened these cost and quality concerns.

The Medicaid expansion, in particular, has spurred interest in super-utilizer populations, stemming from the experiences of the few state Medicaid programs that voluntarily enrolled ACA-target populations before implementation of the ACA. These states have found the new Medicaid beneficiaries more likely to be older, male, in poorer health, and costlier, compared to traditional Medicaid populations.[10,11]

For these reasons, a national discussion related to reducing avoidable use of health care among high-cost populations has accelerated within government agencies, policy organizations, and foundations, resulting in new Medicaid regulatory guidance.[12–14] A boom in super-utilizer program development and a multiplicity of models have resulted, with varying target populations and different theories of avoidable utilization.

Thomas Bodenheimer has developed a taxonomy of care models that distinguishes super-utilizer programs by their relative emphasis on medical care and social services, episodic versus longitudinal focus, and principal site of the program (health plan, primary care, hospital, emergency department, home, or community).[15] Program design may also reflect payers' or providers' priorities and organizational constraints. However, the health policy zeal appears to surpass the evidence available in the promising but limited and largely non-peer-reviewed literature on identifying super-utilizers, engaging with them, and intervening on their behalf.[15,16]

The descriptive literature on super-utilizers is sparse and largely focuses on Medicare patients, with recent narrow attention on risk factors associated with thirty-day hospital readmissions.[17–19] Karen Joynt and coauthors conducted one of the few studies that attempted to disaggregate avoidable from unavoidable utilization and distinguished episodically high-cost from persistently high-cost Medicare patients.[6]

In an analysis of peer-reviewed literature on Medicaid readmissions, Marsha Regenstein and Ellie Andres note that few analyses include outpatient data, and many focus on specific subpopulations: women, people with mental health diagnoses, children with asthma, dual eligibles (those eligible for both Medicaid and Medicare), or Medicaid beneficiaries in specific states.[20] The most comprehensive Medicaid analyses exist in the policy-oriented "grey" literature.[21–23]

Richard Kronick and coauthors showed that the vast majority of Medicaid super-utilizers have multiple comorbid chronic conditions.[3] Among people in the top 1 percent of acute care spending, nearly 83 percent had three or more chronic conditions, and more than 60 percent had five or more. Compared to high-cost Medicare beneficiaries, high-cost Medicaid beneficiaries are younger and more likely to have comorbid behavioral health or substance abuse conditions.[5,20]

Super-utilizer programs that target Medicaid or uninsured populations report that social risk factors—language, health literacy, unemployment, substance abuse, and housing—are key predictors of avoidable use, although their prevalence among super-utilizing populations is less rigorously documented in the peer-reviewed literature.[14,15,24] Several program-relevant considerations are virtually unstudied, including population trends, payer stability, patients' attachment to primary care, use across delivery systems, and delivery system failures associated with excess use.

We provide both cross-sectional and longitudinal descriptive analyses of primarily low-income super-utilizers who are either publicly insured or uninsured. This article adds to the super-utilizer literature by addressing four study objectives: describing the chronic disease burden and social determinants of health at a population level, assessing the persistence of super-utilizer status at the individual level, quantifying cost trends over time under current care models, and identifying subgroups that are amenable to subgroup-aligned intervention strategies.

The Colorado Multiple Institutional Review Board reviewed this project and determined that it was not human subjects research.

Study Data And Methods

Clinical, demographic, and financial data on super-utilizers were extracted from the data warehouse of Denver Health, an integrated safety-net health system and the largest provider in Colorado of services to people in the state with Medicaid or no insurance. In 2014 nearly 214,000 unique patients used Denver Health services. The unusually tight administrative and clinical integration across the outpatient and inpatient settings at Denver Health and the system's additional roles as a health maintenance organization (HMO) and public health department facilitate data capture across the continuum of care.

SUPER-UTILIZER DEFINITION The literature contains widely varying definitions for *super-utilizer*, most of which neither address whether or not the super-utilization is persistent nor distinguish avoidable from nonavoidable use. The Centers for Medicare and Medicaid Services (CMS) has defined *super-utilizers* as "patients who accumulate large numbers of emergency

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department [ED] visits and hospital admissions which might have been prevented by relatively inexpensive early interventions and primary care."[12] Because nationally more than 50 percent of admissions originate in the ED, super-utilizer criteria that focus on multiple readmissions over an extended time period—especially in the case of patients with comorbid behavioral health concerns—align with the CMS definition and with broad themes identified in the literature on high-cost publicly insured populations. Hospitalization or ED thresholds are also a way that many programs identify super-utilizers, with threshold levels driven in part by program capacity considerations.[15,16]

In keeping with the threshold convention, we defined *super-utilizers* as patients who—during the study period, May 1, 2011–April 30, 2013—had three or more hospitalizations in a rolling twelve-month look-back period or had both a serious mental health diagnosis and two or more hospitalizations in that look-back period. We used *International Classification of Diseases*, Ninth Revision (ICD-9), codes to identify serious mental health diagnoses (for a list of the codes we used, see the online Appendix).[25]

We sought to assess the extent to which a broad definition of *super-utilization* might contain clinical subgroups that vary in the degree to which their care pertains to the goal of reducing avoidable hospitalization. Thus, we did not apply a priori exclusions, such as patients with scheduled admissions.

To simulate super-utilizer programs' practices of rolling patient identification, we created the study sample by applying the above criteria each month in the study period. We included super-utilizing adults in Denver County with Medicaid, Medicare, commercial insurance, or no insurance ($N = 4,774$). For example, we included all adults who, on May 1, 2011, had had three hospitalizations since May 2, 2010—regardless of how those three hospitalizations were spread out during the year.

We included non–Denver Health inpatient utilization information for the approximately one-third of super-utilizers who participated in one of Denver Health's managed care plans. The dates that individuals first qualified as super-utilizers as well as disqualifying dates, if any, were captured to track monthly super-utilizer status at the individual level.

CROSS-SECTIONAL ANALYSES Population characteristics were examined on a monthly cross-sectional basis. We focused on sociodemographic characteristics, per capita spending, payer mix, and health risk profile as assessed by predictive modeling tools.[26–28]

LONGITUDINAL ANALYSES Patients identified as super-utilizers during May 2011 were followed longitudinally to quantify the persistence of super-utilizer status and patient mortality. Pre- and post-identification utilization costs were compared to estimate regression to the mean. The "opportunity analysis" framework of Geraint Lewis and coauthors guided our identification of clinically relevant subgroups within the broader super-utilizer population. Specifically, Lewis and coauthors' risk stratification approach calls for literature-informed data mining to identify subpopulations of relatively homogeneous high-opportunity patients for whom cost-effective interventions potentially exist.[29] We provide descriptive statistics for each subgroup, including the percentage established in a Denver Health primary care panel. For technical definitions of study measures, see the Appendix.[25]

LIMITATIONS This study had several limitations. It stemmed from a quality improvement project at a single integrated health system in a midsize city, which limits the generalizability of our results. Our identification of clinical subgroups of super-utilizers, such as trauma patients or those receiving emergency dialysis, may not be equally applicable to non-safety-net populations.

Our analysis only partially captured super-utilizer use that occurred outside the integrated delivery system, specifically for the approximately one-third of the subjects who were enrolled in a Denver Health HMO. Non–Denver Health charges were stable throughout the study period, at approximately 19 percent of total charges. Therefore, they did not skew year-to-year comparisons. However, without data on non–Denver Health use for fee-for-service patients, we may have underestimated costs.

Despite these limitations, this is the first study that employed a longitudinal design and included data across the care continuum. Thus, it provides valuable and novel insights into the super-utilizer phenomenon.

Study Results

BURDEN OF CHRONIC DISEASE AND SOCIAL DETERMINANTS OF HEALTH Our cross-sectional analysis of the twenty-four super-utilizer population snapshots—one for each month in the study period—demonstrated that the clinical, demographic, and financial characteristics of the adult super-utilizers in our study were relatively stable (Exhibit 1). Approximately 3 percent of the super-utilizers accounted for 30 percent of the total charges, excluding professional (specialty) fees, during the study period (data not shown).

EXHIBIT 1

Percentages Of 4,774 Adult Super-Utilizers In Denver County, Colorado, With Selected Characteristics, May 1, 2011–April 30, 2013
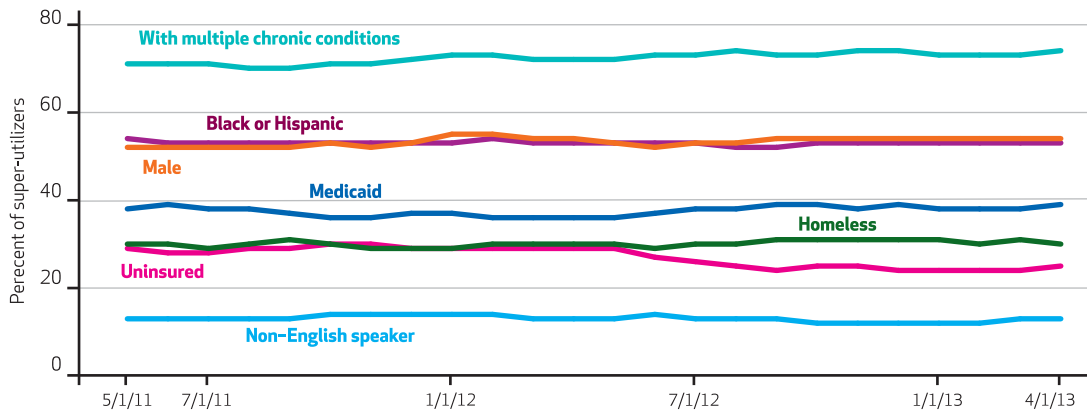
SOURCE Authors' analysis of data from the data warehouse of Denver Health. NOTE Each population characteristic percentage was calculated from the cross-sectional snapshot of patients identified as super-utilizers in that month.

PERSISTENCE OF SUPER-UTILIZER STATUS AT THE INDIVIDUAL LEVEL Despite the stability of population-level characteristics, super-utilizers were not stable at the individual level. Instead, they cycled into and out of super-utilizer status on a monthly basis.

Exhibit 2 illustrates both points with refreshed monthly super-utilizer counts throughout the study period. A relatively stable population of adults (1,650 people on average) met super-

utilizer criteria each month. To examine stability at the individual level, we separately tracked the 1,682 super-utilizers identified during the first month of the study within each subsequent monthly super-utilizer population count for the entire study period. The individuals in this original cohort were divided into the subgroups shown in Exhibit 2.

In all, 4,774 individuals qualified as super-utilizers at least once during the two-year study

EXHIBIT 2

Population- And Individual-Level Analyses Of Adult Super-Utilizers In Denver County, Colorado, May 1, 2011–April 30, 2013
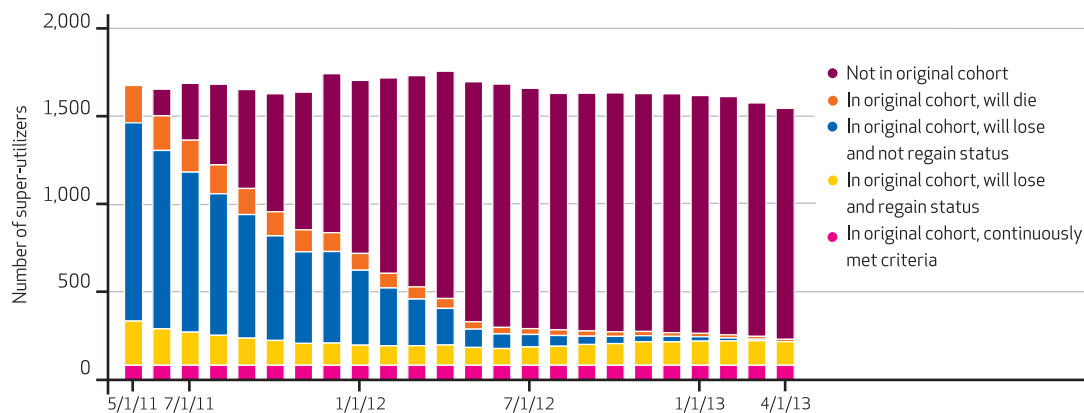
SOURCE Authors' analysis of data from the data warehouse of Denver Health. NOTES "Not in original cohort" is people who became super-utilizers after the study period began (members of all other categories were in the original cohort). "Will die" is people from the original cohort who died during the study period; some people who died also permanently or temporarily lost super-utilizer status. "Will lose and not regain status" is people from the original cohort who stopped being super-utilizers and did not regain that status during the study period. "Will lose and regain status" is people from the original cohort who stopped being super-utilizers and did regain that status during the study period. "Continuously met criteria" is people who met the criteria for super-utilizers throughout the study period. Some people classified as "not in original cohort" also died, permanently or temporarily lost super-utilizer status, or both during the study period. However, these super-utilizer status changes were not tracked. Only status changes affecting the original cohort are shown in the exhibit.

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period. At the end of the first seven months, more than half of the super-utilizers who qualified during the first month either had died or no longer met the criteria (Exhibit 2). At the end of the first year, only 472 of the original 1,682 (28 percent) remained super-utilizers. At the end of the second year, just 240 (14 percent) remained, of whom only 93 (6 percent of the original 1,682) met the criteria in all twenty-four months. Of the original cohort, 156 died in the first year, and 56 died in the second year, yielding a two-year mortality rate of 13 percent.

SUPER-UTILIZER COSTS OVER TIME: REGRESSION TO THE MEAN Variability in the persistence of super-utilizer status affects per person spending over time. For the original cohort of 1,682 super-utilizers, we compared per capita facility charges over time. Because super-utilizer status was defined by recent use, baseline spending for this cohort was quite high, at $113,522 per capita (Exhibit 3). Per person spending for this cohort in subsequent years was much lower, falling almost 60 percent after two years. As is common practice in super-utilizer program evaluation literature, these pre- and post-identification cost estimates did not control for patients who died or left the Denver Health system and thus had no data after the baseline year.[20]

IDENTIFYING CLINICAL SUBGROUPS AND ALIGNED INTERVENTIONS We assessed whether there are subgroups of super-utilizers with distinctive needs, as identified through the literature and clinical expertise. We chose to investigate the six mutually exclusive subgroups shown in Exhibit 4 because they represent clinically relevant and unique populations for whom different potentially effective interventions exist. Following Lewis and coauthors,[29] we list subgroups by name and by the associated interventions because they are intertwined. Thus, these subgroups reflect important granularity. For example, the cancer patient group was limited to people with terminal cancer because the associated interventions are more focused than would be appropriate for all cancer patients.

Exhibit 4 provides unique patient counts for each subpopulation, deduplicated in the order listed. Subgroups were heterogeneous in size, percentage in Denver Health primary care panels, per person spending, and number of inpatient admissions. All subgroups except for terminal cancer patients and recipients of emergency inpatient dialysis showed a reduction in spending in the year after identification as super-utilizers, compared to the year before. Reductions ranged from 28 percent to 60 percent.

Corroborating the reduction in spending calculations, the use of a validated Medicaid risk adjuster (the Chronic Illness and Disability Payment System) produced directionally similar results. For example, the percent change in actual charges per use in the year before, versus the year after, identification was reasonably similar to the percent change of the risk adjuster's concurrent and predictive risk scores for all groups except the (very small) terminal cancer and emergency inpatient dialysis subgroups. The online Appendix includes technical information related to our measures (for example, the definition of *super-utilizer*, predictive modeling estimates, and utilization and charges).[25]

Discussion

This in-depth analysis yielded some critical observations that should inform super-utilizer identification, program design, and evaluation.

STABILITY IN GROUP CHARACTERISTICS, NOT IN GROUP MEMBERSHIP Cross-sectional analyses confirmed that a small but consistent percentage of the adult population in our study qualified as super-utilizers at any given time, with relatively stable population-level demographic profiles, health status, payer sources, and spending. This analysis reinforced previous findings[3] that the vast majority (in the case of this study, 82 percent) of super-utilizers have multiple comorbid chronic conditions, including mental health conditions (Exhibit 4).

However, population-level stability obscures significant instability at the individual level, which may have led to oversimplification of the problem in some policy discussions. Fewer than half of super-utilizers identified at one point in time remained so just seven months later, and the figure was only 28 percent twelve months later. The majority of super-utilizers experienced brief periods of super-utilization and then returned to lower utilization.

Changes in super-utilizer status likely reflect multiple factors, including the natural history of illness that flares up and then improves over

EXHIBIT 3

Per Capita Inpatient And Outpatient Charges For 1,682 Adult Super-Utilizers In Denver County, Colorado, At Baseline And Years 1 And 2

Year	Charges	Percent change from baseline
Baseline	$113,522	—[a]
1	63,434	−44.1
2	47,017	−58.6

SOURCE Authors' analysis of data from the data warehouse of Denver Health. **NOTES** Charges are those for the original cohort of 1,682 super-utilizers identified in the first month of the study period and are in the relevant year's dollars. The baseline year corresponds to the year prior to super-utilizer identification and was May 1, 2010–April 30, 2011. Year 1 corresponds to the year immediately after identification and was May 1, 2011—April 30, 2012. Year 2 corresponds to two years after identification and was May 1, 2012–April 30, 2013. [a]Not applicable.

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EXHIBIT 4

Subgroups Of Super-Utilizers In Denver County, Colorado, And Associated Policies Or Interventions

| Subgroup | Associated policy or intervention | Super-utilizers on May 1, 2011 | | | Before and after identification as super-utilizers | | Risk score, concurrent and predictive |
		Number	Percent	Percent in a Denver Health primary care panel	Average annual per person spending	Mean annual inpatient admissions	
Recipients of emergency inpatient dialysis	Change in federal Medicaid policy to enable access to outpatient dialysis services under emergency Medicaid	30	1.8	43.3	$397,089, $408,567	33.9, 36.4	17.8, 15.7
Terminal cancer patients	Hospice, palliative care	11	0.7	36.4	$230,513, $682,176	5.8, 1.5	14.8, 9.0
Trauma patients	Highway safety/speed limits, violence prevention initiatives	195	11.6	45.1	$136,050, $79,366	4.4, 1.8	6.8, 4.7
Orthopedic surgery patients (not trauma related)	Shared decision making, infection prevention education, postdischarge follow-up	60	3.6	76.7	$201,334, $80,039	4.2, 1.4	10.0, 5.4
Individuals with serious mental health diagnoses	Integrated or collaborative behavioral health models	685	40.7	54.5	$87,236, $62,600	3.2, 1.1	5.4, 4.2
Patients with multiple chronic diseases/other	Redesigned primary care with enhanced social or mental health services	701	41.6	71.4	$120,520, $77,833	3.9, 1.5	7.4, 5.5

SOURCE Authors' analysis of data from the data warehouse of Denver Health. **NOTES** The numbers and percentages for the subgroups are based on the original cohort of 1,682 super-utilizers. Each pair of numbers represents before and after identification as super-utilizers.

time, the impact of care on the course of disease, and mortality. The latter is a reality that is often ignored in designing super-utilizer programs.

Instability in individual super-utilizer status has important implications for program design. Interventions for individuals who have persistently high utilization are likely to be different from those for individuals with time-limited episodes of super-utilization. For the latter group, the window of opportunity is short and requires programs that have timely information about admissions (paid claims are generally not timely enough), efficient outreach, and brief intervention methods as well as the ability to add and graduate patients.

SUPER-UTILIZERS ARE HETEROGENEOUS AND AMENABLE TO DIFFERENT INTERVENTIONS The lack of clinically accepted, sensitive, and specific methods of super-utilizer identification presents a practical barrier to developing aligned interventions. Many super-utilizer program models seek to address common reasons for persistently high and avoidable use among individuals with multiple comorbid chronic conditions, such as medication nonadherence, poor health literacy, housing instability, substance abuse or narcotic-seeking behaviors, and mental health co-

morbidities. Our super-utilizer definition is reasonably aligned with this target population, with 82 percent of the super-utilizers in our study having multiple chronic conditions (Exhibit 4). Additionally, 41 percent of super-utilizers had a serious mental health diagnosis (Exhibit 4), and 30 percent reported homelessness (Exhibit 1).

However, we also found that 18 percent of super-utilizers did not fit this common program profile, and many current programs must manually screen out such individuals. Furthermore, given that this small group accounted for 27 percent of the total charges associated with super-utilizer use in the year prior to identification, it is important to consider population-specific interventions for this subgroup as well.

Patients receiving emergency inpatient dialysis represented only 1.8 percent of the super-utilizers in our study but had the highest per capita costs upon identification (Exhibit 4). Changing federal policies could improve both patient quality and quantity of life as well as utilization management.

For the 0.7 percent of super-utilizers with terminal metastatic cancer, hospice or palliative care may affect high utilization and improve quality of life. Individuals experiencing infec-

tions and other complications from orthopedic surgery (3.6 percent of super-utilizers) could benefit from an approach that included shared decision making, education to prevent infection, and intensive postsurgical follow-up.

Finally, 11.6 percent of super-utilizers had experienced major trauma such as auto accidents or interpersonal violence. This group could be affected by better-organized trauma systems and by programs related to highway safety and violence prevention that reduce trauma rates. Individual patients in the group could also benefit from care models that recognized and managed post-traumatic stress.

DELIVERY SYSTEM DESIGN FOR SUPER-UTILIZERS Our analysis of super-utilizers' patterns of health care seeking can inform decisions about when, where, and how to optimally intervene. Embedding complex case management teams in regular primary care practices might work well for super-utilizers who have existing primary care relationships but might be less effective for those individuals with weak or no primary care attachments. Primary care affiliation varied significantly by subgroup in our study (36.4–76.7 percent; Exhibit 4).

In addition to traditional primary care–based outreach efforts, alternative models such as ambulatory intensive caring unit models and home and community-based approaches may be needed for some patients. (In the ambulatory intensive caring unit model, complex and high-cost patients are selected to receive primary care in an intensively resourced clinic with a reduced patient panel.)[15] Even for super-utilizers who use primary care, confirmation is needed that their use is sufficiently confined to one delivery system for a provider-based approach to make sense. Otherwise, multiple uncoordinated provider programs may attempt to manage the same patients.

The high prevalence of mental health conditions and substance abuse that occurs with high medical need argues for integrated care models. However, the separate financing and delivery of mental and physical health services in many state Medicaid programs—including the one in Colorado, our study site—poses a policy barrier.

Conclusion

More research is needed to answer important questions related to super-utilizer identification, program design, and program effectiveness. Improved predictive modeling should aim not only to identify individuals who are likely to experience sustained levels of avoidable utilization, but also to better classify subgroups of patients for whom aligned interventions are needed. This will likely require blending automated methods and clinical screening approaches. Key unanswered questions about program design and effectiveness include which patients can be effectively engaged in care, which use is modifiable, when services should be short-term versus ongoing, which patients benefit from which services, where the services should be based or delivered, and when payer approaches are preferable to provider approaches.

Answering these important questions requires program evaluation that can distinguish truly effective programs from those that merely reflect the natural history of disease, with reduced use and costs over time. In our study, most patient subgroups showed reductions in utilization when we compared the year after identification as super-utilizers to the year before identification. The average reduction was 44 percent in per person spending (Exhibit 3), which reflects a combination of regression to the mean, patient death, and attrition from Denver Health. Programs that use a pre-post evaluation design may inaccurately claim success with similar levels of reduced utilization.[20]

Most existing programs have not been implemented under a research framework, such as a randomized controlled trial.[15,16] Program evaluations that used strong observational designs would fill an important gap in the literature on the effectiveness of super-utilizer programs. ∎

NOTES

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25 To access the Appendix, click on the Appendix link in the box to the right of the article online.

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