

These Patients Are Hard to Treat

A study examined a popular approach that coordinated care for the most expensive patients, and found that the project did not reduce hospital admissions.



By **Reed Abelson**

Jan. 8, 2020

In the quest to reduce health care spending in the United States, the idea held incredible promise: By addressing the medical and social needs of the most expensive patients, you could keep them out of the hospital.

These individuals, frequently struggling with addiction or homelessness, have extremely complicated medical conditions. By finding them and connecting them to the right doctors and social services, dozens of costly hospital stays could be avoided. The idea has been adopted in numerous communities around the country.

Dr. Jeffrey Brenner, a family physician in New Jersey, founded the Camden Coalition of Healthcare Providers in 2002. He created teams of nurses, social workers and others to coordinate the care of people he saw cycle in and out of the hospital. Dr. Brenner, who was profiled in a 2011 New Yorker piece, “The Hot Spotters,” and who won a MacArthur Foundation fellowship — known as a “genius” grant — in 2013, became the program’s chief evangelist.

But a new study, published Wednesday in the New England Journal of Medicine, showed that the Camden program did not result in fewer hospital readmissions in the six months after a patient left the hospital. While the program appeared to lower readmissions by nearly 40 percent, the same kind of patients who received regular care saw a nearly identical decline in hospital stays.

“We’re disappointed by the results,” said Kathleen Noonan, the chief executive of the Camden Coalition. Finding effective ways to help these patients, known as super-utilizers, “is very, very hard work,” she said.

Several years ago, the small nonprofit began working with M.I.T.’s J-PAL North American Group to devise a way to test whether the coalition’s efforts were effective. “We could have coasted on the publicity we were getting,” Dr. Brenner said, but he wanted to make sure the intervention was having a real impact.

The surprising lack of results offers a cautionary tale about how difficult it is to improve patients’ care and reduce costs. Few efforts that have taken place undergo rigorous study, allowing proponents of a variety of programs, like wellness and disease management, to claim they benefit patients and save money without evidence. The coalition is advising communities like Memphis to help develop programs that may be more targeted and therefore show improvements.

“If the answers were easy, they would have emerged already,” said Craig Garthwaite, a health economist at the Kellogg School of Management at Northwestern University who was not involved in the study. “There are no simple ways of addressing complex problems.”

The study, which involved 800 patients, compared hospital admissions for patients whose care was coordinated by the Camden Coalition with those whose care was not. These patients had at least two chronic conditions. The study took five years, enrolling its first patients in June 2014.

The researchers conducted a randomized controlled trial. While the patients had fewer hospital stays, the decline in admissions was the result of a phenomenon known as regression to the mean, said Amy Finkelstein, an economist at M.I.T. who led the study. Patients with extremely high medical costs tend to see their expenses naturally decline over time, becoming closer to the average.

Such regression is “the Achilles’ heel of a lot of health research,” said Amitabh Chandra, a health economist at Harvard University, who said most studies were based on observing patients and seeing how they did before and after an intervention. The patient in the hospital will be cured of pneumonia, regardless of what else happened.

“All the observational studies will find huge effects,” he said.

When Dr. Brenner, now an executive with UnitedHealth Group, started the Camden Coalition, the answer seemed more straightforward. Camden was one of the nation's poorest cities, and by identifying those patients who were in and out of the hospital, he saw firsthand how chaotic and disjointed their care was. Many were being prescribed too many medications, and they were often simply too overwhelmed to figure out how to navigate the system.

"We needed to break down the silos and coordinate their care," he said. "We saw improvements."

The concept took off. "Hot spotting has enjoyed tremendous, widespread appeal," said Mary D. Naylor, a professor at the University of Pennsylvania School of Nursing who is leading similar efforts to reduce hospitalizations among Medicare patients. Her program has shown promising results in randomized studies.

In retrospect, assigning a team to coordinate the care of the sickest patients, with no quick access to housing or treatment programs for substance abuse, "made it seem like an impossible task," Dr. Naylor said. Camden's program targets patients with the most serious social and medical challenges. One individual struggled with addiction for decades and was incarcerated for much of his life. When he was released, he would bounce from hospitals to treatment programs. After developing a wide range of medical problems, he was hospitalized for pneumonia when he was brought into the program.

These patients may need help well before they become super-utilizers, Dr. Naylor said, and the program could be more effective if it were able to find patients who were most likely to benefit from the coalition's efforts. "I'm hopeful we learn a lot from this," she said.

Her initiative focused on a narrower set of patients, whose care after hospitalization was overseen by a skilled nurse. She is now trying to get the approach adopted more broadly.

The Camden Coalition underestimated how few resources were available to help the patients it identified, Dr. Brenner said. "Care coordination is necessary but insufficient to fix the health care of these patients," he said. The patients served by the coalition had much greater needs than those of Dr. Naylor's program, he said.

Putting a patient with numerous chronic conditions in touch with a primary care doctor for 15 minutes or finding someone a treatment program while that person was still living on the streets or in a shelter is not enough to make a significant difference, Dr. Brenner said. “We’re coordinating to nowhere, essentially,” he said.

Housing, for example, may play a more important role, he said, pointing to one patient who stopped cycling in and out of the hospital after getting housing. At United, Dr. Brenner is leading an experiment to providing housing to high-cost patients.

The doctors seeing these patients were not always equipped to handle their complicated needs, Ms. Noonan of the Camden Coalition said, adding that the program has also evolved to try to address critical needs like housing. It has also recently teamed up with lawyers to try to prevent patients from getting evicted or losing their benefits.

“The study was launched in the heyday of the A.C.A.,” she said, referring to the Affordable Care Act. “We all sort of hoped that primary care was much more robust.”

“Our primary care offices are doing the best they can, but they are inundated,” Ms. Noonan said.

The study’s researchers offered several possible reasons for the program’s lack of success, including a lack of follow-up home visits or doctor’s appointments or insufficient resources. “We don’t know why from the data,” Dr. Finkelstein said.

The study’s design did not allow them to assess whether some types of patients — older patients, say — did benefit from the program, she said. The coalition is examining whether there might be benefits other than hospital readmissions, like a reduction in emergency room visits.

“We have to keep figuring out what is going to work,” Ms. Noonan said.

It is important not to give up, said Dr. Brenner, who likened these efforts to those of cancer researchers trying to find the right treatment for individuals with a certain genetic makeup. “It took us 50 years to figure out cancer,” he said.



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Disappointing Randomized Controlled Trial Results Show A Way Forward On Complex Care In Camden And Beyond

Kathleen Noonan

JANUARY 9, 2020

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Two years ago, when I joined the Camden Coalition of Healthcare Providers, I met with a client we'd been serving for nearly 18 months. When we first met Sarah, she was in the early days of recovery from heroin addiction, just starting to self-manage her medical conditions. She was living with her infant in a shelter. Following intensive work with the Camden Coalition and our partners, we were able to support Sarah's successful transition to stable housing—and along with it, reliable food, peer support, and behavioral health care.

Today, she's thriving.

Across the country, leaders, clinicians, think tanks, and payers are racing to find better ways to treat people like Sarah. These patients are what many call the "5 percent"—the small portion of the population that accounts for more than half of all health care spending.



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The Camden Coalition has been at the forefront of this work since our founding in 2002. We've made tremendous progress and seen significant impact on many patients' health and well-being. Yet, [new evidence](#) from a recent randomized controlled trial (RCT) shows that there is much more work to be done if we truly want to improve care, reduce costs, and advance overall health.

The Camden Coalition Model

At the Camden Coalition, we identify individuals who return to the hospital again and again, receive care, but never get well. Like Sarah, our patients have multiple chronic conditions exacerbated by and layered atop lifetime burdens of housing instability, food insecurity, low literacy, and social vulnerability. Add to that societal challenges such as poverty, racism, and disinvestment, and these patients are left with few resources to self-advocate and heal.

Our model originated after examining claims data from three local hospitals in the Camden, New Jersey, region—one of the nation's poorest cities. Through our [analysis](#), we discovered that just 1 percent of all patients accounted for 30 percent of the area's health care spending. Indeed, many of the patients we identified had more than 100 visits to the emergency department annually. We suspected that their outlier status as high utilizers would mean that even modest additional intervention could yield measurable return; we wanted to know over what period of time, how sustainable the changes would be, and in what areas could we have the most impact.

Alongside leaders and clinicians from across Camden, we made underserved populations our focus—to increase their use of preventative care and social services and to reduce health care costs. Together, we built a regional health information exchange, linking real-time data from local hospitals, primary care providers, medical providers in the county jail, and federally qualified health centers; drove practice transformation in local primary care offices so Medicaid patients could be seen more quickly upon discharge from the hospital; passed state legislation to create a regional Medicaid accountable care organization model; engaged houses of worship in community-organizing efforts; launched a housing first program for chronically homeless patients; partnered with the criminal justice sector to ensure better continuity of care for people entering and released from jail; and built a National Center for Complex Health and Social Needs to engage stakeholders and identify other promising and evidence-based complex care models from around the country.

A Randomized Control Trial

Nearly five years ago, we welcomed the rigor of an RCT into assessing [our model](#) for managing care for this population. While we'd always incorporated evaluation of our work into the work itself to iterate and improve on our practices, we felt an RCT could add to the growing body of research on effective interventions for the most underserved.

Although there is no doubt our efforts have led to immense transformation in the local community and among the populations we served, the recently released results from our RCT—an undertaking with researchers affiliated with J-PAL North America, a research center based at the Massachusetts Institute of Technology—reveal that the data we were originally tracking didn't bear this out. Even with increased use of services such as Supplemental Nutrition Assistance Program benefits and primary care engagement, patients in the intervention groups were readmitted to the hospital at similar rates to those in the control group.

To be sure, we were disappointed. We're also now motivated by two important lessons from the RCT that have powerful implications for the field of complex care.

First, we learned that all of us focused on health need to widen the aperture on our metrics for success.

While the RCT used the 180-day hospital readmission rates as a proxy for improved health, systems-level interventions cannot be effectively appraised using a single

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quantitative metric. That approach may work well in biomedical research and scientific discovery—but our work is the very human, iterative, and long-term process of building personal relationships and supporting a community as it recreates its ecosystem of care. Telling the full story of an initiative’s impact on people’s lives requires a broad array of both quantitative and qualitative measures—which many health systems are beginning to adopt.

The second lesson: Health services interventions in complex care are only as effective as the resources available in the communities in which those interventions are applied.

Our original hypothesis was that targeted, short-term care management, care coordination, and hospital care transitions would be sufficient to reduce costs. We focused on dismantling silos between care systems as we helped patients meet the goals they’d set for themselves. We met patients at the bedside, accompanied them to their primary care appointments, navigated them to specialty and behavioral health services, and helped them apply for benefits.

While the theoretical approach was sound, the practical realities were challenging. Our teams struggled to find community-based services that could meet the needs of patients with high rates of mental health diagnoses, addiction, homelessness, and incarceration. Most of our patients have lifetimes of trauma in addition to their chronic health conditions, making both physical and emotional healing an essential element of their care—a process that takes years, not months. Improvement in outcomes therefore stalled because primary care, behavioral health, addiction treatment, and housing services weren’t built to provide services to people with such extreme experiences and needs. What’s more, the systems themselves weren’t built for collaboration.

We know that the mechanisms by which patients in the 5 percent drive up health care spending are not limited to health care needs alone. The amount spent on their care is high because of root-cause social needs that influence health. And until we address the issues outside the clinic walls by building capacity and forming coalitions among diverse partners, costs will continue to rise as health outcomes decline.

Going Forward

We’ve learned a lot since 2014, when the RCT began. Chief among the takeaways is that no single intervention or institution can independently provide the spectrum of support required to sustainably, meaningfully improve the likelihood of better health and well-being for the 5 percent. As we seek to augment care in the clinic with services outside the clinic walls—such as stable housing, legal resources, access to primary care, and medication-assisted treatment for substance use disorders, we must continue to bring together all community resources to focus on social determinants of health.

At times, we’ll fall short on the path to progress.

In *Complications: A Surgeon’s Notes on an Imperfect Science*, Atul Gawande notes, “We look for medicine to be an orderly field of knowledge and procedure. But it is not. It is an imperfect science, an enterprise of constantly changing knowledge, uncertain information, fallible individuals, and at the same time lives on the line. There is science in what we do, yes, but...the gap between what we know and what we aim for persists. And this gap complicates everything we do.”

Like medicine itself, the work of caring for our nation’s most vulnerable people is neither simple to do nor easy to measure. Sometimes, we can’t make change. And sometimes, the successes just take longer to observe. But let’s welcome the setbacks, iterations, and partnerships that clear the path for better health for all.

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Debbie Duncan • 6 days ago

Kudos to you for coming forward with what some readily classify as "failure" and illustrate the shortcomings of some approaches of research and evaluation; in this case looking at long-term, complex problems with short term, objective data. Kudos for using the data to identify modifications and shifts in both practice and measurement. The lack of coordination and communication among key players, family and community support, access to education, nutritious food, child care, employment all conspire to failure. Did I forget to mention unreliable availability of critical services, bureaucratic barriers and shifts in policy, systemic discrimination on multiple fronts (age, race, mental health, addiction, incarceration, physical attractiveness, etc.)?

These factors are not isolated problems to be addressed as on a checklist. They require a societal commitment to improve our communities and living conditions for ALL residents; from the grassroots level to heads of state and corporations. Waiting for "them" to take care of it doesn't work well.

And the prevailing attitude of short-term ROI is a killer. Years ago a Camden politician expressed skepticism about HIV prevention education spending. Was the annual \$200K for program "X" really a good use of the money? AIDS can take a decade to become apparent. How can you measure the number of people who do NOT become infected? I responded that if we prevent **just 1 person** from contracting HIV, we have saved an average of \$1.5 M in health care expenses! That 1 person justifies 7 years of funding. Give us credit for 10 people out the thousands exposed to intervention and it is a terrific investment, if you choose to be that crass about it.

We must come out of our silos and recognize that there must be substantive community involvement, communication and mutual support. Blaming, finger-pointing and excuses must end. Can accepting responsibility be fashionable again? .

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Paul J. Nelson → Debbie Duncan • 5 days ago

In reply, I offer an interconnected set of hypothetical definitions for Social Cohesion, Social Capital, Caring Relationships, Social Dilemma, and Social Interaction. It is unlikely that our nation, let alone its healthcare industry, has the means or the will to undertake what is required, at least not today.

SOCIAL COHESION may be defined as a general expectation among the resident person's of a nation's communities that the resident persons within each community are trustworthy and their nation's prevalence of these trustworthy person improves when every community progressively collaborates with their adjacent communities to endow each other's SURVIVAL Commons (augmented safety net) with sufficient Social Capital.

SOCIAL CAPITAL may be defined as the pervasive spontaneity occurring among a community's resident persons to express the norms of trust, cooperation, and reciprocity for resolving the Social Dilemmas they encounter daily within their community's municipal life that becomes sustainable when enduring Caring Relationships permeate the community's Social Networks.

CARING RELATIONSHIPS may be defined as the mutual trust and social interaction...

see more

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SPECIAL ARTICLE

Health Care Hotspotting — A Randomized, Controlled Trial

Amy Finkelstein, Ph.D., Annetta Zhou, Ph.D., Sarah Taubman, Sc.D.,
and Joseph Doyle, Ph.D.

ABSTRACT

BACKGROUND

From the Massachusetts Institute of Technology (A.F., J.D.) and the National Bureau of Economic Research (A.Z., S.T.) — both in Cambridge. Address reprint requests to Dr. Finkelstein at the Department of Economics, Massachusetts Institute of Technology, 50 Memorial Dr., Cambridge, MA 02142, or at afink@mit.edu.

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There is widespread interest in programs aiming to reduce spending and improve health care quality among “superutilizers,” patients with very high use of health care services. The “hotspotting” program created by the Camden Coalition of Healthcare Providers (hereafter, the Coalition) has received national attention as a promising superutilizer intervention and has been expanded to cities around the country. In the months after hospital discharge, a team of nurses, social workers, and community health workers visits enrolled patients to coordinate outpatient care and link them with social services.

METHODS

We randomly assigned 800 hospitalized patients with medically and socially complex conditions, all with at least one additional hospitalization in the preceding 6 months, to the Coalition’s care-transition program or to usual care. The primary outcome was hospital readmission within 180 days after discharge.

RESULTS

The 180-day readmission rate was 62.3% in the intervention group and 61.7% in the control group. The adjusted between-group difference was not significant (0.82 percentage points; 95% confidence interval, -5.97 to 7.61). In contrast, a comparison of the intervention-group admissions during the 6 months before and after enrollment misleadingly suggested a 38-percentage-point decline in admissions related to the intervention because the comparison did not account for the similar decline in the control group.

CONCLUSIONS

In this randomized, controlled trial involving patients with very high use of health care services, readmission rates were not lower among patients randomly assigned to the Coalition’s program than among those who received usual care. (Funded by the National Institute on Aging and others; ClinicalTrials.gov number, NCT02090426; American Economic Association registry number, AEARCTR-0000329.)

HEALTH CARE SPENDING IN THE UNITED States is heavily concentrated, with 5% of the population accounting for 50% of annual spending and 1% accounting for almost a quarter of annual spending.¹ There is therefore substantial interest in interventions that can reduce spending and improve health care quality by targeting “superutilizers” of the health care system. Such programs have received considerable positive attention from the media²⁻⁷ as well as support from the federal government.^{8,9}

Since being profiled in Atul Gawande’s seminal *New Yorker* article, “The Hot Spotters,”¹⁰ the program created by the Camden Coalition of Healthcare Providers (hereafter, the Coalition) has been a flagship example of a promising superutilizer program. The Coalition’s Camden Core Model uses real-time data on hospital admissions to identify patients who are superutilizers, an approach referred to as “hotspotting.” Focusing on patients with chronic conditions and complex needs, and starting with the premise that navigation of the standard system is difficult for these patients, the program uses an intensive, face-to-face care model to engage patients and connect them with appropriate medical care, government benefits, and community services, with the aim of improving their health and reducing unnecessary health care utilization.

The program has been heralded as a promising, data-driven, relationship-based, intensive care management program for superutilizers, and federal funding has expanded versions of the model for use in cities other than Camden, New Jersey.⁷⁻¹⁶ To date, however, the only evidence of its effect is an analysis of the health care spending of 36 patients before and after the intervention¹⁷ and an evaluation of four expansion sites in which propensity-score matching was used to compare the outcomes for 149 program patients with outcomes for controls.¹⁸ More broadly, there are a number of promising observational studies of other superutilizer programs.^{12,17,19-21} However, regression to the mean — the tendency for patients selected for the exceptionally high cost of their care at a moment in time to move closer to average cost over time — may bias observational studies of superutilizer programs toward spurious results.^{22,23}

Although there is limited rigorous evidence of the effectiveness of superutilizer programs, several randomized trials of care-transition programs —

which, like the Camden Core Model, start with patients in the hospital and work with them after discharge — have shown substantially reduced readmissions.²⁴⁻²⁹ However, the Camden Core Model targets a much more heterogeneous population with greater social and medical complexity and substantially higher health care utilization. Therefore, the Coalition partnered with investigators to design a prospective, randomized evaluation of this nationally recognized program.

METHODS

TRIAL DESIGN

This investigator-initiated, randomized, controlled trial was approved by institutional review boards at Cooper University Hospital, the National Bureau of Economic Research, Kennedy Health, and Our Lady of Lourdes Medical Center. The trial protocol, available with the full text of this article at NEJM.org, and planned analyses were publicly prespecified in March 2014 in consultation with Dr. Jeffrey Brenner, then director of the Coalition. Minor departures from the plan developed before analysis are described in the Supplementary Appendix, available at NEJM.org. The Coalition staff implemented the protocol and administered the intervention for patients in the treatment group but were unaware of the results until the trial was completed.

PROGRAM

Eligibility

The Camden Core Model is a care-transition program designed to improve patient health and reduce hospital use among some of the least healthy and most vulnerable adults in the United States. Eligibility for trial participation was limited to adults 18 to 80 years of age living in Camden, New Jersey, which is one of the most economically depressed cities in the country and has a high rate of violent crime¹⁰; in 2017, 37% of Camden residents lived below the poverty line as compared with 15% of persons in the United States overall.³⁰

The intervention targeted superutilizers of the health care system — persons with medically and socially complex needs who have frequent hospital admissions. The inclusion criteria were at least one hospital admission at any of four Camden-area hospital systems in the 6 months before the index admission, when patients were enrolled; at least two chronic conditions; and at least two of

the following traits or conditions: use of at least five active outpatient medications, difficulty accessing services, lack of social support, a coexisting mental health condition, an active drug habit, and homelessness. Patients were excluded if they were uninsured, had cognitive impairment, or were receiving oncologic care or had been admitted for a surgical procedure for an acute health problem, for mental health care (with no coexisting physical health conditions), or for complications of a progressive chronic disease for which limited treatments were available. The eligible population composed less than 0.5% of the Camden population but accounted for 11% of the city's hospital expenditures (see the Supplementary Appendix).

Intervention

The time-limited intervention had intensive clinical and social components. Patients were enrolled while in the hospital. Once they returned home, patients worked with a multidisciplinary team that included registered nurses, social workers, licensed practical nurses, community health workers, and health coaches. The team conducted home visits, scheduled and accompanied patients to initial primary and specialty care visits, coordinated follow-up care and medication management, measured blood pressure and blood sugar levels, coached patients in disease-specific self-care, and helped patients apply for social services and appropriate behavioral health programs. The intervention contained many characteristics considered important for successful care-transition programs for high-cost, high-need patients.^{31,32} The Supplementary Appendix includes more details on the intervention.

The control group received usual postdischarge care, which may have included home health care services or other forms of outreach. We were unable to measure the postdischarge services received by the control group.

RECRUITMENT AND RANDOMIZATION

Recruitment took place at Cooper University Hospital and Our Lady of Lourdes Hospital. Using the Camden Coalition Health Information Exchange database — which provided daily updates from hospital electronic medical records at these hospitals and the Virtua Health System and the Kennedy Health System (as of July 2014) — staff selected potentially eligible patients, who formed

the triaged population. A Coalition recruiter approached these patients in the hospital, confirmed their eligibility, obtained written informed consent, and conducted a baseline survey. The recruiter then used a tamper-proof and externally recorded randomization process to assign treatment or control status and informed the patient of the assignment. All patients who completed the baseline survey were compensated with \$20 for their time. Details regarding recruitment and randomization are available in the Supplementary Appendix.

The trial population was enrolled from June 2, 2014, through September 13, 2017. Of the 1520 patients triaged, recruiters deemed 1442 eligible for participation; 809 patients consented, and half were randomly assigned to treatment. Subsequently, 5 of the 809 patients were excluded at their request; the last 4 patients enrolled were excluded in order to reach the target trial population of 800 (Fig. 1).

DATA SOURCES

The primary data were hospital discharge data collected through March 31, 2018, from the four Camden hospital systems; these accounted for 98% of New Jersey hospital discharges of Camden residents (see the Supplementary Appendix). The discharge data contained admission and discharge dates, diagnoses, discharge destination, charges and payments received, and patients' identifying information.

We supplemented these data with data from several other sources. The Camden Coalition Health Information Exchange database contained additional demographic information and a record of the patient's index admission (where recruitment occurred). We matched 782 of the patients (98%) in the trial to the discharge record for their index admission; match rates were balanced between the treatment group (98.5%) and the control group (97.0%). The baseline survey provided additional socioeconomic information on patients. The Coalition recorded staff contacts with patients in the treatment group. Administrative data from the state of New Jersey provided information on social services received by trial participants (specifically, the Supplemental Nutrition Assistance Program, Temporary Assistance for Needy Families, and General Assistance), and the National Death Index provided mortality data. (See the Supplementary Appendix for additional details.)

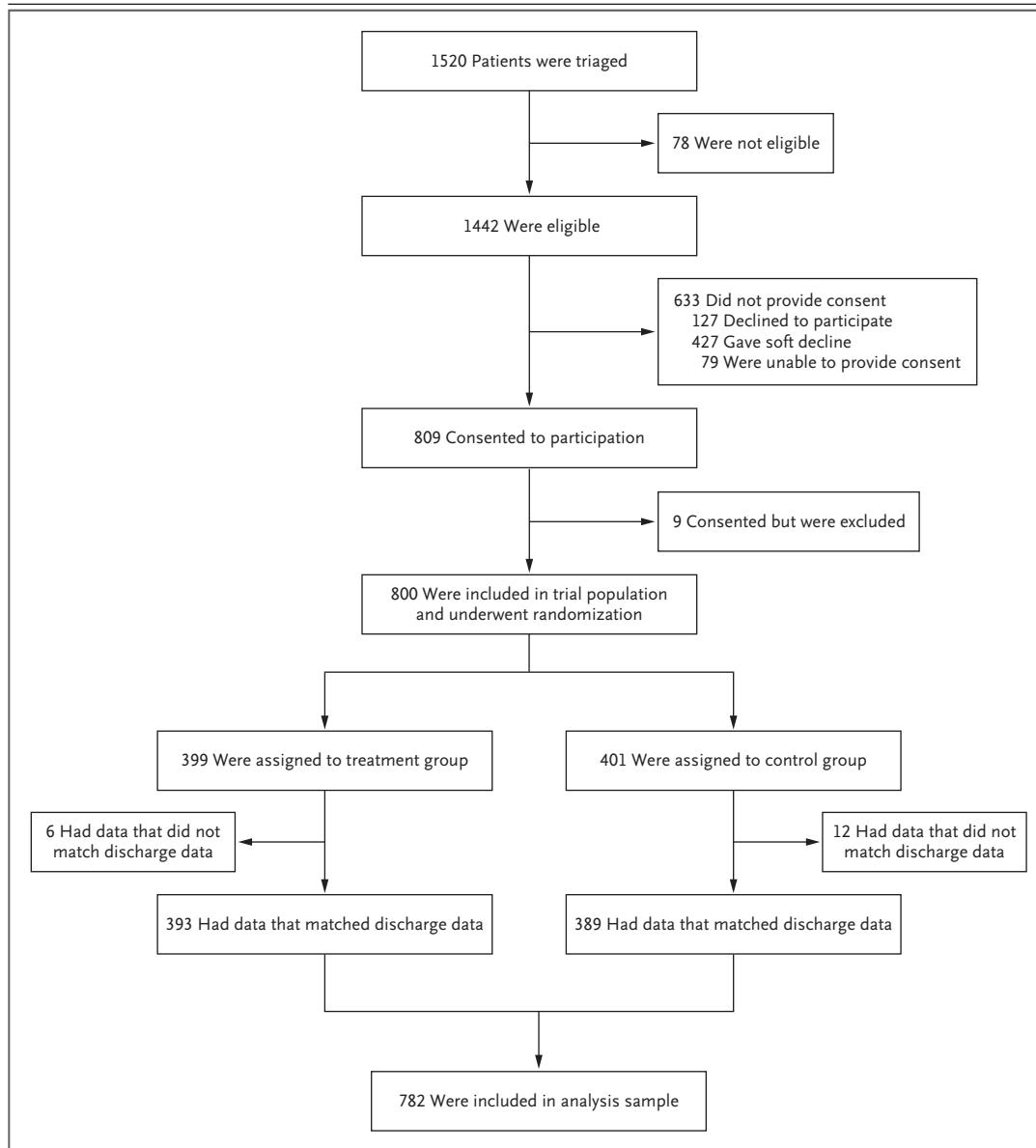


Figure 1. Screening, Randomization, and Analysis.

Data are from the Camden Coalition Health Information Exchange. Patients who declined to participate explicitly said “no” to the offer of randomization. Patients who gave a soft decline did not provide consent when approached but did not decline to participate and could be approached again during future hospitalizations if they were otherwise eligible. Patients who were unable to provide consent were either discharged or died before they could be reached or were unable to consent for reasons such as being asleep. Patients who consented but were excluded included 5 patients who consented and later asked to be removed from the trial and the last 4 patients enrolled in the trial who were excluded to keep the trial population at the target of 800 patients. For patients in the trial population to be included in the analysis sample, a record of their index admission had to have been found in the hospital discharge data. Further information is provided in the Supplementary Appendix.

OUTCOMES

The primary outcome was readmission within 180 days after hospital discharge. Secondary outcomes were the number of readmissions, the pro-

portion of patients with two or more readmissions, hospital days, charges, payments received, and mortality — all measured 180 days after discharge — as well as readmission rates at shorter

Table 1. Characteristics of the Patients at Baseline.*

Characteristic	Overall (N=782)	Treatment (N=393)	Control (N=389)
Age at index admission (%)			
≤44 yr	17.1	16.0	18.3
45–64 yr	55.4	55.0	55.8
≥65 yr	27.5	29.0	26.0
Race or ethnic group (%)			
Non-Hispanic black	54.9	57.8	51.9
Hispanic	29.5	26.7	32.4
Non-Hispanic white	15.1	14.8	15.4
Asian, multiracial, or other	0.5	0.8	0.3
Inpatient admissions before index admission (no.)			
0–6 mo before	1.75	1.72	1.78
7–12 mo before	0.74	0.74	0.75
Primary payer (%)			
Medicaid	44.6	43.0	46.3
Medicare	48.2	47.6	48.8
Other	7.0	9.2	4.9
Employment status (%)			
Currently employed	5.5	4.8	6.2
Not employed	94.0	94.9	93.1
No response	0.5	0.3	0.8
Mental health diagnoses at index admission (%)			
Depression	30.2	32.3	28.0
Substance abuse	44.0	41.2	46.8

* Data on age, number of admissions before the index admission, primary payer, and mental health diagnoses were obtained from hospital discharge data, and data on race, ethnic origin, and employment status were obtained from a survey conducted at baseline. The analysis sample (782 patients) excluded 18 patients with missing outcome data because they could not be matched to the discharge record for their index admission. Percentages may not sum to 100 because of rounding.

and longer time horizons. We also analyzed the primary outcome according to prespecified subgroups. With the exception of receipt of social services and mortality, all outcomes were based on hospital discharge data.

STATISTICAL ANALYSIS

We used linear regressions to compare outcomes for patients in the treatment and control groups. To increase precision, we included prespecified covariates for age (with patients grouped in 5-year increments), sex, indicators for non-Hispanic black

and Hispanic origin, and measures of health care utilization less than 6 months and 7 to 12 months before the index admission. We also report differences in means for patients in the treatment and control groups without adjustment for covariates. We conducted a sensitivity analysis with the use of multiple imputation to account for missing outcome data for 18 patients who could not be matched to the discharge record for their index admission.³³

Initially, we determined that a population of 800 would provide 80% power to detect a decrease of 9 percentage points in the 180-day readmission rate (at a two-sided significance level of 0.05). Subsequently, data from the actual study population — whose readmission rate was twice what we had assumed — indicated power to detect a decline of 9.6 percentage points in the primary outcome (see the Supplementary Appendix). There was no prespecified plan to adjust for multiple comparisons; therefore, we report P values only for the primary outcome and report 95% confidence intervals without P values for all secondary outcomes. The confidence intervals have not been adjusted for multiple comparisons, and inferences drawn from them may not be reproducible.

RESULTS

TRIAL POPULATION

The trial population averaged 1.8 hospital admissions in the 6 months before the index admission (Table 1) as compared with less than 0.1 admissions in the general adult Camden population (see the Supplementary Appendix). The trial population was 50% male; 40% were younger than 55 years of age and 30% were older than 65 years of age; 55% were non-Hispanic black, 30% were Hispanic, and 15% were non-Hispanic white. Our prespecified covariates were balanced between the treatment and control groups (Table S2).

Tables S1 and S2 in the Supplementary Appendix show that three quarters of the trial population were unmarried, one half did not have a high school diploma, and three fifths reported needing help with mobility. Nearly the entire population (95%) was not employed, and 40% received a diagnosis of substance abuse during the index admission. Medicare was the primary payer for 48% of the trial population, and Medicaid was the primary payer for 45% of the population.

PROGRAM IMPLEMENTATION

Table 2 shows measures of program implementation. Among patients in the treatment group, 95% had at least three encounters with program staff after enrollment; on average, a patient received 7.6 home visits and 8.8 telephone calls from staff and was accompanied on 2.5 physician visits, and 90% worked with the Coalition for more than 30 days. The median duration of program participation was 92 days. The Coalition set ambitious goals for connecting patients to care quickly after discharge.³⁴ These goals included a home visit from program staff within 5 days after a patient's arrival at home and a provider visit within 7 days after arrival at home; the first goal was met for 60% of patients, the second goal was met for 36% of patients, and both goals were met for 28% of patients. Three quarters of the patients received both a home visit within 14 days and a provider visit within 60 days.

Receipt of government benefits during the 6 months after discharge was the one metric of program implementation observed in both the treatment and control groups (Table 3). Rates of participation in both Temporary Assistance for Needy Families and General Assistance were low and did not significantly change with the intervention; the adjusted difference in participation in the Supplemental Nutrition Assistance Program associated with the intervention was 4.6 percentage points (95% confidence interval [CI], 0.5 to 8.6).

EFFECTS OF THE INTERVENTION

Table 4 shows the effects of the intervention. The 180-day readmission rate was 62.3% in the treatment group and 61.7% in the control group. The intervention had no significant effect on this primary outcome: the adjusted difference in the probability of readmission was 0.82 percentage points higher in the treatment group than in the control group (95% CI, -5.97 to 7.61; $P=0.81$). This finding is robust to the use of multiple imputation to account for missing data (adjusted difference, 0.64 percentage points; 95% CI, -6.12 to 7.40) (see Table S6 for details). The intervention also had no effect on any of the secondary outcomes or within any of the prespecified subgroups (Table 4).

Results for the primary outcome were not sensitive to alternative specifications or measurement over alternative horizons. The intervention had no significant effects when the hazard rate

Table 2. Program Metrics in the Treatment Group.*

Metric	Values
Encounters	
Home visits — mean no. (median)	7.6 (5)
At least one — %	88.8
At least three — %	70.7
Telephone calls — mean no. (median)	8.8 (5)
At least one — %	88.0
At least three — %	65.4
Primary care provider and specialist visits — mean no. (median)	2.5 (2)
At least one — %	84.7
At least three — %	29.5
Other types of visits — mean no. (median)	5.7 (1)
At least one — %	65.1
At least three — %	36.1
Total no. of encounters — mean no. (median)	28.1 (17)
At least one — %	98.7
At least three — %	95.2
Length of intervention, measured from discharge home — %	
>30 days	89.8
>90 days	50.5
>180 days	17.0
Median — days	91.5
Timing of service provided, measured from day of discharge home — %	
Camden Coalition home visit	
Within 5 days	58.6
Within 14 days	83.0
Office visit with PCP or specialist	
Within 7 days	36.0
Within 14 days	60.2
Within 60 days	83.3
Both home visit within 5 days and office visit with PCP or specialist within 7 days	28.0
Both home visit within 14 days and office visit with PCP or specialist within 60 days	76.1

* Data on program metrics are from the records of the Camden Coalition of Health Care Providers and the 393 patients in the treatment group. Data on timing of services are missing for 4 patients, and data on length of intervention are missing for 11 patients.

of readmission (with either a Cox proportional-hazards model or a competing-risks model accounting for mortality), 180-day mortality, or post hoc subgroups were analyzed; results differed slightly according to hospital of index admission,

Table 3. Benefit Participation during 6 Months after Enrollment.*

Metric	Control Group (N = 389)	Treatment Group (N = 393)	Unadjusted Difference (95% CI)	Adjusted Difference (95% CI)
	<i>percent</i>			
Participation in supplemental nutrition assistance program	50.13	58.52	8.4 (1.43 to 15.36)	4.59 (0.52 to 8.65)
Receipt of temporary assistance for needy families	1.03	1.78	0.75 (−0.9 to 2.4)	0.69 (−0.34 to 1.71)
Receipt of general assistance	6.94	6.87	−0.07 (−3.63 to 3.49)	0.68 (−1.82 to 3.18)

* Data on benefit participation are from the New Jersey Department of Human Services and consist of the analysis sample (782 patients). Shown are the mean values for each outcome in the control group and the treatment group. Calculation of the unadjusted between-group difference was based on an indicator for the treatment group from an ordinary least-squares regression of the outcome, with no other covariates. Calculation of the adjusted between-group difference was based on an indicator for the treatment group from an ordinary least-squares regression of the outcome with pre-specified covariates. All confidence intervals (CIs) were calculated with the use of heteroskedasticity-robust standard errors. Prespecified covariates included the dependent variable 0 to 6 months before the index admission, the dependent variable 7 to 12 months before the index admission, and indicators for age (grouped in 5-year increments), male sex, black non-Hispanic origin, and Hispanic origin. Measurement of covariates was based on hospital discharge data except for the characteristic of race or ethnic origin, which was reported from data in the baseline survey.

but the estimates were quite imprecise (Tables S6 and S8 and Fig. S5).

BEFORE AND AFTER ANALYSIS OF THE INTERVENTION GROUP

In contrast with the results of the randomized, controlled trial, a comparison of admission rates for the intervention group alone in the 6 months before and after enrollment misleadingly suggested a substantial decline in admissions in response to the intervention because it did not account for the similar decline in the control group. Figure 2 shows the average number of admissions per quarter before and after the index admission. In both the intervention and control groups, admissions rose sharply in the 6 months before the intervention and fell rapidly afterward.

In addition, estimates of the change in hospital admissions before and after the intervention that were based only on the intervention group were very sensitive to the definition of the period before the intervention. There was a 38-percentage-point decrease in the probability of a hospital admission during the 6 months after the intervention as compared with the 6 months preceding the intervention, but there was a 29-percentage-point increase in the probability of a hospital admission in the 6-month period after the intervention as compared with the 12-to-18-month period that preceded the intervention (Table S5).

DISCUSSION

In this randomized evaluation involving 800 trial participants, the Camden Core Model had no significant effect on participants' 180-day readmission rate. The 95% confidence intervals rule out a decrease in readmission rates of more than 6 percentage points as compared with a control mean of 62%; this finding rules out the reductions in readmissions of 15 to 45% in the Medicare population reported in randomized evaluations of other care-transition programs.²⁴⁻²⁹ The Camden model targets a different population: one that was younger, with more diverse medical needs, greater social complexity, and much higher health care utilization; previous hospital use was nearly twice that in most previous successful programs involving care transition.

Our results suggest that there are challenges for superutilizer programs aimed at medically and socially complex populations. They are consistent with the mixed results on hospital admissions from randomized evaluations of care-management programs for chronically ill populations, although those programs, unlike the Camden model, did not focus on the postdischarge transition.^{35,36,37} It is possible that approaches to care management that are designed to connect patients with existing resources are insufficient for these complex cases. The Coalition has continually worked to adapt the model to the needs of

Table 4. Effects of Intervention in the Treatment Group, 180 Days after Discharge.*

Effect	No. of Patients	Control Group	Treatment Group	Unadjusted Between-Group Difference (95% CI)	Adjusted Between-Group Difference (95% CI)
<i>mean</i>					
Readmission in total sample					
Any (%)		61.70	62.34	0.64 (−6.17 to 7.46)	0.82 (−5.97 to 7.61)
No. of readmissions		1.54	1.52	−0.02 (−0.29 to 0.26)	0.01 (−0.25 to 0.27)
≥2 readmissions (%)		36.25	36.39	0.14 (−6.61 to 6.89)	0.27 (−6.22 to 6.77)
Days in hospital		9.95	9.36	−0.59 (−2.49 to 1.31)	−0.32 (−2.17 to 1.53)
Hospital charges (\$)		114,768	116,422	1,654 (−25,523 to 28,831)	3,722 (−23,438 to 30,882)
Hospital payments received (\$)		17,650	18,130	480 (−3,613 to 4,573)	680 (−3,415 to 4,775)
Any readmission according to subgroup (%)					
No. of admissions in previous yr					
2	336	52.12	52.63	0.51 (−10.2 to 11.22)	0.78 (−10.35 to 11.91)
≥3	446	68.75	69.82	1.07 (−7.51 to 9.65)	1.27 (−7.38 to 9.92)
Preferred language					
English	638	63.11	62.61	−0.49 (−8.01 to 7.02)	0.1 (−7.42 to 7.61)
Other	144	56.25	60.94	4.69 (−11.58 to 20.96)	8.49 (−9.08 to 26.06)

* Data consist of the analysis sample (a total of 782 patients), and outcomes are measured with the use of hospital discharge data. For the unadjusted difference, the coefficient and 95% confidence interval are shown on the basis of an indicator for treatment group from an ordinary least-squares regression of the outcome, with no other covariates. For the adjusted difference, the coefficient and the 95% confidence interval are shown on the basis of an indicator for treatment group from an ordinary least-squares regression of the outcome, with prespecified covariates. All confidence intervals were calculated with the use of heteroskedasticity-robust standard errors. Prespecified covariates include the number of admissions less than 6 months before the index admission, the number of admissions 7 through 12 months before the index admission, and indicators for age (grouped in 5-year increments), male sex, black non-Hispanic origin, and Hispanic origin. With the exception of race and ethnic origin, for which data was obtained from the baseline survey, covariates were measured on the basis of hospital discharge data. For three of the outcomes (days in hospital, hospital charges, and hospital payments received), the number of admissions from 0 to 6 months before the index admission and from 7 to 12 months before the index admission were replaced with the values of the dependent variable over those two time periods. The P value for the primary outcome (any readmission) for the adjusted difference was 0.81.

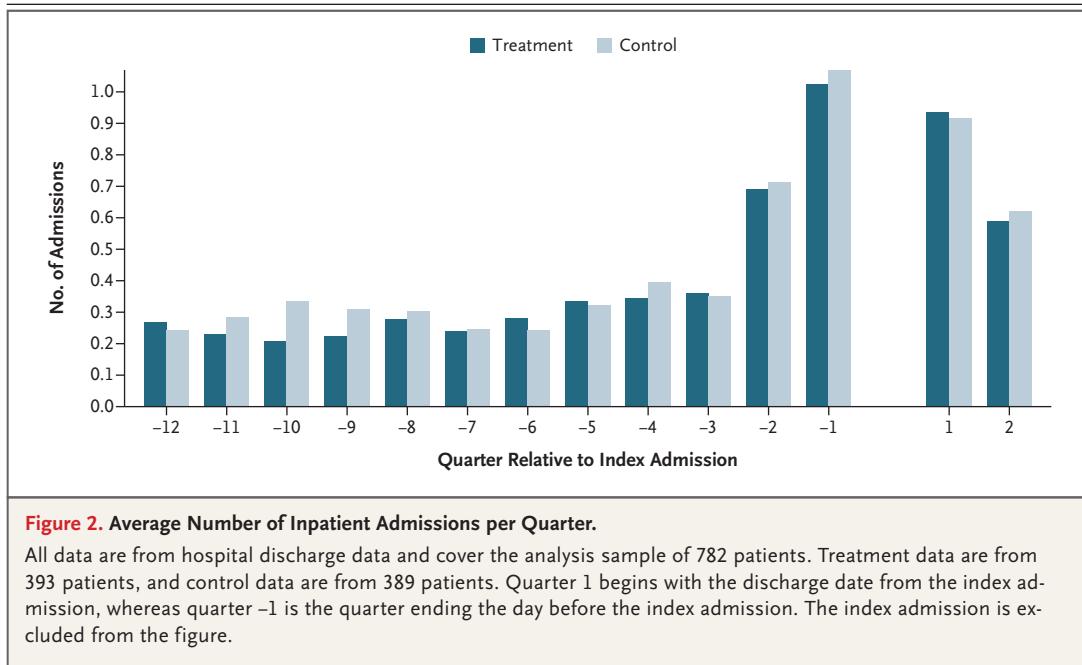
its patient population, and both the Coalition and others are exploring models that involve more complete redesigns of care provision.^{6,38} (See also Comprehensive Care Physician: Integrated Inpatient and Outpatient Care for Patients at High Risk of Hospitalization [ClinicalTrials.gov number, NCT01929005].)

Engagement with the program was high (95% of patients had at least three encounters with program staff), and patients received an intensive intervention (averaging 7.6 home visits), but two program goals related to the timing of services — a home visit within 5 days after hospital discharge and a visit to a provider's office within 7 days after discharge — were achieved less than 30% of the time. Challenges in reaching these goals included patients' lack of stable housing or

a telephone and their behavioral health complexities and providers' few available appointments. The difficulties that this pioneering, data-driven organization had in achieving rapid assistance for patients may portend difficulties in achieving it at scale.

Our findings may also reflect fundamental challenges with the strategy of targeting super-utilizers: many patients whose medical costs are high today will not be as high in the future — and this trend becomes even more pronounced as one goes higher in the cost distribution.^{22,39,40} Moreover, for patients with medical costs that are persistently high, few of those costs may be related to potentially preventable hospitalizations.³⁹⁻⁴¹

Such regression to the mean also underscores the importance of rigorous evaluation through



randomized trials, since observational evaluations of superutilizer programs will be prone to the detection of spurious effects.^{18,22,23} This danger was illustrated in our program by the similar reduction in readmissions in both the treatment and control groups.

Our trial has several limitations. It was powered to detect whether this care-transition program could achieve reductions in readmissions as compared with similar programs focused on patients with less complex health care needs. However, the trial was not powered to detect smaller reductions that could be clinically meaningful, nor was it powered to analyze effects within specific subgroups, where there could be differential effects. The data did not permit evaluation of potential nontangible benefits such as improved relationships with providers.⁴² Nor did the data allow comparison of outpatient care for the treatment and control groups. Usual care in Camden was evolving during the trial period, multiple other care-management programs were starting,⁴³⁻⁴⁶ and the Coalition was leading a city-wide campaign to connect patients with primary care within 7 days after hospital discharge.⁴⁷

Despite these limitations, the trial provides rigorous evidence of the effect of a nationally recognized program aimed at superutilizers of the health care system that has been expanded to

other cities. The results suggest both the challenges of reducing readmissions in a medically and socially complex superutilizer population and the importance of conducting randomized evaluation of interventions such as this one, which, because they target high-cost patients, are likely to show substantial regression to the mean in observational studies.

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