RUTGERS

Center for State Health Policy

A Unit of the Institute for Health, Health Care Policy and Aging Research

A Final Evaluation of the New Jersey Delivery System Reform Incentive Payment (DSRIP) Program: Assessing Program Impact on Outcomes and Cost-Effectiveness

Sujoy Chakravarty, Ph.D.
Kristen Lloyd, M.P.H.
Laura Pizzi, Ph.D.
John S. Palatucci, M.P.A.
Katherine Prioli, M.S.
Jennifer Farnham, M.S.
Jose Nova, M.S.
Feng-Yi Liu, M.A.
Mojdeh Nasiri, M.D., Ph.D.

December 2021

Author Affiliations

Rutgers Center for State Health Policy
Sujoy Chakravarty, Ph.D., Associate Research Professor & Health Economist
Kristen Lloyd, M.P.H., Senior Research Scientist
John S. Palatucci, M.P.A., Graduate Research Assistant
Jennifer Farnham, M.S., Senior Research Analyst
Jose Nova, M.S., Assistant Director of Data Management
Feng-Yi Liu, M.A., Data Analyst
Mojdeh Nasiri, M.D., Ph.D., Research Analyst

Center for Health Outcomes, Policy, and Economics (HOPE), Ernest Mario School of Pharmacy, and the School of Public Health at Rutgers University
Laura Pizzi, Pharm.D., M.P.H., Director, Health Outcomes, Policy, and Economics (HOPE) Program and Professor, Ernest Mario School of Pharmacy
Katherine M. Prioli, M.S., Senior Research Analyst

Table of Contents

List of Tables and Figures

Acknowledgments

Prepared for the New Jersey Department of Human Services (DHS). All opinions expressed in this report are those of the authors and do not necessarily represent the view of the New Jersey DHS.

We would like to thank the New Jersey DHS for funding the evaluation of the Comprehensive Waiver Demonstration. We also gratefully acknowledge representatives from the New Jersey Division of Medical Assistance and Health Services, the New Jersey Department of Health (DOH), Myers & Stauffer LC, and the Public Consulting Group (PCG) for their assistance in providing data and necessary contextual information for the preparation of this report. Finally, we would like to thank our CSHP colleagues Manisha Agrawal, Margaret Koller and Joel C. Cantor for their help with this project.

A Final Evaluation of the New Jersey Delivery System Reform Incentive Payment (DSRIP) Program: Assessing Program Impact on Outcomes and Cost-Effectiveness

Sujoy Chakravarty, Ph.D., Kristen Lloyd, M.P.H., Laura Pizzi, Ph.D., John S. Palatucci, M.P.A., Katherine Prioli, M.S., Jennifer Farnham, M.S., Jose Nova, M.S., Feng-Yi Liu, M.A, and Mojdeh Nasiri, M.D., Ph.D.

Executive Summary

The Delivery System Reform Incentive Payment (DSRIP) Program was approved as part of the New Jersey Medicaid Comprehensive Waiver Demonstration in October 2012. The hospital-based DSRIP program uses resources transitioned from the previously existing Hospital Relief Subsidy Fund to establish a pay-for-performance and pay-for-reporting system to achieve specific health improvement goals for the state's low-income population.

The Rutgers Center for State Health Policy (CSHP) was engaged to evaluate the effectiveness of New Jersey's DSRIP program in achieving its goals. We formulated specific testable hypotheses to examine the following five research questions from the DSRIP Planning Protocol (detailed in the Waiver Special Terms and Conditions document) that determine the scope of the evaluation:

1. To what extent does the DSRIP program achieve better care?
2. To what extent does the DSRIP program achieve better health?
3. To what extent does the DSRIP program lower costs?
4. To what extent did stakeholders report improvement in consumer care and population health?
5. How do key stakeholders perceive the strengths and weaknesses of the DSRIP program?

This report, the DSRIP final evaluation, presents quantitative assessments of the impact of DSRIP program activities on a number of health care quality metrics for the Medicaid and uninsured populations. It also presents a cost-effectiveness analysis of the DSRIP program considering implementation costs to the State. Altogether, it addresses research questions 1-3 and supplements our final report on stakeholder interviews from September 2020 which examines evaluation questions 4 and 5. This is the third and final round of evaluation of the DSRIP program, and this report covers all implementation years of the program through its end in June 2020.

Chapter 1

Chapter 1 examines the impact of the DSRIP program on patient care, patient health, and costs of care through quantitative analysis of quality metrics calculated from Medicaid fee-for-service claims and managed care encounter data and HCUP inpatient and emergency department all-payer databases. The latter captures utilization for the uninsured population. Multiple metrics were used to test the evaluation hypotheses aligned with research questions 1 through 3 that were the focus of this chapter. We compared changes in outcomes from a baseline period of 2011–2013 to two DSRIP implementation periods: the first, under the initial Demonstration (January 2014-June 2017), and the second, the DSRIP extension period under the Demonstration renewal (July 2017-June 2020). Due to limited years in HCUP data, analyses pertaining to the uninsured examined a single, combined DSRIP implementation period spanning 2014-2018. These changes in outcomes are compared between DSRIP-participating hospitals (or areas with such hospitals) and appropriate comparison groups.

In general, there is strong evidence that DSRIP hospitals' asthma management projects have improved asthma outcomes for the Medicaid and uninsured population. Other disease focus area studies reveal minimal impact at the population level. We find indications of a decline in the quality of ambulatory care when examining the impact of the *overall* DSRIP program. Finally, there appears to be some progress towards the reduction of racial/ethnic disparities as a result of DSRIP-participating hospitals' activities.

More detailed findings relevant to each hypothesis were as follows:

Hypothesis 1: DSRIP hospital projects improve care and outcomes related to the project focus area.

- There were several positive impacts of individual DSRIP programs, including improvements reflected in statistically significant decreases in rates of avoidable asthma hospitalizations for Medicaid adults attributable to the DSRIP asthma disease management program. Study of the asthma disease management program demonstrated one of the strongest positive impacts on outcomes at the population-level. Similarly, ED visits for asthma for Medicaid beneficiaries of all ages also showed statistically significant decreases, but the magnitude of these changes were very small. There were also declines in avoidable asthma hospitalizations for the uninsured youth, but these effects were too small to be deemed meaningful. Initiation in alcohol or other drug treatment in regions served by hospitals adopting chemical addiction/substance abuse programs had effect estimates indicating improvements and while this was statistically significant for youth ages 13-17, the effect size was very small. There were also mixed results and non-significant effects for engagement in alcohol or other drug treatment. Outcomes for

assessing the impact of diabetes projects showed mixed results of small magnitudes in the Medicaid population. Therefore, even though diabetic eye exam rates had statistically significant declines attributable to DSRIP diabetes management projects, the effect size was too small to be considered meaningful. Avoidable hospitalizations for short-term diabetes complications showed small, but not statistically significant, improvements in the uninsured population served by hospitals participating in DSRIP diabetes projects. Readmissions following AMI hospitalizations increased for Medicaid beneficiaries in hospitals undertaking cardiac care DSRIP projects. This increase was statistically significant and of a meaningful magnitude, but significant results from falsification models for cardiac care DSRIP projects indicate this association could be driven by factors unrelated to the effect of the program. Pneumonia readmission rates worsened at the hospital conducting a pneumonia DSRIP project compared to hospitals with DSRIP projects in other focus areas during the 2014-2017 DSRIP implementation period but then improved by a commensurate amount over 2018-2020. Quality indicators for other chronic diseases showed no significant changes attributable to DSRIP activities.

Hypothesis 2: The DSRIP program improves the quality of ambulatory care, both recommended and preventive, with positive effects on population health.

- We did not detect positive impacts of the DSRIP program on the quality of ambulatory care for the Medicaid population overall. We found statistically significant decreases in the rate of well-child visits in the 3rd – 6th year of life for children living in areas served by DSRIP participating hospitals, and this finding was of a meaningful magnitude and robust to falsification tests. We also found that as a geographic area's exposure to DSRIP-participating hospitals increased, rates of avoidable inpatient hospitalizations and avoidable ED visits worsened (increased in magnitude) for all ages; while these results were statistically significant for adults, the effect size was below our threshold for being considered meaningful. Costs associated with these avoidable ED visits increased accordingly and this negative impact was also statistically significant, but again very small. Results for readmission rates were mixed and none were statistically significant.
- In contrast to the Medicaid-enrolled population, among the uninsured population, *we found improvements in avoidable inpatient hospitalization rates in geographic areas with greater exposure to DSRIP-participating hospitals compared to areas with less exposure*. This finding was small but of a meaningful magnitude and statistical significance. Rates of avoidable ED visits also showed statistically significant improvements among the uninsured population.
- It is important to acknowledge that the estimates of overall program impacts may have been susceptible to unobserved factors due to the small number of non-participating comparison hospitals. However, this potential limitation is mitigated by fixed effects

estimation and, additionally, by the dose-response framework of models for all population-level metrics that utilize a continuous measure of exposure to assess program effects.

Hypothesis 3: The DSRIP program will reduce racial/ethnic and gender disparities in avoidable hospital admissions, treat-and-release ED visits, and hospital readmissions.

- Changes in racial/ethnic disparities in 30-day readmissions or avoidable hospital use among Medicaid beneficiaries that could be attributed to DSRIP showed a mix of positive and negative results, and most effects were either not statistically significant or based on small sample sizes which limit their reliability. The two statistically significant results ($p<0.05$) with sufficient sample indicate *improvements* in disparities. There was a statistically significant reduction in disparities for heart failure readmissions among minorities of 'other' racial/ethnic groups compared to whites that could be attributable to DSRIP activities. For this same population group, there was also a statistically significant *reduction* in disparities in avoidable inpatient admissions in regions served by DSRIP-participating hospitals. DSRIP impacts on gender disparities were also mixed and not statistically significant.

Chapter 2

Chapter 2 describes the results of our cost-effectiveness analysis (CEA) of the DSRIP program relative to a comparator population (Analysis 1), a CMS-required evaluation component, and examined per beneficiary spending offsets within the DSRIP target population (Analysis 2). We assess the program's effectiveness in reducing healthcare spending and avoidable hospital use in geographic areas with high program exposure relative to areas with low or zero program exposure. Specifically, program effectiveness was measured by assessing the changes in healthcare spending and numbers of avoidable hospitalizations and avoidable ED visits for NJ Medicaid beneficiaries within New Jersey ZIP codes having greater than 75% DSRIP exposure ("DSRIP target population"), as compared to NJ ZIP codes having less than 25% exposure ("comparator population"). Since a large majority of the hospitals took part in the DSRIP program, the comparator population was very small relative to the target population (20,000-30,000 individuals per year over the period, compared with 1.4 to 1.9 million per year), and differed in some demographic and clinical characteristics.

An important component of the CEA is program implementation cost. We measured this by using aggregate labor and outside vendor cost data provided to us by the NJ DOH and DSRIP implementation contractor. The total estimated cost to the state of implementing the DSRIP program was $11,878,845, corresponding to a cost of $3.94 per beneficiary in the DSRIP target

population during the measurement period. There were also costs to hospitals to implement the program, but these were not measured, and this analysis only considers costs to the state.

In terms of cost-effectiveness, our findings calculate for each outcome, the numerator and denominator components of the Incremental Cost-Effectiveness Ratio in a difference-in-differences (DID) framework. We estimate per-beneficiary, per-year increased costs of $4,493 and $3,371 associated with avoidable hospitalizations and avoidable ED visits, respectively, in the DSRIP target population relative to the comparator population. While costs decreased in the analysis of both outcomes, they decreased more in the comparator population. Small per-beneficiary, per-year increases in unadjusted numbers of these two outcomes (0.0025 additional avoidable hospitalizations and 0.0281 additional avoidable ED visits) were also observed after implementation of the DSRIP program, comparing the DSRIP target population to the comparator population. As in the case of costs, avoidable events decreased in both populations, but the decrease in the comparator population was larger. We cannot be certain that the DSRIP program explains all of these differences. For instance, populations are not matched on demographic or clinical characteristics; such matching could change results. Additionally, the hospitals selecting to participate in the program could be systematically different in terms of characteristics that could explain these differences.

We also calculated the total cost of DSRIP that was offset by savings by examining per-beneficiary spending within the target population. This analysis considered the costs of the DSRIP target population alone without comparison to the comparator population, and we find a positive finding reflected in a per-beneficiary savings of $761. This reflects the decrease in total all-cause healthcare costs before and after implementation after subtracting out measured program implementation costs. Thus, in contrast to the relative measures discussed above, the DSRIP program is associated with cost savings, surpassing its implementation costs on a per-beneficiary basis when considering the target population by itself.

It is important to highlight some additional caveats to the estimates. First, we are only able to capture Medicaid utilization and spending, while DSRIP affected all individuals served by participating hospitals or their outpatient partners. A goal of DSRIP was that any initiatives hospitals undertook would benefit all patients, not just Medicaid patients. Additionally, beneficiaries were categorized into "high-" and "low-exposure" populations based on a percentage of DSRIP exposure among hospitals serving their home ZIP code (see Chapter 1 for discussion of choice set methodology). It is possible that a beneficiary in the comparator group could travel to a hospital outside the set of hospitals attributed to their home ZIP code or that beneficiaries in the DSRIP target population could use one of the non-DSRIP hospitals in their ZIP code's attributed hospital list. Additionally, the DSRIP program aimed to create *long-term*

changes in hospitals, improving focus on quality measurement and orientation to population health, and these changes may not be well-measured in the short term. Therefore, although all relevant program implementation costs are captured in the analysis window, *this window may be too narrow to fully capture the long-term effectiveness of program improvements*, resulting in bias in the CEA due to censored data. Finally, we cannot be certain that changes in costs or utilization over time are due to DSRIP exposure as opposed to other environmental changes that may have affected the target and comparator groups differently.

A Final Evaluation of the New Jersey Delivery System Reform Incentive Payment (DSRIP) Program: Assessing Program Impact on Outcomes and Cost-Effectiveness

Sujoy Chakravarty, Ph.D., Kristen Lloyd, M.P.H., Laura Pizzi, Ph.D., John S. Palatucci, M.P.A., Katherine Prioli, M.S., Jennifer Farnham, M.S., Jose Nova, M.S., Feng-Yi Liu, M.A, and Mojdeh Nasiri, M.D., Ph.D.

Introduction

The Delivery System Reform Incentive Payment (DSRIP) Program was approved as part of the New Jersey Medicaid Comprehensive Waiver Demonstration initially over October 2012 to July 2017. The program was re-authorized for a 3-year extension period under the Demonstration renewal (CMS 2017) for a total of eight demonstration years (DYs)[1] ending in June 2020. Our summative evaluation report from April 2018 examined the DSRIP impact over the initial approval period and this current evaluation report expands on that work. It will examine the impact across the entire implementation period spanning 2014-2020 but will distinguish some of the effects by the first (2014-2017) and the second (2018-2020) demonstration periods.

Background and Program Overview

The New Jersey DSRIP program was hospital-based and used resources transitioned from the previously existing Hospital Relief Subsidy Fund to establish a pay-for-performance and pay-for-reporting system to achieve specific health improvement goals for hospitals' low-income patients in Medicaid, CHIP (Children's Health insurance Program), and the charity care population. Under the New Jersey DSRIP Program, hospitals developed and implemented community-based chronic disease management programs addressing one of eight conditions identified by the State as priority areas for quality and cost improvement efforts: asthma, behavioral health, cardiac care, chemical addiction/substance abuse, diabetes, HIV/AIDS, obesity, and pneumonia. Projects had to be evidence-based, include an outpatient focus, and specify relevant and validated outcome metrics for performance assessment (NJDOH 2013).

[1] The first DY of DSRIP was shortened, running from October 2012, when the Comprehensive Waiver governing the DSRIP program was approved, to June 2013.

Training for hospitals on the DSRIP program and application process began in mid-2013 and applications were due in September 2013. Of the 63 eligible hospitals, 55 applied.[2] All hospitals' plans (where they adopted a specific project to improve care related to the chronic disease area of their choice) were approved by May 2014, near the end of DY2 of the 2012-2017 Comprehensive Waiver. The majority of hospitals selected programs in cardiac and diabetes care, with none choosing an HIV/AIDS project, and only one hospital each with projects in the pneumonia and obesity focus areas. After initial project approval, a pay-for-reporting (P4R) and pay-for-performance (P4P) arrangement incentivized hospitals' progress through four cumulative stages. In the first five DYs, these stages were infrastructure development (Stage 1), chronic medical condition redesign and management (Stage 2), quality improvements and assessment (Stage 3), and population-focused improvements and reporting of related metrics (Stage 4).

All hospitals were required to complete the pilot phase of disease management programs and begin implementation of their full DSRIP programs by March 31, 2015. In Stages 3 and 4, hospitals had to report on a menu of (adopted) project-specific and population health-related quality metrics calculated for their specific state-determined attributed population. Over time a greater proportion of DSRIP dollars were tied to measurable improvement over baseline in these pre-specified outcome metrics. In the DSRIP extension period, the original Stage 1 and Stage 2 activities were phased out, and universal reporting on a set of ten "System Transformation" measures was added as the new Stage 1 by DY7. Stage 3 became Stage 2, and Stage 4 became Stage 3 with an added P4P component. The performance calculation mechanics were also modified. While DSRIP program ended in June 2020, the population health improvement and hospital performance assessment that it had initiated continued through the new Quality Improvement Program – New Jersey (QIP-NJ) starting in July 2021 (NJDOH 2021) and continuing as a multi-year initiative.

Evaluation Overview

The Rutgers CSHP was engaged to evaluate the effectiveness of New Jersey's DSRIP program in achieving its goals for the first demonstration period and also the extension period under the Demonstration renewal. The evaluation protocol is based on the two *evaluation questions* stated in the special terms and conditions document relating to the renewal demonstration.

- Was the DSRIP program effective in achieving the goals of better care for individuals (including access to care, quality of care, health outcomes), better health for the

[2] Some hospitals withdrew from DSRIP during the implementation period so that by the end of DY8, 46 hospitals remained in the program.

population, or lower cost through improvement? To what degree can improvements be attributed to the activities undertaken under DSRIP?

- What do key stakeholders (covered individuals and families, advocacy groups, providers, health plans) perceive to be the strengths and weaknesses, successes and challenges of the expanded managed care program, and of the DSRIP pool? What changes would these stakeholders recommend to improve program operations and outcomes?

From these two overarching questions, we enumerate five research questions as follows[3]:

1. To what extent does the program achieve better care?
2. To what extent does the program achieve better health?
3. To what extent does the program lower costs?
4. To what extent did stakeholders report improvement in consumer care and population health?
5. How do key stakeholders perceive the strengths and weaknesses of the program?

We formulated specific testable hypotheses to examine these research questions. Chapter 1, utilizing analysis of claims and hospital discharge data, examines the hypotheses relating to research questions 1-3. Our report on stakeholder interviews from September 2020 examines evaluation questions 4 and 5. The combination of quantitative and qualitative techniques allows a mixed methods approach to examine the effect of the DSRIP program.

To examine specific hypotheses related to research questions 1–3, we conducted a quantitative analysis of the impact of the overall DSRIP program and individual focus areas adopted by the hospitals (e.g., asthma, diabetes, cardiac care etc.) on independently-calculated metrics related to patient access to care, quality of care, patient health, and costs of providing care using Medicaid claims and managed care encounter data. The analyses cover a baseline period of 2011–2013, the first implementation period of January 2014 through June 2017, and the extension period of July 2017 through June 2020. We also utilize hospital discharge data over 2012-2018 to examine the effect of the program on the uninsured population for a smaller set of hospital utilization outcomes.

Chapter 2 presents a cost effectiveness analysis of the DSRIP Program. We compare changes in effectiveness assessed through improvement in outcomes to costs associated with program implementation. We also compare potential savings from improvements in specific outcomes to

[3] These are identical to the evaluation questions from the first round of the demonstration except for one question related to hospital finances which is not included in the renewal.

implementation costs. This analysis has notable limitations. First, it captures cost-effectiveness for the Medicaid population only, while the DSRIP program potentially affects all individuals touched by a hospital (including outpatient partners and outreach). *Second, because the DSRIP program aimed to create sustainable long-term changes in hospitals toward quality measurement and orientation to population health, these changes may not be well-measured in the short-term*. Finally, an important limitation is that this evaluation relies on administrative data, so health measures that fit traditional cost-effectiveness analysis were not available to us.

References

CMS (Centers for Medicare & Medicaid Services). 2017. *New Jersey FamilyCare Comprehensive Demonstration (Project No. 11-W-00279/2)*. Baltimore: CMS. https://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Waivers/1115/downloads/nj/nj-1115-request-ca.pdf.

NJDOH (New Jersey Department of Health). 2013. *Delivery System Reform Incentive Payment (DSRIP) Program Planning Protocol, V1*. Trenton: NJDOH. https://dsrip.nj.gov/Documents/NJ DSRIP PLANNING PROTOCOL_v1_08-09-2013.pdf.

———. 2021. "Quality Improvement Program - New Jersey (QIP-NJ)." Accessed December 9, 2021. https://qip-nj.nj.gov/.

Chapter 1: Analysis of Medicaid Claims and Hospital Discharge Data to Examine DSRIP Program Impact on Patient Care, Health, and Costs

Introduction

This chapter utilizes NJ Medicaid claims and hospital discharge data to examine the first three research questions detailed below. Questions 4 and 5 relating to stakeholder perceptions are addressed in a separate report.

1. To what extent does the DSRIP program achieve better care?
2. To what extent does the DSRIP program achieve better health?
3. To what extent does the DSRIP program lower costs?
4. To what extent did stakeholders report improvement in consumer care and population health?
5. How do key stakeholders perceive the strengths and weaknesses of the program?

In this chapter, we examine the impact of the DSRIP program overall and specific disease management programs on outcomes calculated from Medicaid claims data and hospital discharge data. We formulated specific testable hypotheses flowing directly from research questions related to patient access and quality of care, patient health, and costs of care.

Hypothesis 1: The adoption of hospital projects in a specific focus area (e.g., cardiac care, asthma, etc.) will result in greater improvements in related care and outcomes for patients from hospitals adopting these interventions compared to hospitals which do not adopt these interventions.

This general hypothesis can be broken down into seven sub-hypotheses that examine the effectiveness of each of the seven chronic condition projects that include asthma; behavioral health; cardiac care; chemical addiction/substance abuse; diabetes; obesity; and pneumonia. For instance,

Hypothesis 1a: Rates of 30-day heart failure/acute myocardial infarction readmissions will decrease in hospitals adopting cardiac care interventions during the DSRIP program.

Hypothesis 1b: Rates of asthma admissions and ED visits will decrease for patients in hospitals adopting asthma management programs.
Hypothesis 1c: Rates of follow-up visits after hospitalizations for mental illness will increase for patients from hospitals adopting behavioral health interventions during the DSRIP program.
Hypothesis 1d: Rates of initiation and engagement in alcohol and other drug treatment will increase for patients from hospitals adopting chemical addiction/substance use management projects during the DSRIP program.
Hypothesis 1e: Rates of admissions for diabetes short-term complications will decrease for patients from hospitals adopting diabetes management projects during the DSRIP program.
Hypothesis 1f: Rates of 30-day pneumonia readmissions will decrease for patients from hospitals adopting pneumonia intervention projects during the DSRIP program.
Hypothesis 1g: Rates of children's and adolescents' access to primary care practitioners will increase for patients from hospitals adopting obesity intervention projects under the DSRIP program.

Hypothesis 1 addresses the research questions on whether the program achieves better care and outcomes by examining metrics relating to hospital admissions, readmissions, treat-and-release ED visits, and recommended care. (The specific metrics are detailed in the 'outcome variables' section in Methods, and also in Table A that relates each hypothesis to the specific metrics). The focus of Hypothesis 1 is assessing the effectiveness of the specific disease management programs adopted by the hospitals.

Hypothesis 2: The DSRIP program will improve the quality of ambulatory care in the communities of participating hospitals consequently reducing avoidable inpatient hospitalizations and avoidable/preventable ED visits; it will improve access to care; quality and efficiency of care.

Hypothesis 2 thus examines all three research questions relating to better care, better health and lower costs. The quality and adequacy of ambulatory care will be measured by avoidable inpatient hospitalizations and ED visits. These, and other hospital specific outcomes examine the impact of the overall DSRIP program on better care and better health in the population. Finally, a decrease in costs associated with avoidable hospitalizations would indicate increasing efficiencies in care.

Hypothesis 3: The DSRIP program will reduce racial/ethnic and gender disparities in avoidable hospital admissions, treat-and-release ED visits, and hospital readmissions, in participating hospitals.

Hypothesis 3 also sheds light on whether the program improves care and ensures better health in the population. This specifically recognizes the importance of ensuring that program benefits reach all sections of the Medicaid population. Hospitalizations stratified by race/ethnicity and gender will reveal whether readmission rates or ambulatory care sensitive hospitalizations are higher among racial/ethnic minorities and/or women.

Table A: Metrics for the Quantitative Evaluation of the NJ DSRIP Program

	Program Focus of Evaluation	Metric	Chronic Disease Outcomes	Health Outcomes	Care	Disparities
			Hypothesis			
			1	2		3
1	Behavioral Health	Follow-up after Hospitalization for Mental Illness 7 Days Post Discharge	X			
2	Behavioral Health	Follow-up after Hospitalization for Mental Illness 30 Days Post Discharge	X			
3	Chemical Addiction/ Substance Abuse	Initiation of Alcohol and Other Drug Treatment	X			
4	Chemical Addiction/ Substance Abuse	Engagement of Alcohol and Other Drug Treatment	X			
5	DSRIP Overall & Cardiac Care	30-Day All-Cause Readmission Rate Following Heart Failure (HF) Hospitalization	X	X		X
6	DSRIP Overall & Cardiac Care	30-Day All-Cause Readmission Rate Following Acute Myocardial Infarction (AMI) Hospitalization	X	X		X
7	DSRIP Overall & Pneumonia	30-Day All-Cause Readmission Rate Following Pneumonia (PN) Hospitalization	X	X		X

	Program Focus of Evaluation	Metric	Chronic Disease Outcomes	Health Outcomes	Care	Disparities
			Hypothesis			
			1	2		3
8	DSRIP Overall	30-Day All-Cause Readmission Rate Following Chronic Obstructive Pulmonary Disease (COPD) Hospitalization		X		X
9	Asthma	Emergency Department (ED) Visits for Asthma	X			
10	Diabetes	Comprehensive Diabetes Care: Eye Exam	X			
11	Diabetes	Comprehensive Diabetes Care: Hemoglobin A1c (HbA1c) Testing	X			
12	Obesity	Children and Adolescents' Access to Primary Care Practitioners	X			
13	DSRIP Overall	Well-child Visits in the 3,4,5, 6th Years of Life[a]			X	
14	DSRIP Overall	Mental Health Utilization			X	
15	Asthma	Young Adult Asthma Admission Rate (PQI-15)	X			
16	Asthma	Asthma Admission Rate (PDI-14)[b]	X			
17	Diabetes	Diabetes Short-Term Complications Admission Rate (PQI-01)	X			
18	DSRIP Overall	Preventable Hospitalizations (PQI-90)		X	X	X
19	DSRIP Overall	Pediatric Preventable Hospitalizations (PDI-90)		X	X	
20	DSRIP Overall	Preventable/Avoidable Treat-and-Release ED Visits[c]		X	X	X
21	DSRIP Overall	Hospital Costs Related to Avoidable Inpatient Stays and Treat-and-Release ED Visits			X	

Notes: ED=Emergency Department; PQI=Prevention Quality Indicator relating to ambulatory care sensitive hospitalizations.
[a]Replaces metric Well-Child Visits in the First 15 Months of Life proposed in our evaluation plan which requires age in months. This is not available in our claims database.
[b] This metric was not proposed in our evaluation plan, but was added to help assess the impact of DSRIP asthma projects separately on pediatric populations with asthma.
[c] Our evaluation plan also proposed examining overall treat-and-release ED visits, but we decided the avoidable utilization of EDs was the relevant outcome to assess.

Methods

Data Sources

We used Medicaid fee-for-service claims and managed care encounter data for calendar years (CY) 2011–2019 and the first two quarters of calendar year 2020. Metrics that are assessed on a quarterly basis cover this entire time period and metrics that are assessed annually go through the end of 2019. We also used 2012–2018 AHRQ Hospital Cost and Utilization Project (HCUP) all-payer hospital discharge data to calculate avoidable hospitalization and ED visits for the uninsured population and seven years of American Community Survey 5-year summary file data (2014-2019) to estimate the uninsured population denominators (U.S. Census Bureau 2021; see Appendix D for further detail).

Study Period

The baseline years for this final evaluation of the DSRIP program are 2011–2013. While 2013 was the first DSRIP program year, no hospital projects had formally launched in 2013, and this was still considered part of the "Transition Period" of DSRIP. This summative evaluation compares outcomes in the implementation period spanning 2014 through the second quarter (Q2) of 2020, to the baseline period spanning 2011–2013. However, the implementation period is split into the first demonstration period of the DSRIP program (January 1, 2014- June 30, 2017) and the extension period of the program (July 1, 2017- June 30, 2020) for most metrics to identify any potential differences in impact between the first and second rounds of demonstration. For annual metrics, we partition the implementation period as 2014-2017 and 2018-2020. For assessing disparities, we consider the post-implementation period, overall (2014-2020 Q2). Data from HCUP were available for 2012-2018 and so outcomes assessed using that data also do not split out two implementation periods but instead consider the implementation period overall (2014-2018).

Selection and Calculation of Outcome Variables

Table B below presents the 21 quality metrics examined in this chapter of the report. We selected validated metrics such as those developed by the National Committee on Quality Assurance (NCQA) and National Quality Forum (NQF)-endorsed metrics that could be calculated from available data. We chose metrics that would reflect the effect of DSRIP program on the overall delivery system, both inpatient and ambulatory care, instead of narrower inpatient process-based measures. We focused on metrics that are being used to assess similar delivery system-related pay-for-performance efforts e.g., all-cause readmissions from initial hospitalizations of heart failure, acute myocardial infarction, and pneumonia. We followed the specifications of the measure steward for each metric as closely as possible to create estimates that could be trended

over time. Appendix A provides additional information on how these metrics were prepared and their relevance in assessing delivery system changes.

If not already part of the metric specification, an additional inclusion criterion imposed on all Medicaid claims-based metrics was the requirement that a claim was only counted if the beneficiary had been continuously enrolled in Medicaid for at least 30 days preceding the claim date. As stated in our evaluation plan, this criterion eliminates events which might precipitate Medicaid enrollment because inclusion of those events may confound the analysis of the metrics.

The metrics used in our evaluation of chronic disease outcomes, access and quality of care, and racial/ethnic and gender disparities are organized into two categories: index-event-based, and population-based.

Index Event and Population-Based Metrics: The first category of *Index Event-Based Metrics* comprises outcomes related to an initial *index* event (an initial hospital stay or provider visit) experienced by the patient. Examples include whether the patient had a readmission within 30 days of an initial index hospitalization; had a follow up visit within 7 days of an index hospitalization for mental illness or initiated and engaged in alcohol treatment shortly after an index event-based diagnosis of alcohol or other drug dependence. The second category of *Population-Based Metrics* relates to outcome events where the relevant denominator is a population of Medicaid beneficiaries. (For assessing outcomes for the uninsured population, for instance, avoidable hospitalizations, this would be the population of uninsured beneficiaries.) This metric type could be assessed at an individual level (e.g., ED visit for asthma by any person) or aggregated at a geographic level (rate of avoidable hospitalizations per unit population in a zip code). When calculating quarterly zip code-level rates for Medicaid beneficiaries, we used the sum of enrollment periods for all Medicaid beneficiaries in that zip code for a particular quarter as the denominator. This accounts for differing lengths of enrollment time across zip codes that would influence the likelihood of the outcome event in Medicaid data. When preparing metrics in HCUP data, information on duration uninsured was not available so we assumed the uninsured population was uninsured every day in the quarter. When calculating costs associated with avoidable inpatient and ED use, we put estimates for all years in 2012 dollars using consumer price indices (CPI) for medical care to adjust for medical care inflation over the study period (BLS 2020).

Table B shows that the outcome variables may be binary (e.g., readmissions) or continuous (e.g., number of avoidable hospitalizations per unit population). It also includes beneficiary-related inclusion criteria from the measure specifications that are adopted for calculating each of these metrics.

Table B: Metric Descriptions

	Program Focus of Evaluation	Metric Abbreviation	Metric	Inclusion Criteria	Outcome	DSRIP Exposure Assignment
Index Event-Based Metrics						
1	Behavioral Health	FUH-7	Follow-up after Hospitalization for Mental Illness 7 Days Post Discharge	Ages 6+ at any NJ DSRIP-participating hospital	0/1	by hospital
2	Behavioral Health	FUH-30	Follow-up after Hospitalization for Mental Illness 30 Days Post Discharge	Ages 6+ at any NJ DSRIP-participating hospital	0/1	by hospital
3	Chemical Addiction/ Substance Abuse	IT-AOD	Initiation of Alcohol and Other Drug Treatment	NJ residents[2] ages 13+ at any NJ provider	0/1	by zip
4	Chemical Addiction/ Substance Abuse	ET-AOD	Engagement of Alcohol and Other Drug Treatment	NJ residents[2] ages 13+ at any NJ provider	0/1	by zip
5	DSRIP Overall & Cardiac Care	RSRR-HF	30-Day All-Cause Readmission Rate Following Heart Failure (HF) Hospitalization	Ages 18+ at any NJ hospital[1]	0/1	by hospital

[1] For analysis of readmission metrics assessing DSRIP programs related to chronic conditions, only DSRIP participating hospitals are included.

[2] For population-based metrics assessing DSRIP programs related to chronic conditions, only NJ residents in zips with non-zero DSRIP exposure are included in analyses.

Table B: Metric Descriptions (continued)

	Program Focus of Evaluation	Metric Abbreviation	Metric	Inclusion Criteria	Outcome	DSRIP Exposure Assignment
6	DSRIP Overall & Cardiac Care	RSRR-AMI	30-Day All-Cause Readmission Rate Following Acute Myocardial Infarction (AMI) Hospitalization	Ages 18+ at any NJ hospital[1]	0/1	by hospital
7	DSRIP Overall & Pneumonia	RSRR-PN	30-Day All-Cause Readmission Rate Following Pneumonia (PN) Hospitalization	Ages 18+ at any NJ hospital[1]	0/1	by hospital
8	DSRIP Overall	RSRR-COPD	30-Day All-Cause Readmission Rate Following Chronic Obstructive Pulmonary Disease (COPD) Hospitalization	Ages 40+ at any NJ hospital	0/1	by hospital
Population-Based Metrics						
Person-Level						
9	Asthma	HDC-AC	Emergency Department (ED) Visits for Asthma	NJ residents[2]	0/1	by zip
10	Diabetes	CDC-EYE	Comprehensive Diabetes Care: Eye Exam	NJ residents[2] ages 18-75 with diabetes	0/1	by zip
11	Diabetes	CDC-A1C	Comprehensive Diabetes Care: Hemoglobin A1c (HbA1c) Testing	NJ residents[2] ages 18-75 with diabetes	0/1	by zip
12	Obesity	CAP	Children and Adolescents' Access to Primary Care Practitioners	NJ residents[2] ages 1-19	0/1	by zip
13	DSRIP Overall	W34	Well-child Visits in the 3,4,5, 6th Years of Life	NJ residents[2] ages 3-6	0/1	by zip
14	DSRIP Overall	MPT	Mental Health Utilization	NJ residents	0/1	by zip

[1] For analysis of readmission metrics assessing DSRIP programs related to chronic conditions, only DSRIP participating hospitals are included.

[2] For population-based metrics assessing DSRIP programs related to chronic conditions, only NJ residents in zips with non-zero DSRIP exposure are included in analyses.

Table B: Metric Descriptions (continued)

	Program Focus of Evaluation	Metric Abbreviation	Metric	Inclusion Criteria	Outcome	DSRIP Exposure Assignment
Zip-Level						
15	Asthma	PQI-15	Younger Adult Asthma Admission Rate (PQI-15)[3]	NJ residents[2] ages 18-39[4]	count per 10K beneficiary years	by zip
16	Asthma	PDI-14	Asthma Admission Rate (PDI-14) [3]	NJ residents[2] ages 2-17[5]	count per 10K beneficiary years	by zip
17	Diabetes	PQI-01	Diabetes Short-Term Complications Admission Rate (PQI-01) [3]	NJ residents[2] ages 18+	count per 10K beneficiary years	by zip
18	DSRIP Overall	PQI-90	Preventable Inpatient Hospitalizations (PQI 90) [3]	NJ residents ages 18+	count per 10K beneficiary years	by zip
19	DSRIP Overall	PDI-90	Pediatric Preventable Inpatient Hospitalizations (PDI 90) [3]	NJ residents ages 6-17	count per 10K beneficiary years	by zip
20	DSRIP Overall	AVED	Preventable/Avoidable Treat-and-Release ED Visits[3]	NJ residents ages 18+	count per 10K beneficiary years	by zip
21	DSRIP Overall	AV$	Hospital Costs Related to Avoidable Inpatient Stays and Treat-and-Release ED Visits	NJ residents ages 18+	costs per 10K beneficiary years	by zip

[1] For analysis of readmission metrics assessing DSRIP programs related to chronic conditions, only DSRIP participating hospitals are included.
[2] For population-based metrics assessing DSRIP programs related to chronic conditions, only NJ residents in zips with non-zero DSRIP exposure are included in analyses.
[3] This metric is also calculated in all-payer hospital discharge data for the uninsured population.
[4] For analysis in HCUP data for the uninsured population, this outcome is assessed for ages 18-34 since the population denominator was not available for ages 18-39.
[5] For analysis in HCUP data for the uninsured population, this outcome is assessed for ages 6-17 since the population denominator was not available for ages 2-17.

Defining Exposure to DSRIP Program

For all index event-based metrics, except initiation/engagement of AOD, the index event occurs in an inpatient hospital setting, and the patient was considered exposed to the DSRIP program overall (or a particular chronic disease management program) if the hospital where the index admission occurred was participating in the DSRIP program in 2014 (or participating in a chronic disease management program).

Assignment of DSRIP exposure for all population-based metrics and for initiation/engagement of AOD, (where the qualifying index event could occur at an outpatient provider setting) is based on the extent to which zip codes where the patients resided had DSRIP-participating hospitals. This was operationalized using a "choice set" methodology previously developed at CSHP (DeLia et al. 2009). Using 2011–2012 UB hospital discharge data for both inpatient stays and emergency department treat-and-release visits from 750 NJ zip codes (see Appendix F for details relating to zip code identification and selection), we created a "choice set" (or relevant set) of hospitals for each NJ zip code based on the volume of Medicaid discharges from area hospitals. The hospital choice set for a particular zip code is the smallest number of hospitals that accounts for at least 75% of all hospital discharges relating to Medicaid beneficiaries in that zip code. The purpose of the choice set thus is to focus on those hospitals that as a group account for the majority of Medicaid discharges relating to that zip code.

Based on the choice set hospitals, we considered two alternative measures of the zip code population's (or a patient's, in case of AOD metrics) exposure to DSRIP.

Exposure Measure 1: Equals 1 if any hospital in the choice set took part in the program, 0 otherwise.
Exposure Measure 2: Percent of discharges relating to all hospitals in the choice set that belong to hospitals taking part in the program.

Exposure Measure 2 was our primary indicator of DSRIP exposure at the zip code level. In previous and current analysis, we conducted robustness checks, alternatively defining the hospital choice set based on 90% of Medicaid discharges to a zip code.

The approach for assigning and assessing exposure to DSRIP described here leads to conservative estimates of DSRIP impact. Treating hospitals as if they participated in DSRIP for the entirety of the study period as long as they participated in the beginning is an intent-to-treat design. This method avoids biases in impact estimates that would result if withdrawal from the program was related to actual or potential performance on outcomes. Similarly, a static choice set for defining the hospital utilization patterns used to create zip-level DSRIP exposure variables prevent

endogeneity in exposure assignment if any changes in utilization patterns over the study period are related to performance in the DSRIP program. We note where alternative specifications described above yield meaningfully different results.

Analytic Strategy

The effect of the DSRIP program is assessed by identifying its impact on individual patient-level outcomes as well as population-based outcomes that are aggregated across zip codes. The effect on patient outcomes that are related to hospital events (index event-based metrics) is measured by the change in outcomes over time for hospitals that participated in the DSRIP program relative to comparison hospitals that did not participate in the program. Similarly, the effect of specific disease management programs is examined by comparing hospitals that took part in the program to other DSRIP-participating hospitals that did not take part in the program. For instance, the effectiveness of the cardiac care program is examined by comparing relevant patient outcomes in DSRIP-participating hospitals adopting that program to those that did not adopt at two periods of time-before and after the start of the DSRIP program.

For metrics that are population-based, we examine how patient outcomes vary across NJ zip codes and over time, as the DSRIP program is implemented. The zip codes are distinguished by their differing exposure to the DSRIP program based on the exposure measures defined above.

The statistical method utilized to identify the program effect is a difference-in-differences (DD) estimation technique that examines changes in selected outcomes in the study group, from pre- to post-program implementation, relative to a comparison group. Such an estimation strategy is able to identify changes in outcomes that are due to program impact, and distinct from secular trends. It further accounts for the effect of unobserved factors, as long as their impact on one of the groups relative to the other do not change over time.

$$Y_{it} = \beta_0 + \beta_1(program)_i + \beta_2(post)_t + \beta_3(program_i * post_t) + \gamma X_{\ it} + \varepsilon_{it} \qquad (1)$$

Equation (1) illustrates the general DD specification. This is used when modeling DSRIP impacts on the uninsured population using HCUP data and is also adopted for examining potential changes in disparities related to gender and race/ethnicity for the Medicaid population using claims data. The variable Y_{it} represents the outcome for the ith patient or zip code, depending on the metric, at year t. *Post*= 0 for years 2011–2013 (2012-2013 in uninsured analysis) and =1 for years 2014-2020 Q2 (2014-2018 in uninsured analyses).[4] *Program* equals 0 or 1 (depending on

[4] 30-day readmissions metrics and diabetes care metrics require a full year of retrospective data and are therefore calculated only for years 2012 and later. Therefore, *post*=0 for year 2012-2013 and =1 for 2014 through quarter 2 of 2020 in models using these outcomes.

hospital participation) when the outcome is a hospital-based metric, or equals the continuous DSRIP exposure variable when the program effect operates based on the zip code where the patient resides. In this model, β_3 measures the program impact. X_{it} is a vector of other control variables relating to the patient, and ε_{it} represents the random error term.

For all other metrics, we utilize a more detailed regression model represented by equation (2) that is able to distinguish between potentially differing impacts between the first and second implementation periods of the DSRIP program.

$$Y_{it} = \beta_0 + \beta_1(program)_i + \beta_2(post\_1)_t + \beta_3(post\_2)_t + \beta_4(program_i * post\_1_t) + \beta_5(program_i * post\_2_t) + \gamma X_{it} + \varepsilon_{it} \quad (2)$$

Here post_1= 0 or 1 depending on whether the time is during the first demonstration period of the DSRIP program (January 1, 2014- June 30, 2017), post_2=0 or 1 depending on whether the time is during the second demonstration period (July 1, 2017- June 30, 2020).[5] The reference category is the baseline period spanning January 1, 2011- December 31, 2013. The statistical model in equation (2) thus accounts for these three distinct periods by incorporating the indicator variables for specific years or rounds of demonstration. This will allow estimation of changes in outcomes during the first DSRIP demonstration period from the policy implementation, and additional changes in outcomes during the second demonstration period from continuation of those policy changes. Specifically, β_5 measures the program impact during the second round of demonstration relative to the baseline period and β_4 measures program impact during the first round of the demonstration, also relative to the baseline period.

In each model, depending on the specific metric, Y_{it}, can be modeled as a rate or a binary variable. Details relating to the unit of analysis which may be a patient, a hospital discharge, or zip code, and statistical modeling are detailed in Table C. The base models in equations (1) & (2) are augmented with year, quarter, and zip code or hospital fixed effects as applicable. For analysis of outcomes that have zip code Medicaid population-based denominators (adjusted by differing enrollment periods) or uninsured population-based denominators, regressions were weighted by total beneficiary-years in each zip code in each quarter. This ensured that each zip code contributed to the estimation of DSRIP effects in proportion to the number of individuals and, for Medicaid analyses, additionally, the enrollment duration of individuals who met the inclusion criteria for the metric.

[5] The first program round ends in July 31, 2017 and the second round begins in August 1, 2017. We aligned our quarterly data as closely as possible to this transition.

The model in equation (1) was modified to examine the effect of the DSRIP program on racial/ethnic and gender disparities. We introduced additional terms that included the interaction between the indicators for program, post period and race/ethnicity (or gender) along with other related main and interaction effects.

For assessing disparities based on avoidable hospitalizations and ED visits, we examined the effect of the program on the difference in the rate of these events between each racial/ethnic minority group and whites, and also between females and males. When assessing disparities based on these zip-code based metrics, the total beneficiary-years of the specific minority group, or females, were used as analytic weights to account for variability in these populations across zip codes.

Parallel Pre-Trends Assumption: DD modeling identifies the impact of the policy change by comparing the trend in outcomes for the study population from the pre- to the post-implementation period(s) to that of a comparison group which is otherwise similar, but not subject to the policy effect. The DD estimate is able to account for the effect of unobserved factors and generate an estimate of the true policy effect as long as the impact of the policy on the intervention group relative to the comparison group does not change over time. We tested this assumption by examining whether trends in outcomes prior to policy implementation (pre-trends) for the intervention and comparison group are parallel to each other (Akosa Antwi 2015). Each regression model will examine in supplementary analysis whether there exist statistically significant differences in trends between the intervention and comparison group prior to policy implementation. When such a difference is detected and statistically significant ($p<0.01$), we adjusted the DD estimates to account for differential pre-trends (Willage 2020). This pre-trend adjustment was not conducted in models for person-level annual outcomes. The limited number of baseline time points (two or three years) preclude sufficient variation for implementing trend adjustments.

Effect Size and Falsification Tests: Our analysis utilizes large datasets which provide statistical power to identify significant results. However, such results may not be meaningful from a policy standpoint.

Additionally, spurious associations may also be identified as statistically significant due to chance (Prasad and Jena 2013). To refine our results, we calculated effect sizes and performed falsification tests. Effect size for a given DSRIP Project or various special program (*p)* is defined as follows:

$$Effect\_Size_p = \beta_p / \mu_{pb} \qquad (3).$$

The coefficient from the DSRIP Project or special program (βp) is divided by the sample mean for the DSRIP Project or special program at baseline (μ_{pb}). We define a meaningful result if the magnitude of the effect size is greater than one percent.

For results with meaningful estimates, we conducted falsification tests utilizing alternative outcomes that we did not expect to be impacted by the program under consideration. If the effect size was not just due to chance and reflected impact of the policy on the targeted outcomes, in that case we would not see a similar effect on a non-relevant outcome. For instance, if there was a significant meaningful effect of the asthma program on asthma outcomes and this was not just due to chance, we would expect the effects to disappear when we replaced asthma outcomes with diabetes outcomes while modeling the asthma program impact.

Results relating to event-based metrics are not reported when estimates are based on denominators less than 30. Our estimation procedures were conducted using STATA MP 16.1.

Explanatory Variables

Table C lists details on explanatory variables used in the multivariate regression analysis relating to the 21 metrics. For modeling outcomes related to the index-event based metrics, we used individual-level control variables such as beneficiary age and sex, and a diagnosis-based Chronic Illness and Disability Payment System (CDPS) risk score that measures disease diagnoses and burden of illness with higher values indicating greater disease burden (Kronick et al. 2000). For the FUH and AOD metrics, we used the individual's CDPS risk score category (<=1, 1-2, 2-3, 3-5, and >5) during baseline and the post-implementation year to adjust for health status changes. For readmission metrics we used the full set of risk-adjustment variables that are defined by the CMS methodology related to Risk Standardized Readmission Rates (RSRR) (QualityNet 2017). Appendix E lists all the risk-adjustment variables for each of the readmission outcomes. For all of these metrics, except IT-AOD and ET-AOD, we utilize hospital fixed effects to adjust for the effect on outcomes of time-invariant differences across hospitals.

For population-based metrics and the IT-AOD and ET-AOD metrics where DSRIP exposure is assigned based on zip codes where patients reside, zip code fixed effects account for time-invariant differences across zip codes such as socio-demographic composition and disease prevalence. As before, we account for the change in disease diagnoses and burden of illness over time by adjusting for the CDPS risk score category for each individual for person-level metrics. For metrics that are averages based on zip-populations, such as avoidable hospitalizations or those relating to asthma or diabetes hospitalizations, we use the average CDPS score in the zip code for each quarter. Additionally, we use robust standard errors to account for clustering.

For all metrics, year fixed effects adjust for changes in outcomes over time that are common across all patients and quarter fixed effects adjust for any seasonality effects on outcomes and variation in our claims runout.

Table C: Modeling Details

	Program Focus of Evaluation	Metric	Unit of Analysis & Time Period	Outcome	Model Specification[1]	Control Variables
Index Event-Based Metrics						
1	Behavioral Health	Follow-up after Hospitalization for Mental Illness 7 Days Post Discharge	index hospitalization 2011-2020 Q2	0/1	Linear Probability Model	gender, age, CDPS risk category, quarter, hospital and year FE
2	Behavioral Health	Follow-up after Hospitalization for Mental Illness 30 Days Post Discharge	index hospitalization 2011-2020 Q2	0/1	Linear Probability Model	gender, age, CDPS risk category, quarter, hospital and year FE
3	Chemical Addiction/ Substance Abuse	Initiation of Alcohol and Other Drug Treatment	index event 2011-2020 Q2	0/1	Linear Probability Model[2]	gender, CDPS risk category, quarter, zip and year FE
4	Chemical Addiction/ Substance Abuse	Engagement of Alcohol and Other Drug Treatment	index event 2011-2020 Q2	0/1	Linear Probability Model[2]	gender, CDPS risk category, quarter, zip and year FE
5	DSRIP Overall & Cardiac Care	30-Day All-Cause Readmission Rate Following Heart Failure (HF) Hospitalization	index hospitalization 2012-2020 Q2	0/1	Linear Probability Model	age, gender, clinical risk factors, quarter, hospital and year FE
6	DSRIP Overall & Cardiac Care	30-Day All-Cause Readmission Rate Following Acute Myocardial Infarction (AMI) Hospitalization	index hospitalization 2012-2020 Q2	0/1	Linear Probability Model	age, gender, clinical risk factors, quarter, hospital and year FE
7	DSRIP Overall & Pneumonia	30-Day All-Cause Readmission Rate Following Pneumonia (PN) Hospitalization	Index hospitalization 2012-2019	0/1	Linear Probability Model	age, gender, clinical risk factors, quarter, hospital and year FE

Q2= Quarter 2; CDPS=Chronic Illness and Disability Payment System; FE=Fixed Effects.

[1] All models use robust standard errors.

[2] Models are stratified by age (13-17, and 18+) as per HEDIS specifications for this metric.

[3] Models are stratified by age (0-17, and 18+).

Table C: Modeling Details (continued)

	Program Focus of Evaluation	Metric	Unit of Analysis	Outcome	Model Specification[1]	Control Variables
8	DSRIP Overall	30-Day All-Cause Readmission Rate Following Chronic Obstructive Pulmonary Disease (COPD) Hospitalization	Index hospitalization 2012-2020 Q2	0/1	Linear Probability Model	age, clinical risk factors, quarter, hospital and year FE
Population-Based Metrics						
	Person-Level					
9	Asthma	Emergency Department (ED) Visits for Asthma	Beneficiary 2011-2019	0/1	Linear Probability Model[3]	gender, CDPS risk category zip and year FE
10	Diabetes	Comprehensive Diabetes Care: Eye Exam	Beneficiary 2012-2019	0/1	Linear Probability Model	age, gender, CDPS risk category, zip and year FE
11	Diabetes	Comprehensive Diabetes Care: Hemoglobin A1c (HbA1c) Testing	Beneficiary 2012-2019	0/1	Linear Probability Model	age, gender, CDPS risk category, zip and year FE
12	Obesity	Children and Adolescents' Access to Primary Care Practitioners	Beneficiary 2011-2019	0/1	Linear Probability Model	age, gender, CDPS risk category, zip and year FE
13	DSRIP Overall	Well-child Visits in the 3,4,5, 6th Years of Life	Beneficiary 2011-2019	0/1	Linear Probability Model	age, gender, CDPS risk category, zip and year FE
14	DSRIP Overall	Mental Health Utilization	Beneficiary 2011-2019	0/1	Linear Probability Model	age, gender, CDPS risk category zip and year FE
	Zip-Level					
15	Asthma	Younger Adult Asthma Admission Rate (PQI-15)	zip code-quarter 2011-2020 Q2[4]	count per 10K beneficiary years	Weighted linear regression	CDPS average, zip, quarter, and year FE

Q2= Quarter 2; CDPS=Chronic Illness and Disability Payment System; FE=Fixed Effects.

[1] All models use robust standard errors.

[2] Models are stratified by age (13-17, and 18+) as per HEDIS specifications for this metric.

[3] Models are stratified by age (0-17, and 18+).

[4] In models using HCUP data for the uninsured population, this time period is 2012-2018.

Table C: Modeling Details (continued)

	Program Focus of Evaluation	Metric	Unit of Analysis	Outcome	Model Specification[1]	Control Variables
16	Asthma	Asthma Admission Rate (PDI-14)	zip code-quarter 2011-2020 Q2[4]	count per 10K beneficiary years	Weighted linear regression	CDPS average, zip, quarter, and year FE
17	Diabetes	Diabetes Short-Term Complications Admission Rate (PQI-01)	zip code-quarter 2011-2020 Q2[4]	count per 10K beneficiary years	Weighted linear regression	CDPS average, zip, quarter, and year FE
18	DSRIP Overall	Preventable Inpatient Hospitalizations (PQI-90)	zip code-quarter 2011-2020 Q2[4]	count per 10K beneficiary years	Weighted linear regression	CDPS average, zip, quarter, and year FE
19	DSRIP Overall	Pediatric Preventable Inpatient Hospitalizations (PDI-90)	zip code-quarter 2011-2020 Q2[4]	count per 10K beneficiary years	Weighted linear regression	CDPS average, zip, quarter, and year FE
20	DSRIP Overall	Preventable/Avoidable Treat-and-Release ED Visits	zip code-quarter 2011-2020 Q2[4]	count per 10K beneficiary years	Weighted linear regression[3]	CDPS average, zip, quarter, and year FE
21	DSRIP Overall	Hospital Costs Related to Avoidable Inpatient Stays and Treat-and-Release ED Visits	zip code-quarter 2011-2020 Q2	costs per 10K beneficiary years	Weighted, generalized linear model with gamma log link	CDPS average, quarter and year FE

Q2=Quarter 2; CDPS=Chronic Illness and Disability Payment System; FE=Fixed Effects.

[1] All models use robust standard errors.

[2] Models are stratified by age (13-17, and 18+) as per HEDIS specifications for this metric.

[3] Models are stratified by age (0-17, and 18+).

[4] In models using HCUP data for the uninsured population, this time period is 2012-2018.

Results

In this section we report findings from quantitative analyses that capture the effects of the DSRIP program through the end of the demonstration (June 2020). Unless otherwise noted, findings reported do not differ substantively when sensitivity analyses are done using an alternative specification of the hospital choice set used to define DSRIP exposure (as discussed in the Methods section, the hospital choice set determines the relevant hospitals for a zip code and then determines exposure based on the share of discharges from DSRIP participating hospitals).

We first present findings from analysis of Medicaid claims data (Section A) followed by findings from analysis of HCUP data on the uninsured population (Section B).

Section A: Impact of DSRIP Programs on Medicaid Beneficiaries by Focus Area

Behavioral Health Program: Table 1A.1 reports 7-day and 30-day follow up rates after a hospitalization for mental illness. These rates are shown separately for the group of hospitals that are participating in the BH program and the comparison group of DSRIP hospitals that is not, for the baseline period spanning 2011–2013. Thirty-day follow-up rates are expectedly higher than 7-day rates. The 7-day follow-up rates are higher by 1 percentage point (pp) among the hospitals not participating in the BH program, but the 30-day rates are very nearly the same from both sets of DSRIP hospitals. These small differences are not statistically significant.

Table 1A.2 reports the findings based on a regression analysis examining the effect of the BH program on these outcomes by comparing hospitals that participated in the program to those DSRIP hospitals that did not, for the baseline and the two DSRIP implementation periods. We find no statistically significant effect of the BH program on these rates. Estimates are less than 1 pp decline in both follow-up rates in 2014-2017 and 0.9 and 1.2 pp increases in 7-day and 30-day follow-up rates, respectively, over 2018-2020.

Chemical Addiction/Substance Abuse Program: Table 1A.3 reports rates of initiation and engagement in AOD treatment for two groups of patients classified based on whether at least one hospital in their zip codes was taking part in a chemical addiction/substance abuse (CA/SA) program. These are reported for the baseline period spanning 2011–2013. There are statistically significant differences in both rates based on exposure to the DSRIP program. Those in areas served by a hospital taking part in DSRIP with a CA/SA program had 1.6 pp lower rates of initiation and 1.3 pp lower rates of engagement compared to those in areas where DSRIP hospitals focused on a different chronic disease.

Table 1A.4 reports the findings based on a regression analysis examining the effect of the chemical addiction and substance abuse program on these outcomes. The results are reported overall and separately for age stratifications 13–17 and 18+. The estimates reflect the average increase in the likelihood (ranging between 0 and 1) of initiation and engagement, due to a 1% increase in DSRIP exposure.

The directions of results are the same for both age stratifications. Overall, compared to a zip code with zero exposure to the CA/SA program (i.e., where none of the hospitals took part in the program), a patient in a zip code with 100% exposure to the program (where all hospitals took part in the program) had less than 1 pp change in the likelihood of initiation or engagement in

AOD treatment in 2014-2017. Over 2018-2020, these changes were a 2.2 pp increase for initiation of treatment and a 1.3 pp increase for engagement of treatment, but these were not statistically significant. The only statistically significant change[6] was a 0.1 pp increase in initiation of AOD treatment for every 1% increase in DSRIP CA/SA program exposure among Medicaid beneficiaries ages 13-17 in the 2018-2020 period ($p<0.011$).

Asthma Program: Table 1A.5 reports rates of ED visits for asthma among patients classified by whether their zip code had at least one hospital participating in the asthma program. Rates of ED visits for asthma were lower at baseline for patients in zip codes where there was at least one hospital conducting a DSRIP asthma program. The difference was 0.5 pp lower among 0-17 year olds, and 0.2 pp lower among adults 18+ ($p<0.01$).

Table 1A.6 reports the results from a regression analysis stratifying patients by age. The effect of the program on the likelihood of ED visit for asthma was close to zero for ages 0-17, but statistically significant. Specifically, as a child's exposure to DSRIP asthma programs increased from 0% to 100%, the probability of an ED visit for asthma decreased by 0.8 pp over 2014-2017 and 1.5 pp over 2018-2020. Results for adults are similarly statistically significant declines that are slightly smaller in magnitude. Our test of pre-trends showed a significant difference in baseline trends for the adult and overall models; however, pre-trend adjustment could not be conducted due to the limited number of baseline time points (see Methods).

Tables 1A.7 and 1A.8 report rates of population-based admission rates for asthma at baseline in zip codes distinguished by hospitals' participation in an asthma intervention project. We see that asthma admission rates for both younger adults (18-39) and children (2-17) were higher in the baseline period in zip codes that had at least one hospital participating in the program. These differences of 7.5 visits per 10,000 younger adult beneficiaries per year and 7 visits per 10,000 child beneficiaries were statistically significant.

Table 1A.9 reports the results from a regression analysis examining the effect of the asthma program. We see statistically significant decreases in preventable asthma admissions due to the asthma program in both the 2014-2017 period and the 2018-2020 period ($p<0.05$). The estimates indicate that compared to a zip code that had no exposure to the program, a zip code where all hospitals participated in the asthma program had on an average, 19 fewer preventable asthma hospitalizations per 10,000 Medicaid beneficiaries (for ages 18–39) per year over 2014-2017 and

[6] In sensitivity models using the 90% threshold for the choice set, the impact for all ages (13+) on initiation of treatment reaches marginal statistical significance ($p<0.1$) in the 2018-2020 period and has a magnitude of 0.00029.

20 fewer over 2018-2020. Table 1A.10 shows similar regression results for pediatric asthma hospitalizations where the estimates show increases, but they are not statistically significant.

Diabetes Program: Table 1A.11 reports rates of population-based, diabetes short-term complications admission rates at baseline in zip codes distinguished by hospitals' participation in a diabetes intervention project. We see that diabetes short-term complications admission rates were higher in zip codes that had at least one hospital with a diabetes-related project compared to zip codes served by hospitals participating in other DSRIP disease focus areas; this difference of 5 preventable diabetes admissions per 10,000 beneficiary-years was statistically significant ($p<0.01$).

Table 1A.12 reports the results from a regression analysis examining the effect of the diabetes program. We see a very small decrease in preventable diabetes admissions for short-term complications due to the diabetes DSRIP program over years 2014-2017 and effectively zero change over 2018-2020. Neither of these estimates were statistically significant. The 2014-2017 estimate indicates that compared to a zip code that had no exposure to the program, a zip code where all hospitals participated in the diabetes program had on an average, 1.7 fewer of these preventable diabetes hospitalizations over a year per 10,000 Medicaid beneficiaries (for ages 18 and above).

Table 1A.13 shows two measures of diabetes care, rates of annual eye exams and HbA1c testing, separately for individuals served by hospitals taking part in DSRIP diabetes projects and served by other DSRIP-participating hospitals. The percentages of beneficiaries with diabetes receiving eye exams and HbA1c testing in a year was lower by just above 2 pp for those living in zip codes where at least one attributed hospital took part in a DSRIP diabetes program. These differences were statistically significant ($p<0.01$).

Table 1A.14 reports the results from a regression analysis examining the effect of the diabetes program on eye exams and HbA1c testing. We see a very small statistically significant decrease in diabetic eye exams due to the diabetes DSRIP program over years 2014-2017 and 2018-2019. The 2014-2017 estimate indicates that compared to individuals in zip codes that had no exposure to a diabetes DSRIP project, individuals in a zip code where all hospitals participated in the diabetes program had, on average, 3.9 pp lower likelihood of having a diabetic eye exam ($p<0.01$). Over 2018-2019, the decline was 6.1 pp ($p<0.01$). Results for HbA1c testing were mixed, showing a small increase over 2014-2017 and then a significant decrease of 1.8 pp in the likelihood of having HbA1c testing over 2018-2019 for individuals in zip codes where all serving hospitals participated in DSRIP diabetes projects compared to those with no exposure to such projects ($p<0.05$).

Cardiac Care Program: Tables 1A.15 and 1A.16 report HF and AMI readmission rates in 2012–2013 for patients in hospitals classified by participation in the cardiac care program. Average HF readmission rates were slightly higher for patients in DSRIP hospitals with a cardiac program, but AMI readmission rates were lower by 3.2 pp. Neither difference was statistically significant.

Table 1A.16 reports results from regression analyses examining the effect of the cardiac care program. We estimate small increases in HF readmissions over the two periods, 0.8 and 1.2 pp, but these were not statistically significant. For AMI readmissions, the program effect is reflected in a 2.6 pp increase over 2014-2017 and a 4.4 percentage point over 2018-2020. The 4.4 pp increase was statistically significant ($p<0.05$).

Pneumonia Program: Table 1A.18 reports pneumonia readmission rates in the baseline years for patients in hospitals classified by participation in the pneumonia program. Average pneumonia readmission rates were 3.6 pp lower in the pneumonia DSRIP hospitals than in other DSRIP hospitals, but this baseline difference was not statistically significant.

Table 1A.19 reports results from regression analyses examining the effect of the pneumonia program. The program's effect is reflected in a 2.0 percentage point increase in pneumonia readmissions over 2014-2017, followed by a 2.5 pp decrease over 2018-2020. Both changes were statistically significant. Our test of pre-trends showed a significant difference in baseline trends between the DSRIP hospital conducting a pneumonia project and the comparison hospitals ($p<0.01$); however, there was insufficient variation to produce pre-trend adjusted estimates since only one hospital conducted a pneumonia project.

Obesity Program: Table 1A.20 assesses the percentage of children ages 1-19 years old who had a visit to a primary care physician (PCP) during the baseline period, separately for children in zip codes served by at least one DSRIP-participating hospital with an obesity-focused project versus those in areas served by DSRIP hospitals with other chronic disease focus areas. The percentage of youth with a PCP visit was lower by 1.5 pp in the former population, and this difference was statistically significant ($p<0.01$).

The regression analysis in Table 1A.21 examining the impact of the DSRIP obesity program shows very small changes in the percentage of children and adolescents having a PCP visit in both DSRIP periods, and estimates are not statistically significant. Our test of pre-trends showed a significant difference in baseline trends between the DSRIP hospital conducting an obesity project and comparison hospitals; however, pre-trend adjustment could not be conducted due to the limited number of baseline time points (see Methods).

Table 1A.1: Rates of Follow-up after Hospitalization for Mental Illness at Baseline by DSRIP Hospital Participation in the Behavioral Health Program

(n= 21,504)	Other DSRIP Hospitals	BH DSRIP Hospitals	Percentage Point Difference
7-day follow-up	28.7%	27.7%	-1.0
30-day follow-up	53.5%	53.9%	0.4

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: BH=Behavioral Health.
Discharge-level analysis.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.2: DSRIP Behavioral Health Program's Impact on Follow-up after Hospitalization for Mental Illness

(n=88,594)	**DSRIP BH Program Impact Estimate**
7-Day Follow-up	
2014-2017	-0.002
	(0.016)
2018-2020	0.009
	(0.019)
30-Day Follow-up	
2014-2017	-0.006
	(0.023)
2018-2020	0.012
	(0.027)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: BH=Behavioral Health.
Discharge-level regression analysis with hospital fixed effects.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.3: Rates of Initiation in Alcohol or Other Drug (AOD) Treatment at Baseline by DSRIP Hospital Participation in the Chemical Addiction/Substance Abuse Program

(n= 77,139)	Other DSRIP Hospitals	CA/SA DSRIP Hospitals	Percentage Point Difference
Initiation in AOD Treatment	20.2%	18.7%	-1.6***
Engagement in AOD Treatment	7.8%	6.5%	-1.3***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: CA/SA=Chemical Addiction/Substance Abuse.
Rates are reported for patients in zip codes with DSRIP hospitals participating in the CA/SA program, and also zip codes where hospitals did not take part in the program.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.4: DSRIP Chemical Addiction/Substance Abuse Program's Impact on Initiation and Engagement in Alcohol and Other Drug Treatment

	DSRIP CA/SA Program Impact Estimate		
	Ages 13-17	**Ages 18+**	**Overall**
	(n=15,189)	*(n=314,130)*	*(n=329,319)*
Initiation of AOD Treatment			
2014-2017	0.00006	0.00003	0.00008
	(0.00033)	(0.00009)	(0.00009)
2018-2020	0.00115***	0.00014	0.00022
	(0.00037)	(0.00017)	(0.00017)
Engagement in AOD Treatment			
2014-2017	-0.00021	-0.00004	-0.00001
	(0.00017)	(0.00004)	(0.00005)
2018-2020	0.00040	0.00008	0.00013
	(0.00034)	(0.00014)	(0.00014)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: CA/SA=Chemical Addiction/Substance Abuse.
Patient-level regression analysis with zip code fixed effects.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.5: Emergency Department Visit for Asthma at Baseline by DSRIP Hospital Participation in the Asthma Program

(n= 77,139)	Other DSRIP Hospitals	Asthma DSRIP Hospitals	Percentage Point Difference
Ages 0-17 *(n= 2,343,781)*	2.84%	3.36%	0.52***
Ages 18+ *(n= 2,289,936)*	2.46%	2.66%	0.21***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Note: Estimates reflect the percentage of Medicaid beneficiaries with one or more ED visits for asthma during the year. Percentages in the 'Asthma DSRIP Hospitals' category represent patients in zip code areas where hospitals took part in a DSRIP asthma program. The 'Other DSRIP Hospital' category represents patients in zip codes that have at least one hospital participating in DSRIP, but none participating in the DSRIP asthma program.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.6: DSRIP Asthma Program's Impact on Emergency Department Visits for Asthma

	DSRIP Asthma Project Impact Estimate		
	Ages 0-17	**Ages 18+**	**Overall**
	(n=7,472,816)	*(n=9,656,660)*	*(n=17,129,476)*
ED Visit for Asthma			
2014-2017	-0.00008***	-0.00005***	-0.00007***
	(0.00001)	(0.00001)	(0.00001)
2018-2020	-0.00015***	-0.00012***	-0.00014***
	(0.00002)	(0.00002)	(0.00002)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: ED=Emergency Department.
Person-level regression analysis with zip code fixed effects.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.7: Younger Adult Asthma Admission Rates at Baseline by Area DSRIP Hospital Participation in the Asthma Program (Age 18-39)

(n= 7,368)	Other DSRIP Hospitals	Asthma DSRIP Hospitals	Difference
Younger Adult Asthma Hospitalizations	13.8	21.3	7.5***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 Medicaid beneficiary-years.
The 'Asthma DSRIP' category represents those zip codes that have at least one DSRIP-participating hospital with an asthma project in the 50% choice set. The 'Other DSRIP' category represents those zip codes that have at least one choice set hospital participating in DSRIP, but with a chronic disease focus area other than asthma.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.8: Pediatric Asthma Admission Rates at Baseline by Area DSRIP Hospital Participation in the Asthma Program (Age 2-17)

(n= 7,390)	Other DSRIP Hospitals	Asthma DSRIP Hospitals	Difference
Pediatric Asthma Hospitalizations	22.9	29.9	7.0***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 Medicaid beneficiary-years.
The 'Asthma DSRIP' category represents those zip codes that have at least one DSRIP-participating hospital with an asthma project in the 50% choice set. The 'Other DSRIP' category represents those zip codes that have at least one choice set hospital participating in DSRIP, but with a chronic disease focus area other than asthma.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.9: DSRIP Asthma Program's Impact on Younger Adults Asthma Admission Rate

(n=24,516)	**DSRIP Asthma Project Impact Estimate**
Younger Adult Asthma Admission Rate	
2014-2017	-0.1902**
	(0.077)
2018-2020	-0.2009**
	(0.082)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Rates are per 10,000 Medicaid beneficiary-years for beneficiaries ages 18-39.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.10: DSRIP Asthma Program's Impact on Pediatric Asthma Admission Rate

(n=24,572)		DSRIP Asthma Project Impact Estimate
Pediatric Asthma Admission Rate		
	2014-2017	0.0421
		(0.039)
	2018-2020	0.0081
		(0.039)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Rates are per 10,000 Medicaid beneficiary-years for beneficiaries ages 2-17.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.11: Diabetes Short-Term Complications Admission Rates at Baseline by Area DSRIP Hospital Participation in the Diabetes Program (Age 18+)

(n= 7,605)	Other DSRIP Hospitals	Diabetes DSRIP Hospitals	Difference
Diabetes Short-term Complication Admissions	11.1	16.1	5.0***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 Medicaid beneficiary-years.
The 'Diabetes DSRIP' category represents those zip codes that have at least one DSRIP-participating hospital with a diabetes project in the 50% choice set. The 'Other DSRIP' category represents those zip codes that have at least one choice set hospital participating in DSRIP, but with a chronic disease focus area other than diabetes.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.12: DSRIP Diabetes Program's Impact on Diabetes Short-Term Complications Admission Rate

(n=25,302)		DSRIP Diabetes Project Impact Estimate
Diabetes Short-term Complications Admission Rate		
	2014-2017	-0.017
		(0.020)
	2018-2020	0.002
		(0.021)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Rates are per 10,000 Medicaid beneficiary-years for beneficiaries ages 18+.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.13: Diabetic Eye Exams and HbA1c Testing Rates at Baseline by Area DSRIP Hospital Participation in the Diabetes Program (Age 18-75)

(n= 128,847)	Other DSRIP Hospitals	Diabetes DSRIP Hospitals	Percentage Point Difference
Diabetic Eye Exams	58.4%	56.0%	-2.4***
Diabetes HbA1c Testing	53.6%	51.3%	-2.3***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: HbA1c= Hemoglobin A1c level
Percentages in the 'Diabetes DSRIP Hospitals' category represent patients in zip code areas where hospitals took part in a DSRIP diabetes program. The 'Other DSRIP Hospital' category represents patients in zip codes that have at least one hospital participating in DSRIP, but none participating in the DSRIP diabetes program
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.14: DSRIP Diabetes Program's Impact on Diabetic Eye Exams and HbA1c Testing

(n=688,048)	**DSRIP Diabetes Project Impact Estimate**
Diabetic Eye Exams	
2014-2017	-0.00039***
	(0.00006)
2018-2019	-0.00061***
	(0.00009)
Diabetes HbA1c Testing	
2014-2017	0.00011*
	(0.00006)
2018-2019	-0.00018**
	(0.00008)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data;
Analysis by Rutgers Center for State Health Policy.
Notes: HbA1c= Hemoglobin A1c level
Person-level regression analysis with zip code fixed effects.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.15: Heart Failure Readmission Rates at Baseline by DSRIP Hospital Participation in the Cardiac Care Program (Age 18+)

(n= 4,523)	Other DSRIP Hospitals	Cardiac DSRIP Hospitals	Percentage Point Difference
30-day Readmissions after Heart Failure	17.2%	18.0%	0.8

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Discharge-level analysis.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.16: Acute Myocardial Infarction (AMI) Readmission Rates at Baseline by DSRIP Hospital Participation in the Cardiac Care Program (Age 18+)

(n= 1,680)	Other DSRIP Hospitals	Cardiac DSRIP Hospitals	Percentage Point Difference
30-day Readmissions after AMI	13.6%	10.4%	-3.2

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy. Discharge-level analysis.

*** p<0.01, ** p<0.05, * p<0.1

Table 1A.17: DSRIP Cardiac Program's Impact on 30-Day Readmissions for Heart Failure and Acute Myocardial Infarction

	DSRIP Cardiac Project Impact Estimate
HF Readmissions *(n=23,012)*	
2014-2017	0.008
	(0.014)
2018-2020	0.012
	(0.014)
AMI Readmissions *(n=8,835)*	
2014-2017	0.0259
	(0.0227)
2018-2020	0.0440**
	(0.0207)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.

Notes: Discharge-level regression analysis with hospital fixed effects.

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 1A.18: Pneumonia Readmission Rates at Baseline by DSRIP Hospital Participation in the Pneumonia Program (Age 18+)

(n= 5,986)	Other DSRIP Hospitals	Pneumonia DSRIP Hospital	Percentage Point Difference
30-day Readmissions after Pneumonia	11.1%	7.6%	-3.6

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy. Discharge-level analysis.

*** p<0.01, ** p<0.05, * p<0.1

Table 1A.19: DSRIP Pneumonia Program's Impact on 30-Day Readmissions for Pneumonia

	DSRIP Pneumonia Project Impact Estimate
PN Readmissions *(n=23,285)*	
2014-2017	0.020***
	(0.006)
2018-2019	-0.025***
	(0.007)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Discharge-level regression analysis with hospital fixed effects. Impact estimate is not adjusted for significantly different pre-trends. There was insufficient variation to produce pre-trend adjusted estimates since only one hospital conducted a pneumonia project.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.20: Children and Adolescents' Access to Primary Care Physicians by DSRIP Hospital Participation in the Obesity Program

(n= 1,814,255)	Other DSRIP Hospitals	Obesity DSRIP Hospitals	Percentage Point Difference
Visit to Primary Care Physicians	85.2%	83.7%	-1.5***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Note: Estimates reflect the percentage of Medicaid beneficiaries age 1-19 with one or more PCP visits during the year. Percentages in the 'Obesity DSRIP Hospitals' category represent patients in zip code areas where hospitals took part in a DSRIP obesity program. The 'Other DSRIP Hospital' category represents patients in zip codes that have at least one hospital participating in DSRIP, but none participating in the DSRIP obesity program.

Table 1A.21: DSRIP Obesity Program's Impact on Children and Adolescents' Access to Primary Care Physicians

	DSRIP Obesity Project Impact Estimate
Visit to Primary Care Physicians *(n=5,732,959)*	
2014-2017	-0.00006
	(0.0004)
2018-2019	-0.00064
	(0.0005)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Person-level regression analysis with zip code fixed effects. Impact estimate is not adjusted for significantly different pre-trends. There was insufficient variation to produce pre-trend adjusted estimates since only one hospital conducted an obesity project.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Section A: Impact of DSRIP Program Overall on Medicaid Beneficiaries

30-Day Readmissions: Table 1A.22 shows averages of 30-day readmission rates utilized to assess the overall effect of the DSRIP program. Average rates are for patients in hospitals distinguished by participation in the DSRIP program, for the baseline years 2012–2013. Readmission rates for all conditions were higher in DSRIP hospitals than non-DSRIP hospitals by 3.1 pp for heart failure, 6.7 pp for AMI, 3.0 pp for pneumonia, and 1.7 pp for COPD. Differences for AMI and pneumonia were statistically significant ($p<0.05$), marginally significant for HF ($p<0.1$) and not significant for COPD.

Regression analyses results shown in Table 1A.23 reveal that the overall effect of the DSRIP program measured in terms of changes in any of the four readmission rates was not statistically significant. In terms of magnitude the effect ranges from a 2.7 percentage point decrease over 2014-2017 in readmissions following AMI hospitalizations to a 2.0 percentage point increase in readmissions following hospitalization for heart failure over 2014-2017.

Mental Health Utilization: Table 1A.24 reports mental health utilization rates for beneficiaries in zip codes distinguished by whether the area hospitals participated in the DSRIP program. The utilization rates were 2.4 pp lower at baseline in zip codes with DSRIP-participating hospitals than in zip codes without DSRIP-participating hospitals, and this was statistically significant ($p<0.01$).

The regression analysis in Table 1A.25 shows an increase of 0.2 pp in the likelihood of mental health utilization in 2014-2017 and 0.1 pp in 2018-2020 as zip code DSRIP exposure increases from 0 to 100%. These effects were not statistically significant.

Well-Child Visits: Table 1A.26 reports the percentage of beneficiaries ages 3-6 with a well-child visit in the baseline period in zip codes distinguished by whether at least one area hospital participated in the DSRIP program. The rates were 6.4 pp lower at baseline in zip codes with DSRIP-participating hospitals than in zip codes without DSRIP-participating hospitals, and this was statistically significant ($p<0.01$).

Table 1A.27 shows results of the regression analysis examining the impact of the DSRIP program on well-child visits. We see a decrease of 11.4 pp in the likelihood of children having a well-child visit in 2014-2017 and 13.8 pp decrease in 2018-2020 as zip code DSRIP exposure increases from 0 to 100%. These changes were statistically significant ($p<0.01$).

Avoidable Inpatient Hospitalizations and Associated Costs

Adults

Tables 1A.28 reports rates of avoidable hospitalizations at baseline aggregated across zip codes distinguished by their exposure to the DSRIP program. Rates and costs are reported per 10,000 Medicaid beneficiary-years for ages 18 and older. Compared to zips with no area hospitals participating in DSRIP, rates of avoidable hospitalizations among adults age 18+ were lower in zips where at least one hospital among the choice set of hospitals participated in the program. This difference of 35.3 fewer avoidable hospitalizations per 10,000 Medicaid beneficiaries (age 18+) was statistically significant ($p<0.01$). In contrast, average costs were statistically significantly higher in DSRIP zips compared to non-DSRIP zips over the baseline years ($p<0.05$).

Table 1A.29 reports regression analyses examining the effect of the DSRIP program on avoidable inpatient hospitalizations and avoidable inpatient costs. The effect of the DSRIP program is reflected in an increase in avoidable hospitalizations. On average, as a zip code goes from 0% to 100% exposure to DSRIP, rates of avoidable hospitalizations over a year increased on an average by 11.3 per 10,000 Medicaid beneficiaries in 2014-2017 and 32.2 per 10,000 beneficiaries in 2018-2020. This increase in the second period was statistically significant ($p<0.05$).

This table also reports the ratio of risk ratios (RRR) of costs for avoidable hospitalizations where a magnitude greater than one reflects a positive association between the DSRIP program and avoidable costs. We see the effect of the DSRIP program (measured as the effect of a zip code going from zero to full DSRIP exposure) results in virtually no change (RRR≈1) in avoidable costs.

Youth

In the baseline years, Table 1A.30 shows the avoidable hospitalization rate difference for youth was higher by 2.3 visits per 10,000 Medicaid beneficiaries per year in DSRIP areas, though this was not statistically significant. Avoidable hospitalization costs were also higher in DSRIP areas, though only marginally statistically significant ($p<0.1$).

Table 1A.31 reports regression analyses examining the effect of the DSRIP program on avoidable inpatient hospitalizations and avoidable inpatient costs among youth age 6-17. No statistically significant changes are observed. On average, as a zip code goes from 0% to 100% exposure to DSRIP, rates of avoidable hospitalizations over a year decreased by 4.8 per 10,000 Medicaid beneficiaries in 2014-2017 and 5.4 per 10,000 beneficiaries in 2018-2020. The DSRIP program results in virtually no change (RRR≈1) in avoidable hospitalization costs for youth.

Avoidable Emergency Department Visits and Associated Costs:

Adults

Table 1A.32 shows that the rate of avoidable ED visits at baseline was slightly higher in the group of zip codes which had at least one hospital participating in the DSRIP program compared to those

that had none. This difference of 21.2 avoidable ED visits per 10,000 Medicaid beneficiaries was not statistically significant. Average annual costs associated with avoidable ED visits were also higher in DSRIP zips compared to non-DSRIP zips over the baseline years, but again this difference was not statistically significant.

Table 1A.33 reports regression analyses examining the effect of the DSRIP program on avoidable ED visits and avoidable ED costs among adults. The effect of the DSRIP program is reflected in an increase in avoidable ED visits. On average, as a zip code goes from 0% to 100% exposure to DSRIP, rates of avoidable ED visits over a year increased by 440 per 10,000 Medicaid beneficiaries in 2014-2017 and 422 per 10,000 beneficiaries in 2018-2020. The increases in both periods were statistically significant ($p<0.01$).

This table also reports the ratio of risk ratios (RRR) of costs for avoidable ED visits and shows magnitudes greater than one, meaning a positive association between the DSRIP program and avoidable ED costs. Over both DSRIP periods, avoidable ED costs increased (around 3/10 of a percent) and this was statistically significant.

Youth

Tables 1A.34 and 1A.35 show results of avoidable ED analyses for youth age 0-17. The rate of avoidable ED visits at baseline was higher by 105.2 visits per 10,000 Medicaid beneficiaries per year in the group of zip codes which had at least one hospital participating in the DSRIP program compared to those that had none. This difference was not statistically significant. Average annual costs associated with avoidable ED visits for youth were also higher in DSRIP zips compared to non-DSRIP zips over the baseline years. This difference of $99,601 was statistically significant ($p<0.01$).

Regression analyses examining the effect of the DSRIP program on avoidable ED visits and avoidable ED costs among youth show increases in visits over both periods, but these increases are not statistically significant. The RRR of costs for avoidable ED visits show magnitudes greater than one, meaning over both DSRIP periods, avoidable ED costs increased under the DSRIP program. This increase was statistically significant in 2014-2017 ($p<0.01$), but only marginally significant over 2018-2020 ($p<0.1$).

Racial/Ethnic Disparities in Hospital Readmissions: Table 1A.36 reports regression-based findings from analysis of racial disparities in readmission rates with separate estimates for patients belonging to each of the racial/ethnic categories. The analysis compares changes in readmission rates over time for DSRIP participating hospitals relative to a comparison group of hospitals.

Disparities between whites and both Hispanic patients and patients of other race/ethnicity in readmission rates following heart failure decreased among DSRIP-participating hospitals by 10.6 and 11.7 percentage points, respectively. This difference was statistically significant between Hispanic and white patients ($p<0.05$), but small cell sizes affect the reliability of this estimate. The other statistically significant findings of disparity increases in AMI readmissions were also based on insufficient sample sizes and cannot be deemed reliable. All other changes were not statistically significant.

Gender Disparities in Hospital Readmissions: Table 1A.37 reports findings from the regression analysis examining gender-based disparities in hospital readmissions. There were no statistically significant changes observed. The magnitude and direction of estimates show a 0.5 pp decrease in gender disparities for heart failure readmissions, a 6 pp increase in gender disparities for AMI readmissions, a 2.0 pp decrease in gender disparities for pneumonia readmissions, and a 4.8 pp increase in gender disparities for COPD readmissions.

Racial/Ethnic and Gender Disparities in Avoidable Inpatient Hospitalizations:

Adults

Table 1A.38 reports the extent to which racial/ethnic and gender disparities in avoidable hospitalizations for adults were impacted by the DSRIP program. The coefficient estimates reported here represent the average effect of a 1% increase in DSRIP exposure on the difference in rates of avoidable hospitalizations between any minority group and whites, or correspondingly, the difference in rates of avoidable hospitalizations between females and males. We see that compared to a zip code with zero exposure to DSRIP, a zip code with 100% exposure to DSRIP (100% exposure means that all hospitals, and zero exposure means none of the hospitals serving a zip code, took part in the DSRIP program) had 14 fewer hospitalizations per 10,000 Medicaid beneficiaries over a year, by black patients relative to hospitalizations by white patients. Similarly, the difference in hospitalization rates between other race/ethnicities and whites decreased by 81.6. This latter estimate was statistically significant ($p<0.05$). The rate difference between Hispanic and white patients was 22.5 more visits among Hispanic adults, although this was not statistically significant.

We also found that females had lower rates of hospitalizations compared to males (difference in rates decreased by 14.8 hospitalizations per 10,000 beneficiaries), but the magnitude of this change was not statistically significant.

Youth

Table 1A.39 shows the analogous regression results examining racial/ethnic and gender disparities in avoidable inpatient hospitalizations among youth age 6-17. Estimates show decreases in all disparities, but these results are not statistically significant.

Racial/Ethnic and Gender Disparities in Avoidable ED Visits:

Adults

Table 1.A.40 reports the effect of the DSRIP program on racial/ethnic and gender disparities in avoidable ED visits among adults based on a regression analysis. Estimates show an increase in the difference in rates of avoidable ED visits between Blacks and whites, but this difference was not statistically significant. Estimates for Hispanics compared to whites and females compared to males show decreases (i.e. reduction in disparities) in rate differences, though these are not statistically significant either. The change in the avoidable ED rate difference for those of Other race/ethnicity compared to whites points to a reduction in disparities that was associated with the DSRIP program, and this estimate was marginally statistically significant ($p<0.1$). Compared to a zip code with no DSRIP exposure, in a zip code with full DSRIP exposure, the difference in rates of avoidable ED visits (per 10,000 Medicaid beneficiary-years) between the population of Medicaid beneficiaries belonging to Other race/ethnicity groups and whites decreased by 346 visits per 10,000 beneficiary years.

Youth

Table 1A.41 shows the analogous regression results examining racial/ethnic and gender disparities in avoidable ED visits among youth age 6-17. Estimates show decreases in Black-White and Other race/ethnicity-White disparities and increases in Hispanic-White and Female-Male disparities, but none of these results were statistically significant.

Table 1A.22: Readmission Rates at Baseline by Hospital Participation in the DSRIP Program

(n= 4,890)	Non-DSRIP Hospitals	DSRIP Hospitals	Percentage Point Difference
30-day Readmissions after Heart Failure (*n=4,890*)	14.4%	17.5%	3.1*
30-day Readmissions after AMI *(n=1,809)*	5.4%	12.1%	6.7**
30-day Readmissions after Pneumonia *(n=6,644)*	8.1%	11.1%	3.0***
30-day Readmissions after COPD *(n=6,501)*	12.8%	14.6%	1.7

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy. Discharge-level analysis.

*** p<0.01, ** p<0.05, * p<0.1

Table 1A.23: Overall DSRIP Program Impact on 30-Day Readmissions for Heart Failure, Acute Myocardial Infarction, Pneumonia, and Chronic Obstructive Pulmonary Disease

		Overall DSRIP Impact Estimate
Heart Failure *(n=24,841)*		
	2014-2017	0.020
		(0.034)
	2018-2020	0.008
		(0.028)
Acute Myocardial Infarction *(n=9,437)*		
	2014-2017	-0.0277
		(0.0302)
	2018-2020	-0.0253
		(0.0313)
Pneumonia *(n=25,791)*		
	2014-2017	-0.000
		(0.020)
	2018-2020	0.000
		(0.020)
COPD *(n=26,908)*		
	2014-2017	0.005
		(0.021)
	2018-2020	0.006
		(0.018)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.

Notes: COPD=Chronic Obstructive Pulmonary Disease.

Discharge-level regression analysis with hospital fixed effects.

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 1A.24: Mental Health Utilization at Baseline by Hospital Participation in the DSRIP Program

(n=4,667,183)	No DSRIP	DSRIP	Percentage Point Difference
Mental Health Utilization	9.23%	6.82%	-2.41***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Note: Estimates reflect the percentage of Medicaid beneficiaries with any mental health service utilization during the year.
Percentages in the 'DSRIP' category represent patients in zip code areas where hospitals took part in the DSRIP program. The 'No DSRIP' category represents patients in zip codes that have no hospitals participating in DSRIP.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.25: Overall DSRIP Program Impact on Mental Health Utilization

(n=17,258,262)	**Overall DSRIP Impact Estimate**
Mental Health Utilization	
2014-2017	0.00002
	(0.00002)
2018-2020	0.00001
	(0.00003)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data, Analysis by Rutgers Center for State Health Policy.
Notes: Person-level regression analysis with zip code fixed effects.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.26: Well-Child Visit Rates at Baseline by Hospital Participation in the DSRIP Program

(n=492,933)	No DSRIP	DSRIP	Percentage Point Difference
Mental Health Utilization	71.9%	65.5%	-6.4***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Note: Estimates reflect the percentage of Medicaid beneficiaries age 3-6 with a well-child visit during the year.
Percentages in the 'DSRIP' category represent patients in zip code areas where hospitals took part in the DSRIP program. The 'No DSRIP' category represents patients in zip codes that have no hospitals participating in DSRIP.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.27: Overall DSRIP Program Impact on Well-Child Visits

(n=1,467,351)	**Overall DSRIP Impact Estimate**
Well-Child Visits	
2014-2017	-0.00114***
	(0.00020)
2018-2020	-0.00138***
	(0.00028)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data, Analysis by Rutgers Center for State Health Policy.
Notes: Person-level regression analysis with zip code fixed effects.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.28: Rates of Avoidable Inpatient Hospitalizations and Associated Costs at Baseline by Area Hospital Participation in the DSRIP Program (Age 18+)

(n= 8,209)	**No DSRIP**	**DSRIP**	**Difference**
Avoidable Hospitalizations	296.3	261.0	-35.3***
Avoidable Hospitalization Costs	$873,392	$1,016,320	$142,928***

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 Medicaid beneficiary-years.
DSRIP participation for zip code defined as having at least one DSRIP-participating hospital in the 50% choice set.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.29: Overall DSRIP Program Impact on Rates of Avoidable Inpatient Hospitalizations and Associated Costs (Age 18+)

(n= 26,015)	**DSRIP Overall Impact Estimate**
Avoidable Hospitalizations	
2014-2017	0.113
	(0.143)
2018-2020	0.322**
	(0.143)
Avoidable Hospitalization Costs	
2014-2017	1.000
	(0.001)
2018-2020	1.001
	(0.001)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Estimates for avoidable hospitalizations based on a zip-level regression analysis with zip fixed effects.
Estimates for avoidable hospitalization costs are based on a zip-level generalized linear model with gamma log link.
Results are per 10,000 Medicaid beneficiary-years.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.30: Rates of Avoidable Inpatient Hospitalizations at Baseline by Area Hospital Participation in the DSRIP Program (Age 6-17)

(n= 7,922)	**No DSRIP**	**DSRIP**	**Difference**
Avoidable Hospitalizations	23.8	26.1	2.3
Avoidable Hospitalization Costs	$79,475	$103,771	$24,295*

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 Medicaid beneficiary-years.
DSRIP participation for zip code defined as having at least one DSRIP-participating hospital in the 50% choice set.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.31: Overall DSRIP Program Impact on Rates of Avoidable Inpatient Hospitalizations and Associated Costs (Age 6-17)

(n= 25,076)	**DSRIP Overall Impact Estimate**
Avoidable Hospitalizations	
2014-2017	-0.048
	(0.035)
2018-2020	-0.054
	(0.035)
Avoidable Hospitalization Costs	
2014-2017	1.002
	(0.003)
2018-2020	1.000
	(0.003)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Estimates for avoidable hospitalizations based on a zip-level regression analysis with zip fixed effects.
Estimates for avoidable hospitalization costs are based on a zip-level generalized linear model with gamma log link.
Results are per 10,000 Medicaid beneficiary-years.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.32: Rates of Avoidable Emergency Department (ED) Visits and Associated Costs at Baseline by Area Hospital Participation in the DSRIP Program (Age 18+)

(n= 8,614)	**No DSRIP**	**DSRIP**	**Difference**
Avoidable ED Visits	3,571.6	3,592.8	21.2
Avoidable ED Costs	$753,390	$838,706	$85,316

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 Medicaid beneficiary-years.
DSRIP participation for zip code defined as having at least one DSRIP-participating hospital in the 75% choice set.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.33: Overall DSRIP Program Impact on Rates of Avoidable Emergency Department Visits and Associated Costs (Age 18+)

(n= 26,912)	**DSRIP Overall Impact Estimate**
Avoidable ED Visits	
2014-2017	4.400***
	(1.223)
2018-2020	4.218***
	(1.319)
Avoidable ED Costs	
2014-2017	1.003***
	(0.001)
2018-2020	1.003***
	(0.001)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: ED=Emergency Department
Estimates for avoidable ED visits based on a zip-level regression analysis with zip fixed effects.
Estimates for avoidable ED costs based on a zip-level generalized linear model with gamma log link.
Results are per 10,000 Medicaid beneficiary-years.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.34: Rates of Avoidable Emergency Department (ED) Visits and Associated Costs at Baseline by Area Hospital Participation in the DSRIP Program (Age 0-17)

(n= 8,409)	**No DSRIP**	**DSRIP**	**Difference**
Avoidable ED Visits	2,593.5	2,698.7	105.2
Avoidable ED Costs	$599,025	$698,626	$99,601**

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 Medicaid beneficiary-years.
DSRIP participation for zip code defined as having at least one DSRIP-participating hospital in the 75% choice set.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.35: Overall DSRIP Program Impact on Rates of Avoidable Emergency Department Visits and Associated Costs (Age 0-17)

(n= 26,044)	**DSRIP Overall Impact Estimate**
Avoidable ED Visits	
2014-2017	1.322
	(0.935)
2018-2020	0.775
	(0.980)
Avoidable ED Costs	
2014-2017	1.002***
	(0.001)
2018-2020	1.001*
	(0.001)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: ED=Emergency Department
Estimates for avoidable ED visits based on a zip-level regression analysis with zip fixed effects.
Estimates for avoidable ED costs based on a zip-level generalized linear model with gamma log link.
Results are per 10,000 Medicaid beneficiary-years.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.36: Overall DSRIP Impact on Racial/Ethnic Disparities in 30-Day Readmission Rates for Heart Failure, Acute Myocardial Infarction, Pneumonia, and Chronic Obstructive Pulmonary Disease

	Black Disparities	**Hispanic Disparities**	**Other Disparities**
Heart Failure *(n=24,818)*	-0.018	-0.106**	-0.117*
	(0.066)	(0.047)	(0.065)
AMI *(n=9,437)*	0.063	0.322**	0.098**
	(0.043)	(0.145)	(0.045)
Pneumonia *(n=25,768)*	-0.017	0.014	0.029
	(0.033)	(0.044)	(0.038)
COPD *(n=26,857)*	-0.049	-0.015	-0.032
	(0.042)	(0.077)	(0.046)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data; Analysis by Rutgers Center for State Health Policy.
Notes: AMI=Acute Myocardial Infarction; COPD=Chronic Obstructive Pulmonary Disease.
Discharge-level regression analysis with hospital fixed effects.
Shaded estimates are based on small sample sizes that may affect the reliability of these estimates.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.37: Overall DSRIP Impact on Gender Disparities in 30-Day Readmission Rates for Heart Failure, Acute Myocardial Infarction, Pneumonia, and Chronic Obstructive Pulmonary Disease

	Gender Disparities Impact Estimate
Heart Failure *(n=24,841)*	-0.005
	(0.023)
AMI *(n=9,437)*	0.060
	(0.038)
Pneumonia *(n=25,791)*	-0.020
	(0.038)
COPD *(n=26,908)*	0.048
	(0.032)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data;
Analysis by Rutgers Center for State Health Policy.
Notes: AMI=Acute Myocardial Infarction; COPD=Chronic Obstructive Pulmonary Disease.
Discharge-level regression analysis with hospital fixed effects.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.38: Overall DSRIP Impact on Racial/Ethnic and Gender Disparities in Avoidable Inpatient Hospitalization Rates (Age 18+)

	DSRIP Overall Impact Estimate
Black - White *(n=21,318)*	-0.143
	(0.467)
Hispanic - White *(n=20,330)*	0.225
	(0.380)
Other - White *(n=22,800)*	-0.816**
	(0.330)
Female - Male *(n=24,928)*	-0.148
	(0.222)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data,
Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip fixed effects.
Rates are per 10,000 Medicaid beneficiary-years for beneficiaries age 18 and up.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.39: Overall DSRIP Impact on Racial/Ethnic and Gender Disparities in Avoidable Inpatient Hospitalization Rates (Age 6-17)

	DSRIP Overall Impact Estimate
Black - White *(n=19,228)*	-0.007
	(0.120)
Hispanic - White *(n=20,102)*	-0.076
	(0.085)
Other - White *(n=19,836)*	-0.113
	(0.105)
Female - Male *(n=22,952)*	-0.004
	(0.069)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data, Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip fixed effects.
Rates are per 10,000 Medicaid beneficiary-years for beneficiaries age 18 and up.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.40: Overall DSRIP Impact on Racial/Ethnic and Gender Disparities in Avoidable Emergency Department Visit Rates (Age 18+)

	DSRIP Overall Impact Estimate
Black-White *(n=21,318)*	1.104
	(2.411)
Hispanic-White *(n=20,330)*	-0.551
	(2.016)
Other-White *(22,800)*	-3.464*
	(2.079)
Female-Male *(n= 24,987)*	-0.676
	(1.452)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data, Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip fixed effects.
Rates are per 10,000 Medicaid beneficiary-years for beneficiaries age 18 and up.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1A.41: Overall DSRIP Impact on Racial/Ethnic and Gender Disparities in Avoidable Emergency Department Visit Rates (Age 0-17)

	DSRIP Overall Impact Estimate
Black-White *(n=20,004)*	-1.064
	(1.588)
Hispanic-White *(n=20,634)*	1.446
	(2.016)
Other-White *(21,111)*	-0.508
	(1.266)
Female-Male *(n= 23,673)*	0.175
	(0.808)

Source: Medicaid Fee-for-Service Claims & Managed Care Encounter Data, Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip fixed effects.
Rates are per 10,000 Medicaid beneficiary-years for beneficiaries age 18 and up.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The results of falsification findings are summarized in Table D. Of fourteen models with statistically significant results (p<0.1), four had effect sizes indicating meaningful results. Of those with meaningful results, one had significant results in the falsification model. This was for readmissions due to acute myocardial infarction. We conclude that our meaningful effects remain relevant after being assessed through falsification with the exception of the model for readmissions due to acute myocardial infarction.

Table D: Assessment of Effect Sizes and Falsification Tests

Outcome	Unit of Analysis	Initial Result	Effect Size (2014-2017)	Effect Size (2018-2019/20)	Alternative Outcome	Falsification Test Result
AOD – Initiation (age <18)	Zip-quarter	Second post period exposure coefficient significant at p<0.01	-	<1%	*No suitable alternative outcome to use for falsification purposes and no meaningful effect.*	
Emergency Department Visits for Asthma (All)	Person-year	Both post period exposure coefficient significant at P<0.01	<1%	<1%	*No meaningful effect.*	
Emergency Department Visits for Asthma (Adult)	Person-year	Both post period exposure coefficient significant at P<0.01	<1%	<1%	*No meaningful effect.*	
Emergency Department Visits for Asthma (Youth)	Person-year	Both post period exposure coefficient significant at P<0.01	<1%	<1%	*No meaningful effect.*	
Asthma Preventable Hospitalizations	Zip-quarter	Both post period exposure coefficient significant at P<0.05	-1.24%	-1.31%	Diabetes hospitalizations	Neither post period exposure coefficient is significant p<0.05.
Diabetes- Eye Exam	Person-year	Both post period exposure coefficient	<1%	<1%	*No meaningful effect.*	

Outcome	Unit of Analysis	Initial Result	Effect Size (2014-2017)	Effect Size (2018-2019/20)	Alternative Outcome	Falsification Test Result
		significant at P<0.01				
Diabetes-HbA1c Test	Person-year	First post period exposure coefficient significant at p<0.05	<1%	-	*No meaningful effect.*	
Acute Myocardial Infarction (AMI) Readmissions	Index-event	Second post period exposure coefficient significant at p<0.05	-	45.43%	Pneumonia readmissions	First post period exposure coefficient is significant at p<0.01
Pneumonia Readmissions	Index-event	Both post period exposure coefficient significant at p<0.01	25%	-31.25%	Acute Myocardial Infarction (AMI) Readmissions	Neither post period exposure coefficient is significant p<0.05.
Well-Child Visits in the Third, Fourth, Fifth and Sixth Years of Life (W4)	Person-year	Both post period exposure coefficient significant at P<0.01	-1.74%	-2.11%	EDVA Youth	Neither post period exposure coefficient is significant p<0.05.
Overall Impact on Preventable Hospitalizations	Zip-quarter	Second post period exposure coefficient significant at p<0.01	-	<1%	*No suitable alternative outcome to use for falsification purposes and no meaningful effect.*	
Avoidable Emergency Department Utilization (Adult)	Zip-quarter	Both post period exposure coefficient significant at p<0.01	<1%	<1%	*No meaningful effect.*	
Avoidable Emergency Department Cost (Adult)	Zip-quarter	Both post period exposure coefficient	<1%	<1%	*No meaningful effect.*	

Outcome	Unit of Analysis	Initial Result	Effect Size (2014-2017)	Effect Size (2018-2019/20)	Alternative Outcome	Falsification Test Result
		significant at p<0.01				
Avoidable Emergency Department Cost (Youth)	Zip-quarter	Second post period exposure coefficient significant at p<0.05	<1%	<1%	*No meaningful effect.*	

Section B: Impact of DSRIP Programs on the Uninsured Population by Focus Area

Asthma Program: Tables 1B.1 -1B.4 present the results of the analyses examining the impact of the asthma program on the uninsured population by examining avoidable asthma hospitalizations among children/youth (age 6-17) and young adults (age 18-34).

We did not find a statistically significant difference in rates of avoidable asthma hospitalizations at baseline between two categories of zip codes classified by whether they had at least one hospital participating in the asthma program (See Tables 1B.1 and 1B.2)

Table 1B.3 and 1B.4 report the results from regression analyses for children/youth and adults. We see a small positive impact on younger adult asthma admission rates that was marginally significant ($p<0.1$).[7] The estimate indicates that compared to a zip code that had no exposure to the program, a zip code where all hospitals participated in the asthma program had on an average, 3 fewer preventable asthma hospitalizations per 10,000 uninsured beneficiaries (ages 18-34) over a year. The corresponding decrease for youth/children of age 6-17 was of the same magnitude but not statistically significant.

Diabetes Program: Rate of diabetes short-term complication hospitalizations was higher by 1.8 per 10,000 uninsured beneficiaries in a year in zip codes that had at least one hospital participating in the diabetes program compared to others with DSRIP participating hospitals involved in other programs (See Table 1B.5). This was statistically significant ($p<0.05$).

We do not see an effect of the diabetes program on the uninsured. In Table 1B.6, the regression coefficient indicates that that compared to a zip code that had no exposure to the program, a zip code where all hospitals participated in the diabetes program had on an average, 2 fewer

[7] In sensitivity analysis defining program exposure based on a broader choice set of hospitals accounting for 90% of discharges in a zip code, the impact of DSRIP on the younger adult asthma admission rate was no longer significant.

preventable diabetes hospitalizations per 10,000 uninsured beneficiaries (ages 18+) over a year, but this was not statistically significant.

Table 1B.1: Younger Adult Asthma Admission Rates at Baseline by Area Hospital Participation in the DSRIP Program (Uninsured Population, Age 18-34)

(n= 4,052)	Other DSRIP	Asthma DSRIP	Difference
Younger Adult Asthma Hospitalizations	8.03	8.98	0.94

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 uninsured person-years.
The 'Asthma DSRIP' category represents those zip codes that have at least one DSRIP-participating hospital with an asthma project in the 50% choice set. The 'Other DSRIP' category represents those zip codes that have at least one choice set hospital participating in DSRIP, but with a chronic disease focus area other than asthma.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.2: Pediatric Asthma Admission Rates at Baseline by Area Hospital Participation in the DSRIP Program (Uninsured Population, Age 6-17)

(n= 3,020)	Other DSRIP	Asthma DSRIP	Difference
Pediatric Asthma Hospitalizations	6.74	8.14	1.40

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 uninsured person-years.
The 'Asthma DSRIP' category represents those zip codes that have at least one DSRIP-participating hospital with an asthma project in the 50% choice set. The 'Other DSRIP' category represents those zip codes that have at least one choice set hospital participating in DSRIP, but with a chronic disease focus area other than asthma.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.3: DSRIP Asthma Program's Impact on Younger Adults Asthma Admission Rate (Uninsured Population, 18-34)

(n=14,704)	**DSRIP Asthma Project Impact Estimate**
Younger Adult Asthma Admission Rate	-0.030*
	(0.018)

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Rates are per 10,000 uninsured person-years for adults ages 18-34.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.4: DSRIP Asthma Program's Impact on Pediatric Asthma Admission Rate (Uninsured Population, Age 6-17)

(n=11,120)	**DSRIP Asthma Project Impact Estimate**
Pediatric Asthma Admission Rate	-0.032
	(0.041)

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Rates are per 10,000 uninsured person-years for youth ages 6-17.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.5: Diabetes Short-Term Complications Admission Rates at Baseline by Area Hospital Participation in the DSRIP Program (Uninsured Population, Age 18+)

(n= 4,136)	Other DSRIP	Diabetes DSRIP	Difference
Diabetes Short-term Complication Admissions	8.18	9.99	1.82**

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 uninsured person-years.
The 'Diabetes DSRIP' category represents those zip codes that have at least one DSRIP-participating hospital with a diabetes project in the 50% choice set. The 'Other DSRIP' category represents those zip codes that have at least one choice set hospital participating in DSRIP, but with a chronic disease focus area other than diabetes.
Significance of difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.6: DSRIP Diabetes Program's Impact on Diabetes Short-Term Complications Admission Rate (Uninsured Population, Age 18+)

(n=15,320)	**DSRIP Diabetes Project Impact Estimate**
Diabetes Short-term Complications Admission Rate	-0.018
	(0.013)

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Rates are per 10,000 uninsured person-years for adults ages 18+.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Section B: Impact of DSRIP Program Overall on the Uninsured Population

Avoidable Inpatient Hospitalizations: Tables 1B.7 -1B.10 present the results of the analyses examining the impact of the DSRIP program overall on avoidable hospitalizations among the uninsured population, separately examining children (age 6-17) and adults (18+).

Rate of inpatient hospitalizations was lower at baseline among uninsured adults in zip codes with at least one DSRIP participating hospital (Table 1B.7) compared to zip codes without participating hospitals ($p<0.1$). Among uninsured youth, the rate was higher for those residing in DSRIP exposed areas, but this difference was not statistically significant (Table 1.B.8).

Table 1B.9 reveals a positive impact of the DSRIP program on avoidable hospitalizations among uninsured population, age 18+. Compared to a zip code that had no exposure to the program, a zip code where all hospitals participated in the DSRIP program had on an average, 71 fewer preventable asthma hospitalizations per 10,000 uninsured beneficiaries (ages 18+) over a year. The effect on children/youth (age 6-17) was much smaller in magnitude, in the opposite direction and not statistically significant (See Table 1B.10).

Avoidable Emergency Department Visits: Tables 1B.11 -1B.14 present the results of the analyses examining the impact of the DSRIP program overall on avoidable ED visits among the uninsured population, separately examining children/youth (age 0-17) and adults (18+).

Rates of avoidable ED visits were higher among zip codes which had at least one DSRIP participating hospitals both for adults and children/youth. The differences were respectively 366.8 and 929.4 per 10,000 uninsured people ($p<0.01$). (See Tables 1B.11 and 1B.12).

Regression results indicate the DSRIP program was associated with a decrease in avoidable ED visits among uninsured adults (Table 1B.13). Compared to a zip code that had no exposure to the program, a zip code where all hospitals participated in the DSRIP program had on an average, 1,511 fewer avoidable ED visits per 10,000 uninsured beneficiaries (ages 18+) over a year.

The effect on children/youth (age 6-17) was much smaller in magnitude, in the opposite direction and marginally significant ($p<0.1$) (See Table 1B.14). When we conducted sensitivity analysis with a more expansive choice set of hospitals, this effect was no longer significant.

Table 1B.7: Rates of Avoidable Inpatient Hospitalizations at Baseline by Area Hospital Participation in the DSRIP Program (Uninsured Population, Age 18+)

(n= 4,440)	**No DSRIP**	**DSRIP**	**Difference**
Avoidable Hospitalizations	83.52	74.13	-9.39*

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 uninsured person-years.
DSRIP participation for zip code defined as having at least one DSRIP-participating hospital in the 50% choice set.
Significance of baseline difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.8: Rates of Avoidable Inpatient Hospitalizations at Baseline by Area Hospital Participation in the DSRIP Program (Uninsured Population, Age 6-17)

(n= 3,236)	**No DSRIP**	**DSRIP**	**Difference**
Avoidable Hospitalizations	8.71	11.77	3.06

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 uninsured person-years.
DSRIP participation for zip code defined as having at least one DSRIP-participating hospital in the 50% choice set.
Significance of baseline difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.9: Overall DSRIP Program Impact on Rates of Avoidable Inpatient Hospitalizations (Uninsured Population, Age 18+)

(n= 15,540)	**DSRIP Overall Impact Estimate**
Avoidable Hospitalizations	-0.714***
	(0.148)

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Results are per 10,000 uninsured person-years for adults ages 18+.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.10: Overall DSRIP Program Impact on Rates of Avoidable Inpatient Hospitalizations (Uninsured Population, Age 6-17)

(n= 11.260)	**DSRIP Overall Impact Estimate**
Avoidable Hospitalizations	0.024
	(0.056)

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Results are per 10,000 uninsured person-years for adults ages 18+.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.11: Rates of Avoidable Emergency Department (ED) Visits at Baseline by Area Hospital Participation in the DSRIP Program (Uninsured Population, Age 18+)

(n= 4,440)	**No DSRIP**	**DSRIP**	**Difference**
Avoidable ED Visits	2,452.8	2,819.6	366.8***

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 uninsured person-years.
DSRIP participation for zip code defined as having at least one DSRIP-participating hospital in the 50% choice set.
Significance of baseline difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.12: Rates of Avoidable Emergency Department (ED) Visits at Baseline by Area Hospital Participation in the DSRIP Program (Uninsured Population, Age 0-17)

(n= 3,296)	**No DSRIP**	**DSRIP**	**Difference**
Avoidable ED Visits	1,666.0	2,595.4	929.4***

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Rates are per 10,000 uninsured person-years for youth age 0-17.
DSRIP participation for zip code defined as having at least one DSRIP-participating hospital in the 50% choice set.
Significance of baseline difference tested using weighted zip-level regression analysis with robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.13: Overall DSRIP Program Impact on Rates of Avoidable Emergency Department Visits (Uninsured Population, Age 18+)

(n= 15,540)	**DSRIP Overall Impact Estimate**
Avoidable ED Visits	-15.114***
	(2.872)

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Results are per 10,000 uninsured person-years for adults ages 18+.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 1B.14: Overall DSRIP Program Impact on Rates of Avoidable Emergency Department Visits (Uninsured Population, Age 0-17)

(n= 11,536)	**DSRIP Overall Impact Estimate**
Avoidable ED Visits	4.249*
	(2.423)

Source: AHRQ HCUP hospital discharge data; Analysis by Rutgers Center for State Health Policy.
Notes: Zip-level regression analysis with zip code fixed effects.
Results are per 10,000 uninsured person-years for youth age 0-17.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table E summarizes the direction and statistical significance of computed DSRIP effects based on all of the metrics analyzed in this chapter. This representation of results organized by each hypothesis, helps determine the presence or absence of evidence in support of each hypothesis over the DSRIP implementation period.

Hypothesis 1: DSRIP hospital projects improve care and outcomes related to the project focus area.

- There were statistically significant improvements reflected in decreasing rates of avoidable asthma hospitalizations for Medicaid adults attributable to the DSRIP asthma disease management programs. ED visits for asthma for Medicaid beneficiaries of all ages also showed statistically significant decreases, but the magnitude of these changes was very small. There were also marginally significant declines in avoidable asthma hospitalizations for the uninsured youth, but these were, again, too small to be deemed meaningful. Initiation in alcohol or other drug treatment in regions served by hospitals adopting chemical addiction/substance abuse programs had effect estimates indicating improvements and while this was statistically significant for youth ages 13-17, the effect size was very small. There were mixed and non-significant effects for engagement in alcohol or other drug treatment. Outcomes for assessing the impact of diabetes projects showed mixed results of small magnitudes in the Medicaid population. Therefore, even though diabetic eye exam rates had statistically significant declines attributable to DSRIP diabetes management projects, the effect size was too small to be considered meaningful. Avoidable hospitalizations for short-term diabetes complications showed small, but not statistically significant improvements in the uninsured population served by hospitals participating in DSRIP diabetes projects. Readmissions following AMI hospitalizations increased for Medicaid beneficiaries in hospitals undertaking cardiac care DSRIP projects. This increase was statistically significant and of a meaningful magnitude, but significant results from falsification models for cardiac care DSRIP projects indicate this association could be spurious. Pneumonia readmission rates worsened at the hospital conducting a pneumonia DSRIP project compared to hospitals with DSRIP projects in other focus areas during the 2014-2017 DSRIP implementation period, but then improved by a commensurate amount over 2018-2020. Quality indicators for other chronic diseases showed no significant changes attributable to DSRIP activities.

Hypothesis 2: The DSRIP program improves the quality of ambulatory care, both recommended and preventive, with positive effects on population health.

- There were no positive impacts of the DSRIP program detected on quality of ambulatory care for the Medicaid population. In contrast, we found statistically significant decreases in the rate of well-child visits in the 3rd – 6th year of life for children living in areas served

by DSRIP participating hospitals, and this finding was of a meaningful magnitude and robust to falsification tests. We also find that as a geographic area's exposure to DSRIP-participating hospitals increased, rates of avoidable inpatient hospitalizations and avoidable emergency department visits worsened (increased in magnitude) for all ages, and while reaching statistical significance for adults, the effect size was below our threshold for being considered meaningful. Costs associated with these avoidable ED visits increased accordingly and this negative impact was also statistically significant, but again very small. Results for readmission rates were mixed and none were statistically significant. Among the uninsured population, we found improvements in avoidable inpatient hospitalization rates in geographic areas with greater exposure to DSRIP-participating hospitals compared to areas with less exposure. This finding was small, but of a meaningful magnitude and statistically significant. Rates of avoidable ED visits also showed statistically significant improvements among the uninsured population.

Hypothesis 3: The DSRIP program will reduce racial/ethnic and gender disparities in avoidable hospital admissions, treat-and-release ED visits, and hospital readmissions.

- Changes in racial/ethnic disparities in 30-day readmissions or avoidable hospital use among Medicaid beneficiaries that could be attributed to DSRIP showed a mix of positive and negative results, and most effects were either not statistically significant or based on small sample sizes which limit their reliability. The two statistically significant results ($p<0.05$) with sufficient sample indicate improvements in disparities. There was a statistically significant reduction in disparities for heart failure readmissions among minorities of other racial/ethnic groups compared to whites that could be attributable to DSRIP activities. For this same population group, there was also a statistically significant reduction in disparities in avoidable inpatient admissions in regions served by DSRIP-participating hospitals. DSRIP impacts on gender disparities were also mixed and not statistically significant.

Table E: Summary of Results by Hypothesis

Hypothesis 1: Focus Area Impact	
Metric	**+/-**
Medicaid Population	
FU after MI Hosp – 7 days	+/-
FU after MI Hosp – 30 days	+/-
Initiation AOD	+
Age 13–17	+
Age 18+	+
Engagement AOD	+/-
Age 13–17	+/-
Age 18+	+/-
ED Asthma (Age 0–17)	+
ED Asthma (Age 18+)	+
Avoidable Asthma IP (Age 2-17)	-
Avoidable Asthma IP (Age 18+)	**+**
Avoid. Diabetes Hospitalizations	+/-
Diabetic Eye Exams	-
Diabetes HbA1c Testing	+/-
HF Readmissions	-
AMI Readmissions	-
PN Readmissions	+/-
Child Access to PCP	-
Uninsured Population	
Avoidable Asthma IP (Age 2-17)	+
Avoidable Asthma IP (Age 18+)	+
Avoid. Diabetes Hospitalizations	+

Hypothesis 2:[1] Overall Impact	
Metric	**+/-**
Medicaid Population	
HF Readmissions	-
AMI Readmissions	+
PN Readmissions	+/-
COPD Readmissions	-
MH Utilization	+
Well-Child Visits	**-**
Avoidable IP (Age 6-17)	+
Avoidable IP (Age 18+)	-
Avoidable ED (Age 0-17)	-
Avoidable ED (Age 18+)	-
Avoidable IP $	+
Avoidable ED $	-
Uninsured Population	
Avoidable IP (Age 6-17)	-
Avoidable IP (Age 18+)	**+**
Avoidable ED (Age 0-17)	-
Avoidable ED (Age 18+)	+

Hypothesis 3: Disparities Impact				
Metric	**Black**	**Hispanic**	**Other**	**Female**
	+/-	**+/-**	**+/-**	**+/-**
Medicaid Population				
HF Readmissions	+	+[1]	+	+
AMI Readmissions[2]	-	-	-	-
PN Readmissions	+	-	-	+
COPD Readmissions	+	+[1]	+	-
Avoidable IP (youth)	+	+	+	+
Avoidable IP (adult)	+	-	+	+
Avoidable ED (youth)	+	-	+	-
Avoidable ED (adult)	-	+	+	+

Notes: "+" means direction of the estimated impact indicates either no effect or an improvement; "-" means direction of the estimated impact indicates a worsening; "+/-" indicates a mixed direction of effects over the two time periods; $p<0.1$; $p<0.05$; Bolded outline indicates result was robust in sensitivity analyses, consistent across periods, was of a meaningful magnitude (>1% change from overall baseline), and was not falsified (when testing was possible).

[1] Small sample affects the reliability of the Hispanic-White disparities estimate.

[2] Small sample affects the reliability of all the racial/ethnic disparities estimates for this outcome.

Conclusions

Our analysis of quality metrics related to patient care, health outcomes and costs broadly shows:

- Hypothesis 1, that DSRIP hospital projects improve care and outcomes related to the project focus area, is supported with respect to the asthma chronic disease focus area. Other disease focus areas have not had clinically meaningful (very small magnitude) or consistent effects on the population-level.
- Hypothesis 2, that the DSRIP program improves the quality of ambulatory care with positive effects on population health, is not supported for the Medicaid population. We find indications of declines in the quality of ambulatory care when comparing DSRIP areas to areas with less exposure to DSRIP hospitals. There is support for this hypothesis among the uninsured population where rates of avoidable hospitalizations and avoidable ED visits for adults have shown DSRIP-attributable decreases.
- Hypothesis 3, that the DSRIP program will reduce racial/ethnic and gender disparities, is supported for the Medicaid population, a positive finding. We observe some progress towards reduction of racial/ethnic disparities as a result of DSRIP-participating hospitals' activities. The most reliable effects of DSRIP on racial/ethnic disparities have been positive, reducing heart failure readmissions and avoidable inpatient visits for patients of other racial/ethnic groups compared to Whites. There is no evidence of change in gender disparities among the Medicaid population due to DSRIP.

It is important to remember the program effects reported in this chapter are evaluated for the DSRIP-exposed Medicaid and uninsured populations, of which the DSRIP attributed population used for calculating pay-for-performance metrics is only a subset. Thus, the evaluation examines program impacts that are discernible in a broader Medicaid and uninsured population due to disease management efforts directed towards particular subsets of the population. However, this is consistent with assessing the overall objective of the program which is to improve health of the entire low income population.

Limitations

The estimates presented in this chapter were derived using a conservative analytic methodology where we examined the impact of hospital participation in the program at any point of time. However, sensitivity tests conducted, as described in the Methods, did not yield results that differed in direction or significance (except where noted), but the magnitude of effects reported would be different for these alternative specifications. Moreover, if there are positive spillover effects of DSRIP on the comparison group, then difference-in-difference estimates will not accurately capture the effect of the program.

It is also important to acknowledge that the overall program impacts may have been susceptible to unobserved factors due to the small number of non-participating comparison hospitals. However, this potential limitation is mitigated by fixed effects estimation and, additionally, by the dose response framework of models for all population-level metrics that utilize a continuous measure of exposure to assess program effects.

The Medicaid claims and encounter data available to us for this assessment also present specific limitations related to the dual-eligible population. Duals in managed care plans may not always have all of their utilization captured in the Medicaid claims data. This may underestimate utilization and also inaccurately measure health status and co-morbidities when these measures are derived from claims (e.g., as is done for the CDPS and hospital readmission risk factors). We believe that the effect of these factors on our findings should be minimal since we use a comparison group which would also be subject to such effects. As a result our pre-post analysis should mitigate these effects to a large extent.

References

AHRQ (Agency for Healthcare Research and Quality). 2015a. "Engagement of Alcohol and Other Drug (AOD) Treatment: Percentage of Members Who Initiated Treatment and Who Had Two or More Additional Services with a Diagnosis of AOD within 30 Days of the Initiation Visit." National Quality Measures Clearinghouse. Accessed September 23. https://www.qualitymeasures.ahrq.gov/summaries/summary/49778.

———. 2015b. "Follow-up after Hospitalization for Mental Illness: Percentage of Discharges for Members 6 Years of Age and Older Who Were Hospitalized for Treatment of Selected Mental Illness Diagnoses and Who Had an Outpatient Visit, an Intensive Outpatient Encounter, or Partial Hospitalization with a Mental Health Practitioner within 7 Days of Discharge." National Quality Measures Clearinghouse. Accessed September 23. https://www.qualitymeasures.ahrq.gov/summaries/summary/49734.

———. 2016a. "Pediatric Quality Indicators Technical Specifications." Accessed October 28, 2019. https://www.qualityindicators.ahrq.gov/Archive/PDI_TechSpec_ICD10_v60.aspx.

———. 2016b. "Prevention Quality Indicators Technical Specifications." Accessed October 28, 2019. https://www.qualityindicators.ahrq.gov/Modules/PQI_TechSpec.aspx.

Akosa Antwi Y, AS Moriya, K Simon, and BD Sommers. 2015. "Changes in Emergency Department Use Among Young Adults After the Patient Protection and Affordable Care Act's Dependent Coverage Provision." *Ann Emerg Med* 65(6): 664-672.

Basu J, B Friedman, and H Burstin. 2004. "Managed Care and Preventable Hospitalization among Medicaid Adults." *Health Services Research* 39 (3): 489–510.

Benbassat J, and M Taragin. 2000. "Hospital Readmissions as a Measure of Quality of Health Care: Advantages and Limitations." *Archives of Internal Medicine* 160 (8): 1074–81.

Billings J, N Parikh, and T Mijanovich. 2000. *Emergency Department Use: The New York Story*. New York: Commonwealth Fund. http://www.commonwealthfund.org/~/media/Files/Publications/Issue%20Brief/2000/Nov/Emergency%20Room%20Use%20%20The%20New%20York%20Story/billings_nystory%20pdf.pdf.

Billings J, L Zeitel, J Lukomnik, TS Carey, AE Blank, and L Newman. 1993. “Impact of Socioeconomic Status on Hospital Use in New York City.” *Health Affairs (Millwood)* 12 (1): 162–73.

Bindman AB, K Grumbach, D Osmond, M Komaromy, K Vranizan, N Lurie, J Billings, and A Stewart. 1995. “Preventable Hospitalizations and Access to Health Care.” *Journal of the American Medical Association* 274 (4): 305–11.

BLS (Bureau of Labor Statistics). 2021. “CPI for All Urban Consumers (CPI-U).” United States Department of Labor. Accessed September 24. https://data.bls.gov/timeseries/CUUR0000SAM?output_view=data.

DeLia D, JC Cantor, A Tiedemann, and CS Huang. 2009. “Effects of Regulation and Competition on Health Care Disparities: The Case of Cardiac Angiography in New Jersey.” *Journal of Health Politics, Policy and Law* 34 (1): 63–91.

Howard DL, FB Hakeem, C Njue, T Carey, and Y Jallah. 2007. “Racially Disproportionate Admission Rates for Ambulatory Care Sensitive Conditions in North Carolina.” *Public Health Reports* 122 (3): 362–72.

Jencks SF, MV Williams, and EA Coleman. 2009. “Rehospitalizations among Patients in the Medicare Fee-for-Service Program.” *New England Journal of Medicine* 360 (14): 1418–28.

Kronick R, T Gilmer, T Dreyfus, and L Lee. 2000. “Improving Health-Based Payment for Medicaid Beneficiaries: CDPS.” *Health Care Financing Review* 21 (3): 29–64.

NCQA (National Committee for Quality Assurance). 2014. *HEDIS 2014: Healthcare Effectiveness Data and Information Set. Vol. 2: Technical Specifications for Health Plans.* Washington, DC: NCQA.

———. 2016. *HEDIS 2016: Healthcare Effectiveness Data and Information Set. Vol. 2: Technical Specifications for Health Plans.* Washington, DC: NCQA.

———. 2018. *HEDIS 2018: Healthcare Effectiveness Data and Information Set. Vol. 2: Technical Specifications for Health Plans.* Washington, DC: NCQA.

———. 2020. *HEDIS 2018: Healthcare Effectiveness Data and Information Set. Vol. 2: Technical Specifications for Health Plans.* Washington, DC: NCQA.

NIDA (National Institute on Drug Abuse). 2018. "How effective is drug addiction treatment?" Accessed June 17. https://www.drugabuse.gov/publications/principles-drug-addiction-treatment-research-based-guide-third-edition/frequently-asked-questions/how-effective-drug-addiction-treatment.

———. 2015. "Webinar 8: Performance Measurement and Attribution." Presentation at the New Jersey DSRIP Training Webinar, Trenton, NJ, February 11. https://dsrip.nj.gov/Documents/Webinar%208_Performance%20Measurement%20and%20Attribution_02-11-2015.pdf.

Prasad V and AB Jena. 2013. "Prespecified falsification end points: can they validate true observational associations?" *JAMA* 309(3): 241-242.

QualityNet. 2017. "Measure Methodology Reports." Accessed November 12. http://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier4&cid=1219069855841.

SAMSHA (Substance Abuse and Mental Health Services Administration). 2020. "Medication Assisted Treatment (MAT)." Accessed June 17. https://www.integration.samhsa.gov/clinical-practice/mat/mat-overview.

Trudnak T, D Kelley, J Zerzan, K Griffith, HJ Jiang, and GL Fairbrother. 2014. "Medicaid Admissions and Readmissions: Understanding the Prevalence, Payment, and Most Common Diagnoses." *Health Affairs (Millwood)* 33 (8): 1337–44.

U.S. Census Bureau. 2021. American Community Survey 5-year Summary File Data [Data file]. Retrieved from https://www.census.gov/programs-surveys/acs/data/summary-file.2019.html.

Willage B. 2020. "Unintended consequences of health insurance: Affordable Care Act's free contraception mandate and risky sex." *Health Economics* 29: 30–45.

Appendix A: Description of Measures

Ambulatory Care Sensitive (ACS) Inpatient Hospitalizations and Avoidable/Preventable Emergency Department Visits: We calculate rates of ACS inpatient (IP) hospitalizations and avoidable treat-and-release ED visits that may occur due to inadequate ambulatory/primary care within communities. Avoidable hospitalizations have been widely used in previous research to measure access to primary care, and disparities in health outcomes (Basu, Friedman, and Burstin 2004; Billings et al. 1993; Bindman et al. 1995; Howard et al. 2007).

The federal Agency for Healthcare Research and Quality (AHRQ) provides validated programming algorithms to calculate rates of avoidable ACS hospitalizations which are used in this analysis. These are known as the Prevention Quality Indicators (PQI) for adults (ages 18 and above) and Pediatric Quality Indicators (PDI) for children (ages 6-17). For years 2011 through September of 2015 we used version 4.5 of AHRQ's quality indicators software. Version 6.0 of the software accommodates ICD-10 codes and was used for calculating PQIs and PDIs from October 2015 through June 2020 (AHRQ 2016a; 2016b). Updates and enhancements made to the version 6.0 software included the exclusion of one very low prevalence component indicator.

Appendix B gives a list of ACS conditions that constitute the adult and pediatric composite indices that measure the overall rate of avoidable IP hospitalizations per unit of population. We also report two of the individual PQI rates that are specific to two of the chronic disease focus areas of the DSRIP program: PQI #01 Diabetes short-term complications admission rate and PQI #15 Adult asthma admissions rate. These two PQI component metrics are also part of the Medicaid Adult Core Set of Health Care Quality Measures. For the pediatric population, we report PDI #14 Asthma admission rate.

We calculate avoidable treat-and-release ED visits based on the methodology provided by the New York University, Center for Health and Public Service Research (Billings, Parikh, and Mijanovich 2000). These comprise three categories of avoidable ED visits that could have been treated in an outpatient primary care setting or could have been prevented with timely access to primary care. Detailed definitions of these classifications are provided with examples in Appendix C. ICD-10 versions of diagnosis codes for this metric were provided on the New York University website.[8]

Readmissions: Because hospital readmissions can result from poor quality of care or inadequate transitional care, 30-day readmissions metrics are used to broadly measure the quality of care

[8] http://wagner.nyu.edu/faculty/billings/nyued-background.

delivered by hospitals (Benbassat and Taragin 2000; Jencks, Williams, and Coleman 2009). Such 'potentially preventable' readmissions are defined as readmission for any cause within 30 days of the discharge date for the index hospitalization, excluding a specified set of planned readmissions. While readmissions rates have been most heavily utilized to assess quality for the Medicare population, calculating these measures among the Medicaid population has received growing attention (Trudnak et al. 2014). The readmissions metrics we calculate [heart failure (HF), pneumonia (PN), acute myocardial infarction (AMI), and chronic obstructive pulmonary disease (COPD)] are endorsed by the National Quality Forum (NQF) and are adapted from the federal Centers for Medicare and Medicaid Services methodology available at QualityNet (2017). The specification versions used by year were:

	AMI	HF	COPD	PN
2012	v7.0	v7.0[a]	v3.0	v9.0
2013	v7.0	v7.0[a]	v3.0	v9.0
2014	v7.0	v7.0[a]	v3.0	v9.0
2015	v7.0	v7.0[a]	v3.0	v9.0
2016	v10.0	v10.0	v6.0	v9.0
2017	v11.0	v11.0	v7.0	v11.0
2018	v12.0	v12.0	v8.0	v12.0
2019	v13.0	v13.0	v9.0	v13.0
2020	v13.0	v13.0	v9.0	[b]

[a]The HF cohort respecification in v10.0 was applied to these earlier years as well.

[b]Due to COVID-19's substantial impact on this metric, it was not calculated for 2020.

We consider index admissions and readmissions at any NJ general acute care hospital. In accordance with specifications for all Centers for Medicare and Medicaid Services (CMS) readmissions metrics, we required that the beneficiary be enrolled for 12 months prior to the index hospitalization (ignoring gaps of 45 days or less) to allow for sufficient claims history for risk-adjustment. Therefore, estimates for year 2011 could not be calculated due to this restriction. We also modified the metric slightly by identifying readmissions for hospital discharges through December 31 of the CY (instead of through December 1) and looking for readmission events that could occur in the beginning of the following year.

ED Visits for Asthma: Visits to the ED for asthma can result from inefficient or improper symptom management. This metric assesses the percent of patients who had a visit to an Emergency Department for asthma. It is based off a quality metric developed by the Health Resources and Services Administration's (HRSA) Asthma Collaborative which was designed to help providers improve the care they provide to people with asthma and is part of an effort to reduce disparities in the treatment of chronic diseases. In our calculation of this metric we look at whether individuals had any ED visit in the year (the HRSA metric looks at 6 months) and we do not include

visits to urgent care offices. We use the National Committee of Quality Assurance's (NCQA) Healthcare Effectiveness Data and Information Set (HEDIS) value sets to define ED visits and asthma diagnoses as done for the ED discharge component of the NCQA metric "Relative Resource Use for People with Asthma" (NCQA 2014; 2016; 2018; 2020).

Mental Health Utilization: This measure of utilization assess the extent to which individuals use any mental health services in any of the following settings: inpatient, intensive outpatient, partial hospitalization, outpatient, emergency department, or via telehealth. We followed the NCQA HEDIS specifications for the calculation of this metric (NCQA 2014; 2016; 2018; 2020), adapting as necessary to the available variables in our Medicaid claims database. For consistency across years, we do not exclude individuals on hospice since this criteria was not introduced until 2018 specifications.

Follow-up after Hospitalization for Mental Illness: Following a hospitalization for mental illness, it is recommended that patients have an outpatient visit with a mental health practitioner to ensure appropriate and regular follow-up therapy and medication monitoring (AHRQ 2015b). This measure is used to assess the percentage of discharges for members age 6 and older hospitalized for the treatment of selected mental health disorders that were followed by a qualifying visit with a mental health practitioner within 7 and 30 days. This measure is endorsed by the NQF and is part of the Medicaid Adult Core and Child Core Sets of Health Care Quality Measures. We followed the National Committee of Quality Assurance's specifications for the calculation of this metric (NCQA 2014; 2016; 2018; 2020), adapting as necessary to the available variables in our Medicaid claims database. For consistency across years, we do not exclude individuals on hospice since this criteria was not introduced until 2018 specifications.

Initiation and Engagement in Alcohol and Other Drug Abuse or Dependence Treatment: After identification of alcohol or drug (AOD) dependence, initiation and engagement in treatment for the condition is important for reducing morbidity and mortality due to substance use disorder and improving productivity and social outcomes for those afflicted (AHRQ 2015a; NIDA 2018; SAMSHA 2020). The AOD initiation metric assesses the percentage of individuals ages 13 and older with a new episode of alcohol or other drug dependence who have service use indicating initiation of treatment within 14 days of their diagnosis. The engagement AOD metric taps an intermediate point in care after initiation, but prior to completion of a full course of treatment. It measures the percentage of individuals with an AOD diagnosis who initiated treatment and also had service use signifying treatment engagement within 30 days after the date of the initiation encounter. Both of these measures are endorsed by the NQF and are part of the Medicaid Adult Core Set of Health Care Quality Measures.

We followed the NCQA's HEDIS specifications for the calculation of this metric (NCQA 2014; 2016; 2018; 2020), adapting as necessary to the available variables in our Medicaid claims database in consultation with the Business Intelligence Unit of the Division of Medical Assistance and Health Services (DMAHS) and other State subject matter experts.[9] We also modified the metric slightly by identifying index episodes of AOD through December 31 of each CY (instead of through mid-November) and identifying initiation and engagement service use that could extend into the beginning of the following year. For consistency across years, we do not exclude individuals on hospice since this criteria was not introduced until 2018 specifications.

Comprehensive Diabetes Care: Hemoglobin A1C Testing and Diabetic Eye Exam*:* Unmanaged diabetes can lead to serious health complications. We used NCQA's Comprehensive Diabetes Care measure specifications to assess whether individuals age 18-75 with diabetes had Hemoglobin A1c testing and a retinal eye exam performed during the measurement year (NCQA 2014; 2016; 2018; 2020). In accordance with these specifications, we required that the beneficiary be enrolled for 12 months (ignoring gaps of 45 days or less) to be included in this measure. For consistency across years, we do not exclude individuals on hospice since this criteria was not introduced until 2018 specifications.

Well Child Visits in the 3rd, 4th, 5th, and 6th Year of Life*:* It is recommended that children have regular well-child visits in the early years of life to receive necessary preventive care and track growth and development. This measure determines the percentage of children 3-6 years of age who had at least one well-child visit with a primary care provider during the measurement year. We followed the NCQA HEDIS specifications for the calculation of this metric (NCQA 2014; 2016; 2018; 2020). In accordance with these specifications, we required that the beneficiary be enrolled for 12 months (ignoring gaps of 45 days or less) to be included in this measure. For consistency across years, we do not exclude individuals on hospice since this criteria was not introduced until 2018 specifications.

Children's and Adolescents' Access to Primary Care Practitioners*:* Primary care is important for the health of children and adolescents and helps reduce avoidable emergency department visits. This measure determines the percentage of children and adolescents 1-19 years of age who had at least one visit with a primary care provider during the measurement year. We followed the NCQA HEDIS specifications for the calculation of this metric (NCQA 2014; 2016; 2018; 2020). In accordance with these specifications, we required that the beneficiary be enrolled for 12 months

[9] For years 2016-2020, we included additional state-specific MAT codes in the AOD Medication Treatment Value Set. Additionally, the Place of Service (POS) variable in our claims database is not as detailed as the federal POS variable referenced in NCQA HEDIS specifications. We used an approved translation of the POS variable provided to us by DMAHS subsequent to discussions with CMS.

(ignoring gaps of 45 days or less) to be included in this measure. For consistency across years, we do not exclude children or adolescents on hospice since this criteria was not introduced until 2018 specifications.

Table F enumerates the measure stewards, measure collections, and National Quality Forum numbers for all evaluator-calculated metrics used in this report.

Table F: Reference Information for Evaluator-Calculated Metrics

	Evaluation	Metric	Measure Steward; [1] Measure Collection(s)	NQF#[2] (if available)
1	Behavioral Health	Follow-up after Hospitalization for Mental Illness 7 Days Post Discharge	NCQA; HEDIS; Medicaid Adult Core; Medicaid Child Core	0576
2	Behavioral Health	Follow-up after Hospitalization for Mental Illness 30 Days Post Discharge		
3	Chemical Addiction/ Substance Abuse	Initiation of Alcohol and Other Drug Abuse or Dependence Treatment	NCQA; HEDIS; Medicaid Adult Core	0004
4	Chemical Addiction/ Substance Abuse	Engagement of Alcohol and Other Drug Abuse or Dependence Treatment		
5	DSRIP Overall & Cardiac Care	30-Day All-Cause Readmission Rate Following Heart Failure (HF) Hospitalization	CMS; Joint Commission National Hospital Inpatient Quality Measures	0330
6	DSRIP Overall & Cardiac Care	30-Day All-Cause Readmission Rate Following Acute Myocardial Infarction (AMI) Hospitalization		0505

[1] CMS = Center for Medicare & Medicaid Services; AHRQ = Agency for Healthcare Research and Quality; NCQA = National Committee for Quality Assurance; HEDIS=Healthcare Effectiveness Data and Information Set; NYU = New York University; HRSA = Health Resources and Services Administration.

[2] NQF=National Quality Forum (http://www.qualityforum.org/Home.aspx).

[3] HRSA metric includes visits to urgent care offices which we did not identify in Medicaid data.

Table F: Reference Information for Evaluator-Calculated Metrics (continued)

	Evaluation	Metric	Measure Steward;[1] Measure Collection(s)	NQF#[2] (if available)
7	DSRIP Overall & Pneumonia	30-Day All-Cause Readmission Rate Following Pneumonia (PN) Hospitalization	CMS; Joint Commission National Hospital Inpatient Quality Measures	0506
8	DSRIP Overall	30-Day All-Cause Readmission Rate Following Chronic Obstructive Pulmonary Disease (COPD) Hospitalization		1891
9	Asthma	Emergency Department (ED) Visits for Asthma	HRSA[3]	—
10	Diabetes	Comprehensive Diabetes Care: Eye Exam	NCQA; HEDIS	0055
11	Diabetes	Comprehensive Diabetes Care: Hemoglobin A1c (HbA1c) Testing	NCQA; HEDIS; Medicaid Adult Cire	0057
12	Obesity	Children and Adolescents' Access to Primary Care Practitioners	NCQA; HEDIS; Medicaid Child Core	—
13	DSRIP Overall	Well-child Visits in the 3,4,5, 6th Years of Life	NCQA; HEDIS; Medicaid Child Core	1516
14	DSRIP Overall	Mental Health Utilization	NCQA; HEDIS	—
15	Asthma	Younger Adult Asthma Admission Rate (PQI-15)	AHRQ; Prevention Quality Indicators; PQI #15 and #1 also part of Medicaid Adult Core	0283
17	Diabetes	Diabetes Short-Term Complications Admission Rate (PQI-01)		0272*
18	DSRIP Overall	Preventable Inpatient Hospitalizations (PQI-90)		
16	Asthma	Asthma Admission Rate (PDI-14)	AHRQ; Pediatric Quality Indicators	0728*
19	DSRIP Overall	Pediatric Preventable Hospitalizations (PDI-90)		—
20	DSRIP Overall	Preventable/Avoidable Treat-and-Release ED Visits	NYU	—
21	DSRIP Overall	Hospital Costs Related to Avoidable Inpatient Stays and Treat-and-Release ED Visits	—	—

[1] CMS = Center for Medicare & Medicaid Services; AHRQ = Agency for Healthcare Research and Quality; NCQA = National Committee for Quality Assurance; HEDIS=Healthcare Effectiveness Data and Information Set; NYU = New York University; HRSA = Health Resources and Services Administration.

[2] NQF=National Quality Forum (http://www.qualityforum.org/Home.aspx).

[3] HRSA metric includes visits to urgent care offices which we did not include in this measure.

*endorsement removed

Appendix B: AHRQ Prevention Quality Indicators and Pediatric Quality Indicators – Composites and Constituents

Overall Composite (PQI #90)	
PQI #01 Diabetes Short-Term Complications Admission Rate	PQI #11 Bacterial Pneumonia Admission Rate
PQI #03 Diabetes Long-Term Complications Admission Rate	PQI #12 Urinary Tract Infection Admission Rate
PQI #05 Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate	PQI #13 Angina without Procedure Admission Rate[10]
PQI #07 Hypertension Admission Rate	PQI #14 Uncontrolled Diabetes Admission Rate
PQI #08 Congestive Heart Failure (CHF) Admission Rate	PQI #15 Asthma in Younger Adults Admission Rate
PQI #10 Dehydration Admission Rate	PQI #16 Rate of Lower-Extremity Amputation Among Patients With Diabetes

Source: Prevention Quality Indicators Technical Specifications - Version 6.0, September 2016; http://www.qualityindicators.ahrq.gov/Modules/PQI_TechSpec.aspx.

Overall Composite (PDI #90)
PDI #14 Asthma Admission Rate
PDI #15 Diabetes Short-Term Complications Admission Rate
PDI #16 Gastroenteritis Admission Rate
PDI #18 Urinary Tract Infection Admission Rate

Source: Pediatric Quality Indicators Technical Specifications - Version 6.0, September 2016; https://www.qualityindicators.ahrq.gov/Archive/PQI_TechSpec_ICD10_v60.aspx

[10] This component was retired in Version 6.0 of the PQI software which accommodated ICD-10 coding. This software version was used for generating the overall composite indicator beginning in October 2015.

Appendix C: Classification of Emergency Department Visits

Type Description	Diagnoses
Non-Emergent: The patient's initial complaint, presenting symptoms, vital signs, medical history, and age indicated that immediate medical care was not required within 12 hours.	Headache, Dental disorder, Types of migraine
Emergent, Primary Care Treatable: Conditions for which treatment was required within 12 hours, but care could have been provided effectively and safely in a primary care setting. The complaint did not require continuous observation, and no procedures were performed or resources used that are not available in a primary care setting (e.g., CAT scan or certain lab tests)	Acute bronchitis, Painful respiration, etc.
Emergent, ED Care Needed, Preventable/Avoidable: Emergency department care was required based on the complaint or procedures performed/resources used, but the emergent nature of the condition was potentially preventable/avoidable if timely and effective ambulatory care had been received during the episode of illness	Flare-ups of asthma, diabetes, congestive heart failure, etc.
Emergent, ED Care Needed, Not Preventable/Avoidable: Emergency department care was required and ambulatory care treatment could not have prevented the condition	Trauma, appendicitis, myocardial infarction

The first three categories are considered to be avoidable/preventable.
Type descriptions taken from http://wagner.nyu.edu/faculty/billings/nyued-background.php.

Appendix D: American Community Survey Summary File Data

The population of uninsured individuals by zip code tabulation area and age were extracted from American Community Survey (ACS) 5-year Summary File Data to serve as denominators for preventable hospital utilization calculated using State Inpatient and Emergency Department HCUP datasets. Data came from Table B27001 – Health Insurance Coverage Status by Sex by Age.

We used 5-year summary files for 2014-2019 and attributed the denominators to the year of HCUP data corresponding to the midpoint year of the five year period. For example, estimates from the 2014 5-year ACS data are period estimates reflecting data collected over 2010-2014. These estimates were used to create population denominators for utilization measures from the 2012 HCUP data. Because only experimental 2020 5-year ACS summary file data were recently released, we used the 2019 ACS estimates for both 2017 and 2018 denominators.

Appendix E: Risk-Adjustment Variables for Readmissions Metrics

For the 30-day readmission metrics, control variables for health status come from a full year of data prior to the index admission date and encompass clinically relevant comorbidities (not complications) that have strong relationships with readmission for the specific condition being analyzed.

Heart Failure Readmissions

• Age • Sex • History of Coronary Artery Bypass Graft • History of Percutaneous Transluminal Coronary Angioplasty • Diabetes Mellitus (DM) or DM Complications • Disorders of Fluid/Electrolyte/Acid-Base • Iron Deficiency or Other Unspecified Anemias and Blood Disease • Cardio-Respiratory Failure or Shock • Congestive Heart Failure • Vascular or Circulatory Disease • Chronic Obstructive Pulmonary Disease • Pneumonia • Renal Failure • Other Urinary Tract Disorders • Decubitus Ulcer or Chronic Skin Ulcer • Other Gastrointestinal Disorders • Acute Coronary Syndrome • Valvular or Rheumatic Heart Disease	• Specified Arrhythmias • Asthma • Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders • Cancer • Drug/Alcohol Abuse/Dependence/Psychosis • Major Psychiatric Disorders • End-Stage Renal Disease or Dialysis • Severe Hematological Disorders • Nephritis • Liver or Biliary Disease • Metastatic Cancer or Acute Leukemia • Stroke • Dementia or Other Specified Brain Disorders • Coronary Atherosclerosis or Angina • Other or Unspecified Heart Disease • Other Psychiatric Disorders • Fibrosis of Lung or Other Chronic Lung Disorders • Hemiplegia, Paraplegia, Paralysis, Functional Disability • Depression

Acute Myocardial Infarction (AMI) Readmissions

• Age • Sex • History of Coronary Artery Bypass Graft • History of Percutaneous Transluminal Coronary Angioplasty	• Vascular or Circulatory Disease • Disorders of Fluid/Electrolyte/Acid-Base Coronary Atherosclerosis • History of infection • Cerebrovascular Disease

Acute Myocardial Infarction (AMI) Readmissions (continued)

• Diabetes Mellitus (DM) or DM Complications • Iron Deficiency or Other Unspecified Anemias and Blood Disease • Congestive Heart Failure • Valvular or Rheumatic Heart Disease • Chronic Obstructive Pulmonary Disease • End-Stage Renal Disease or Dialysis • Other Urinary Tract Disorders • Specified Arrhythmias • Pneumonia • Renal Failure	• Metastatic Cancer or Acute Leukemia • Cancer • Decubitus Ulcer or Chronic Skin Ulcer • Dementia or Other Specified Brain Disorders • Angina Pectoris/Old Myocardial Infarction • Stroke • Asthma • Acute Coronary Syndrome • Hemiplegia, Paraplegia, Paralysis, Functional Disability • 'Protein-Calorie Malnutrition; • Anterior Myocardial Infarction • Other Location of Myocardial Infarction

Pneumonia Readmissions

• Age • Sex • History of Coronary Artery Bypass Graft • History of infection • Septicemia/Shock • Metastatic Cancer or Acute Leukemia • Lung, Upper Digestive Tract, and Other Severe Cancers • Other Major Cancers • Diabetes Mellitus (DM) or DM Complications • Protein-Calorie Malnutrition • Disorders of Fluid/Electrolyte/Acid-Base • Other Gastrointestinal Disorders • Severe Hematological Disorders • Iron Deficiency or Other Unspecified Anemias and Blood Disease • Dementia or Other Specified Brain Disorders • Drug/Alcohol Abuse/Dependence/Psychosis • Major Psychiatric Disorders • Other Psychiatric Disorders • Hemiplegia, Paraplegia, Paralysis, Functional Disability	• Cardio-Respiratory Failure or Shock • Congestive Heart Failure • Acute Coronary Syndrome • Chronic Atherosclerosis or Angina • Valvular or Rheumatic Heart Disease • Specified Arrhythmias • Stroke • Vascular or Circulatory Disease • Chronic Obstructive Pulmonary Disease • Fibrosis of Lung or Chronic Lung Disorders • Asthma • Pneumonia • Pleural Effusion/Pneumothorax • Other Lung Disorders • Dialysis Status • Renal Failure • Urinary Tract Infection • Other Urinary Tract Disorders • Decubitus Ulcer or Chronic Skin Ulcer • Vertebral Fractures • Other Injuries • Respirator Dependence/Tracheostomy Status

Chronic Obstructive Pulmonary Disease (COPD) Readmissions

• Age • Fibrosis of Lung or Other Chronic Lung Disorder • Other Digestive and Urinary Neoplasms • Renal Failure • Decubitus Ulcer or Chronic Skin Ulcer • Cellulitis, Local Skin Infection • Vertebral Fractures • Protein-Calorie Malnutrition • Other Endocrine/Metabolic/Nutritional Disorders • Pancreatic Disease • Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders • Other Gastrointestinal Disorders • Severe Hematological Disorders • Iron Deficiency or Other Unspecified Anemia and Blood Disease • Depression • Anxiety Disorders • Other Psychiatric Disorders • Metastatic Cancer or Acute Leukemia • Cardio-Respiratory Failure or Shock • Lung, Upper Digestive Tract, and Other Severe Cancers	• Polyneuropathy • Congestive Heart Failure • Hypertensive Heart and Renal Disease or Encephalopathy[11] • Specified Arrhythmias • Other or Unspecified Heart Disease • History of Infection • Vascular or Circulatory Disease • Pneumonia • Diabetes Mellitus (DM) or DM Complications • Disorders of Fluid/Electrolyte/Acid-Base • Dementia or Other Specified Brain Disorders • Drug/Alcohol Abuse/Dependence/Psychosis • Major Psychiatric Disorders • Quadripelgia, Paraplegia, Functional Disability • Respirator Dependence/Respiratory Failure • Acute Coronary Syndrome • Chronic Atherosclerosis or Angina • Lymphatic, Head and Neck, Brain, and Other Major Cancers Breast, Colorectal and Other Cancers and Tumors; Other Respiratory and Heart Neoplasms • Stroke • Sleep Apnea • History of Mechanical Ventilation

[11] This risk factor was removed when specifications were updated to be ICD-10 compatible. Results presented in this report come from models excluding this variable.

Appendix F: Zip Code Identification Methods

All analyses by zip code in Medicaid claims and encounter data start with a 755 NJ zip universe. These 755 zips are an intersection of the zip codes present in two data sources. They occur as zips of residence for Medicaid beneficiaries in the recipient file accompanying the claims data, and they are also zips of residence on Medicaid discharge records in the UB data, which was our source for creating the hospital choice sets and DSRIP exposure variables. Using this intersection of zips helps us discard erroneous zips present in either UB or Medicaid data and was necessary for assuring non-missing exposure variables in zip-level analyses. Individual outcomes determined the specific subset of these 755 zips used in the final regression models. Only zip codes with non-zero population for the metric denominator across all years of the analysis were included.

Analyses using HCUP data relied on population denominators from the American Community Survey (ACS) 5-year Summary Files. The ACS uses Zip Code Tabulation Areas (ZCTAs) which are generalized representations of postal zip codes. There are 595 ZCTAs in New Jersey. The intersection of these ZCTAs with zips of residence on Medicaid discharge records in the UB data was our starting point for analyses of the uninsured population. As with claims analyses, individual outcomes determined the specific subset of these 595 zips used in the final regression models. Only zip codes with non-zero population for the metric denominator across all years of the analysis were included.

Chapter 2: Cost-Effectiveness Analysis of the DSRIP Program

Introduction

In this chapter, we examine the reforms under the New Jersey FamilyCare Comprehensive Demonstration that implemented the Delivery System Reform Incentive Payment (DSRIP) program. The CEA analysis (along with other analysis) addresses the following research question and the corresponding evaluation hypothesis in the approved evaluation design.[1]

Research Question 10: **"Was the DSRIP program effective in achieving the goals of better care for individuals (including access to care, quality of care, health outcomes), better health for the population, or lower cost through improvement? To what degree can improvements be attributed to the activities undertaken under DSRIP?"**

Hypothesis: **"The DSRIP program will improve the quality of ambulatory care in the communities of participating hospitals consequently reducing avoidable inpatient hospitalizations and avoidable/preventable emergency department visits; it will improve access to care; quality and efficiency of care."**

Background

This chapter summarizes the methods and findings of a cost-effectiveness analysis (CEA), required for the evaluation. This approach has been widely used in healthcare for decades as a formal method to quantify the value of healthcare programs. In the case of this evaluation, CEA entails measuring the cost and effectiveness of the DSRIP program implemented as a part of New Jersey FamilyCare Comprehensive Demonstration. Strictly speaking, CEA is intended to measure the total costs of implementing a new treatment or program compared to an existing treatment or program that is the standard of care. In addition, the effectiveness component of CEA should be a clear and measurable health outcome or quality of life measure. In the case of the NJ FamilyCare Demonstration, the policies being evaluated are broad and may have many health and quality of life impacts, but it is difficult to aggregate benefits across all these disparate effects and they are not measurable in the administrative data available to complete the evaluation. For instance, one of the benefits of DSRIP is that it changed the hospital culture, but this is not directly measurable in our data. Accordingly, we have used two healthcare utilization outcomes as proxy measures of effectiveness (avoidable hospitalizations and avoidable emergency department

visits) but these are limited in scope, and are unlikely to capture the full costs and benefits of the program.

Formal guidance on CEA has been published by the US Panel on Cost-Effectiveness in Health and Medicine (Neumann et al. 2016). Important to this application is the ability to compare the costs and effectiveness of the new policies to a reference case. The reference case may consist of a concurrent standard of care, for example, a comparable policy available during the same time as the new policy, or if no concurrent comparator exists then pre-policy costs and outcomes may serve as the reference case. In this particular analysis examining the DSRIP program, for the overall cost and outcome calculations the comparator population serves as the reference case.

The cost and effects of the new policy compared to the comparison population are calculated using a difference-in-differences (DID) approach, which examines how costs and effects changed before versus after the DSRIP program was implemented. With respect to the costs included in CEA, best practice guidelines call for inclusion of all relevant costs fitting the perspective of the analysis chosen. The most common perspectives taken in CEA are healthcare payer, healthcare provider, or societal. Of these, the healthcare payer is the most relevant to our evaluation, specifically the New Jersey Medicaid program. Taking this perspective, relevant costs include those relating to all healthcare services under the new policy versus the reference case, as well as implementation costs to develop the systems and practices necessary for the policy. In terms of program implementation costs, ideally both personnel time (i.e., state staff and vendor costs), as well as supplies, travel, and other resources should be included. Our analysis includes state staff costs and external vendors that officials could retrospectively identify as relevant for DSRIP.

Effectiveness measures included in the CEA should be a) the outcomes associated with the policy or those that the policy is specifically targeting; AND b) measurable with available data. Typically, CEA is expected to employ an effectiveness measure that is a clinical outcome measure, not a surrogate or process measure. Most importantly, the effectiveness measure chosen should be a meaningful indicator of the value of the policy being assessed.

In this report, we describe results of our CEA on the Delivery System Reform Incentive Payment (DSRIP) program. Our team gave considerable deliberation to identifying relevant clinical outcome measures to serve as the CEA effectiveness measures for evaluating this program. Given that one of the goals of DSRIP is to increase efficiencies in the delivery of healthcare services, we decided that avoidable healthcare use in the form of avoidable hospitalizations and ED visits would be relevant to include as the effectiveness measures in the CEA. Hence, our analysis examines costs and avoidable events averted for each of these two types of events. To avoid biasing our CEA ratios with double-counting, (for example, inclusion of the costs of

avoidable hospitalizations in the numerator while also including the number of avoidable hospitalizations in the denominator), we excluded the outcome-specific costs from total costs in the numerator.

It is important to note that CEA is best done in parallel with the program being implemented to 1) collect all necessary information, 2) avoid temporal bias, and 3) minimize recall bias. However, in the case of this evaluation, CEA is being performed years after the program was developed. This approach prevented us from prospectively gathering cost data pertaining to program implementation; however, we were able to obtain aggregate costs for NJ DOH staff time as well as vendor-provided services required for program implementation.

Methods

Data Sources

Data sources for this analysis included 1) aggregate staff and outside vendor costs for DSRIP program development and implementation, and 2) a query of unadjusted outcomes events and costs from the Medicaid claims data from 2011-2020 for Medicaid beneficiaries in the DSRIP target population and a comparator group. The DSRIP target population comprised NJ Medicaid beneficiaries within New Jersey ZIP codes having greater than 75% DSRIP exposure, and the comparator population comprised NJ ZIP codes having less than 25% DSRIP exposure. Both groups were defined on a yearly basis, and included individuals who, for years from 2014-2020 in which they were enrolled in Medicaid, lived in either the targeted or comparison population ZIP codes and never moved into a ZIP code of a different classification. The DSRIP target population ranged from 1.4 to 1.9 million individuals annually over the period analyzed (2011-2020), while the comparator population ranged from about 20,000 to about 30,000 individuals annually. These populations differed in terms of race/ethnicity, age, and eligibility category, with the comparator population more frequently white, older, and more likely to be eligible on the basis of age or disability (ABD) both in 2012 and in 2017. CDPS scores, which measure the burden of illness/disability, were higher in the comparator population in 2012 (by about 10%), but about equal in 2017 (within 2%).

Measures

The DSRIP program was rolled out beginning in 2014. Cost and outcome measures were captured annually for both the period prior to rollout (January 2011 through December 2013, “pre-period”) and the period after rollout began (January 2014 through December 2020, “post-period”). Cost measures include total cost of care, the portion of personnel and vendor costs of program planning and implementation, plus the costs of avoidable hospitalizations and avoidable

emergency department visits. We downward adjusted total costs to 1) account for the DSRIP target population only (i.e., based on the ratio of the number of beneficiaries in the target population to the number of beneficiaries with any exposure to DSRIP), and 2) represent Medicaid-only beneficiaries (i.e., removing estimated costs attributed to charity care beneficiaries). Outcome measures include the number of avoidable hospitalizations and avoidable emergency department visits. All costs are reported in $US 2020, consistent with the most recent year of data included in the analysis.

DSRIP Program Planning and Implementation

Aggregate personnel costs were obtained from NJ DOH. These comprised 75% effort for both the Executive Director and Health Care Consultant for 2013 through 2020, and included fringe benefits. In addition to personnel costs, two outside vendors and one outside consultant contributed to program planning and implementation. Sums paid to these vendors were obtained from the NJ DOH.

Personnel and vendor costs were summed by year, and the sums were inflated to $US 2020 using general inflation rates.[3] Because the DSRIP target population is a subset of the whole DSRIP population, program costs were downward-adjusted by the average post-period ratio of target population beneficiaries to all beneficiaries in ZIP codes with any nonzero DSRIP exposure. Additionally, because DSRIP comprises both Medicaid-only beneficiaries and charity care beneficiaries, program costs were further downward-adjusted to represent Medicaid-only beneficiaries.

The per-beneficiary cost of program implementation was calculated by dividing the adjusted implementation costs by the number of beneficiaries in the DSRIP target population.

Analysis 1. DSRIP Cost-Effectiveness Analysis

To assess cost-effectiveness of DSRIP, we performed a pre versus post analysis comparing net per-beneficiary, per-year costs of DSRIP in the target population against those of the comparator group. The pre-period comprised years 2011-2013, and the post-period comprised years 2014-2020. For each outcome measure, we calculated the numerator and denominator of the incremental cost-effectiveness ratio (ICER) shown Equation 2.1:

$$\text{ICER} = \frac{\text{Net costs}_{\text{DSRIP}} - \text{Net costs}_{\text{Comparator group}}}{\text{Net \# Outcomes}_{\text{DSRIP}} - \text{Net \# Outcomes}_{\text{Comparator group}}} \quad (2.1)$$

where “Net costs” for each group comprise the per-beneficiary, per-year post-period healthcare costs plus program planning and implementation costs, minus the per-beneficiary, per-year pre-period healthcare costs.

To calculate the net costs for each group (numerator of Eq. 2.1), all healthcare service costs were first inflated to $US 2020 using medical cost inflation rates.[3] This is a common step in health economic analyses since costs should be valued in a common year. Per-beneficiary healthcare costs were calculated as the total costs of all-cause healthcare service use minus costs related to the outcome of interest (for example, for the “avoidable hospitalizations” outcome, costs of avoidable hospitalizations were subtracted from total healthcare costs), and then divided by the number of beneficiaries enrolled in that year. Per-beneficiary program planning and implementation costs were included in the post-period and were calculated as described above (for the DSRIP target population only). Costs were then summed within each time period and divided by the number of years in the time period (i.e., 3 years for the 2011-2013 pre-period; 7 years for the 2014-2020 post-period) to yield the per-beneficiary, per-year net cost.

The net per-beneficiary, per-year outcome events in each group (denominator in Eq. 2.1) was calculated similarly within each group for each outcome of interest as the per-beneficiary, per-year number of post-period outcome events minus the per-beneficiary, per-year number of pre-period outcome events. Next we calculated the difference between the differences in the DSRIP and comparator groups. The numerator and denominator of Eq. 2.1 thus represent the “difference-in-differences” calculation.

It should be noted that calculation of ICERs is only relevant when the new policy either costs more money than usual care but results in additional effectiveness, or it costs less money than usual care but results in less effectiveness. In cases where the new policy is more costly and less effective than usual care, the decision would be to stick with usual care; whereas in cases when the new policy is less costly and more effective, the decision would be to adopt the new policy. In the latter case, we say that the new policy is dominant in that it achieves better outcomes at lower cost than usual care. In addition, ICERs have limited ability to inform decisions unless there are benchmarks that serve as a basis of comparison. In the case of the results presented here, we include net cost and effectiveness differences (i.e., the “difference-in-differences” result), but did not specifically calculate ICERs because CEA benchmarks for delivery system improvement policies where effectiveness is based on avoidable events do not exist. Thus, it would be impossible to put ICERs generated from our analysis into context. However, to allow for easy visualization of the results of the CEA, incremental costs and effectiveness for the DSRIP target population vs. the comparator group were plotted on the incremental cost-effectiveness (ICE) plane. The horizontal axis of the ICE plane represents incremental effectiveness, the vertical axis

represents incremental costs, and the costs and effectiveness of the comparator group occupy the origin. The four quadrants of the ICE plane then show the relative costs and effectiveness experienced by beneficiaries in the DSRIP target population vs. the comparator population.

Analysis 2. Per-Beneficiary Savings

Per-beneficiary savings for DSRIP for each outcome were calculated per Eq. 2.2:

$$\text{Per-beneficiary savings} = (\text{per-beneficiary health care savings from pre- to post-period}) - (\text{per-beneficiary program cost}) \quad (2.2)$$

where the incremental per-beneficiary healthcare savings is the difference in mean per-person all-cause healthcare costs (post-period minus pre-period) and the per-beneficiary program cost is the mean per-person cost of personnel time for program planning and implementation as described above. The first term in Eq. 2.2 was found by inflating total all-cause healthcare costs for each year in the analysis to $US 2020 using medical cost inflation rates (Halfhill 2021), dividing each year's costs by the number of DSRIP target population beneficiaries for that year to find mean per-beneficiary costs, averaging these costs separately for pre-period (2011-2013) and post-period (2014-2020), and calculating the difference (post-period minus pre-period). This savings calculation is based on the target group and does not take into account potential savings that may have occurred even without the program.

Results

DSRIP Program Planning and Implementation Costs

Analysis of the DSRIP program implementation cost data (personnel plus vendors) yielded a total cost of $11,878,845. Based on 3,011,828 unique DSRIP target population beneficiaries enrolled from 2014-2020, the per-beneficiary cost of DSRIP program planning and implementation is $3.94 over a 7 year period, or an annualized per-beneficiary cost of $0.56.

Analysis 1. Cost-Effectiveness of DSRIP vs. Comparator Group

Results of the cost-effectiveness analysis comparing DSRIP target population beneficiaries to the comparator group are presented in Table 2.1. Avoidable hospitalizations showed a difference-in-differences cost increase of $4,493 per beneficiary per year and a corresponding increase of 0.0025 events on DID analysis. These are changes in the DSRIP target population relative to the change in the comparator group, pre-post (e.g., for avoidable hospitalizations the increase in cost of $4,493 equals the decrease in the DSRIP target population of $1,143 relative to a decrease of

$5,636 in the comparison group). Similarly, for avoidable ED visits, the DID costs increased by $3,371 with 0.0281 additional events.

Table 2.1. Per-Beneficiary, Per-Year CEA, DSRIP vs. Comparator Group

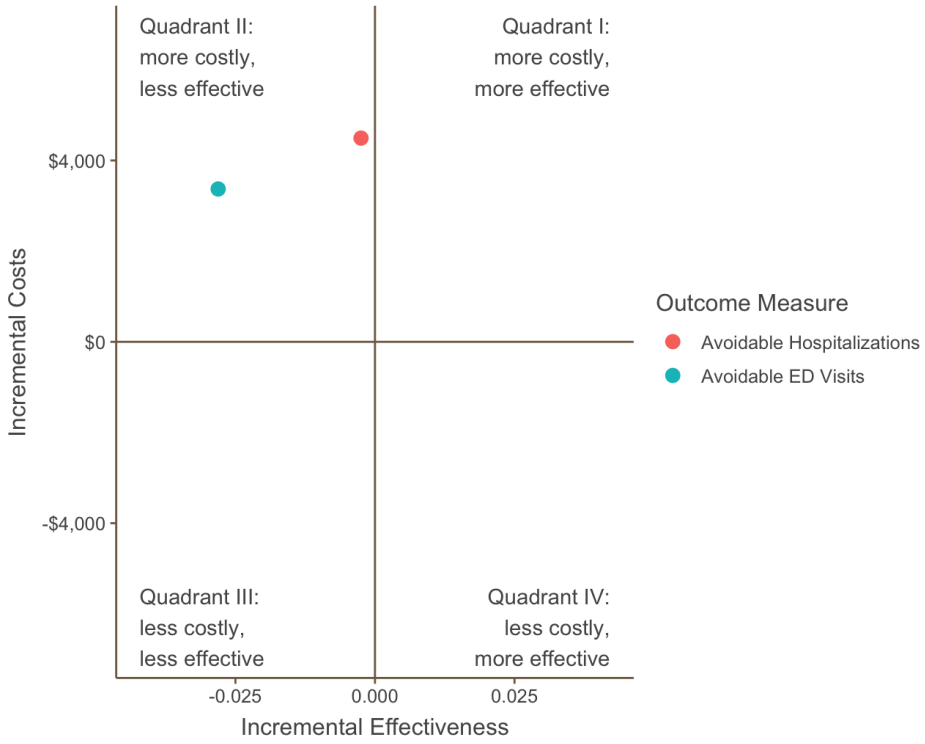
Outcome Measure	Type	Population	Pre-period	Post-period	Difference	Difference-in-Differences
Avoidable Hospitalizations	Costs	DSRIP	$8,033	$6,890	-$1,143	$4,493
		Comparator	$18,759	$13,123	-$5,636	
	Number of Events	DSRIP	0.0143	0.0105	-0.0038	0.0025
		Comparator	0.0156	0.0092	-0.0063	
Avoidable ED Visits	Costs	DSRIP	$7,118	$6,348	-$770	$3,371
		Comparator	$16,028	$11,887	-$4,141	
	Number of Events	DSRIP	0.2712	0.2510	-0.0202	0.0281
		Comparator	0.2382	0.1900	-0.0483	

Abbreviations: CEA = Cost-Effectiveness Analysis, ED = Emergency Department, DSRIP = Delivery Service Reform Incentive Payment

Note: Post-period cost includes implementation costs.

The ICE plane is presented in Fig. 2.1. Both avoidable hospitalizations and avoidable ED visits appear in Quadrant II, indicating that with respect to these measures, the population with higher DSRIP exposure had higher costs and higher avoidable events than the population with less DSRIP exposure. We cannot be certain that the DSRIP exposure caused these differences.

Figure 2.1. Incremental Cost-Effectiveness of DSRIP vs. Comparator



Analysis 2. Per-Beneficiary Savings among DSRIP Beneficiaries

When looking only within the DSRIP target population itself without considering the comparator population, the DSRIP program showed a per-beneficiary savings of $761 (Table 2.2).

Table 2.2. Per-Person Savings among DSRIP Target Population Beneficiaries

Per-Beneficiary Costs				Net Per-Beneficiary Savings[b]
Pre-period Mean Total Healthcare Costs per Beneficiary	***Post-period Mean Total Healthcare Costs per Beneficiary***	***Difference[a]***	***Program Cost***	
$7,202	$6,437	-$765	$3.94	$761

[a]The negative difference in this column indicates a savings in pre- versus post-period costs in the DSRIP target population per beneficiary

[b]Savings as defined in Eq. 2.2.

Discussion

This chapter presents findings on the costs of implementing the DSRIP program and its effectiveness. The total cost to the state for the measurement period is $11,878,845, or $3.94 per DSRIP participant during the measurement period. These costs were not a significant factor in the findings. Hospital costs of implementation were not recorded during the program, but it is possible that hospitals redeployed existing staff and other resources to DSRIP projects at the expense of other population health or quality initiatives (Chakravarty, Lloyd, Brownlee, & Farnham, 2018) that may have impacted outcomes in DSRIP participating hospitals.

In terms of cost-effectiveness relative to a comparator group (Analysis 1), DID analysis findings show per-beneficiary, per-year increases for the DSRIP target population relative to the comparator population in the costs and number of events observed for both outcomes of interest, with the smaller increase in events found for avoidable hospitalizations (0.0025 events), followed by avoidable ED visits (0.0281 events). Net cost increases of $4,493 and $3,371 per beneficiary, per year, were calculated in analyses for avoidable hospitalizations and avoidable ED visits respectively. The comparison group are those Medicaid beneficiaries with <25% DSRIP coverage, who were not adjusted to match the DSRIP target population sample. Adjusting, or comparing beneficiary subgroups, could show different results. Also, it is important to note that there were decreases in both populations with respect to costs and avoidable events. Though the decreases in the comparator population were larger on a per-beneficiary basis, the target population is much larger than the comparator population and were these costs and events aggregated for the population as a whole, there would be greater overall savings to Medicaid and aversion of avoidable events in the target population.

However, we also quantify the value of DSRIP program by examining whether it results in per-beneficiary cost savings (Analysis 2). *This analysis specifically examined whether the total cost of DSRIP was offset by savings in this population. The per-beneficiary savings presented in Table 2.2 reveal that the cost of implementing DSRIP is offset by the savings experienced in the DSRIP target population, yielding a per-beneficiary savings of $761.* These findings suggest that the cost of DSRIP has been more than offset by savings in total healthcare costs during the measurement period. Though this per-beneficiary savings analysis shows a savings associated with DSRIP whereas the CEA showed increased costs for both outcomes of interest, it should be noted that the per-beneficiary savings analysis considers the DSRIP target population only (i.e., it does not include a comparator population).

Limitations

This analysis captures Medicaid enrollees only, while the DSRIP program potentially affects all individuals touched by a hospital (including outpatient partners and outreach). Beneficiaries

were categorized into populations based on percentage of DSRIP exposure among hospitals in their home ZIP code, *but it is possible that a beneficiary in the comparator group could use a hospital outside the set of hospitals attributed to their home ZIP code, or that beneficiaries in the DSRIP target population could use one of the non-DSRIP hospitals in their ZIP code's attributed hospital list.* Additionally, the hospitals selecting to participate in the program could be systematically different in terms of characteristics that could explain some of the differences. Because the DSRIP program aimed to create sustainable long-term changes in hospitals toward quality measurement and orientation to population health, these changes may not be well-measured in the short-term. Therefore, *although relevant state program implementation costs are captured in the window of analysis, this window may be too narrow to fully capture the long-term effectiveness of program improvements, resulting in bias in the CEA due to censored data.*

Finally, an important limitation is the lack of effectiveness measures that fit traditional cost-effectiveness analysis. As mentioned in the Background section of this chapter, the effectiveness measure used in CEA is ideally a health outcome, not a surrogate or process/utilization measure. Given that this evaluation relies on administrative data, health measures such as those typically captured in medical records were not available to us, and condition-specific readmissions (heart failure and COPD), did not have enough events in the comparator group to use as a reliable measure. This is an important lesson learned about the feasibility of conducting cost-effectiveness analyses post-hoc to assess a state health policy. If cost-effectiveness analyses will be necessary for future policy evaluations, it is advisable that the evaluation be initiated in parallel with policy development so that precise and relevant data can be captured.

References

CMS (Centers for Medicare & Medicaid Services). 2019. *Approved Evaluation Design to the New Jersey Comprehensive Demonstration (Project No. 11-W-00279/2)*. Baltimore: CMS. https://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Waivers/1115/downloads/nj/Comprehensive-Waiver/nj-1115-request-eval-des-appvl-10012019.pdf.

Chakravarty, S., Lloyd, K., Brownlee, S., & Farnham, J. (2018). A summative evaluation of the New Jersey DSRIP program: Findings from stakeholder interviews, hospital surveys, Medicaid claims data, and reported quality metrics. New Brunswick, NJ: Rutgers Center for State Health Policy.

Halfhill, Tom R. 2021. Tom's Inflation Calculator. https://www.halfhill.com/inflation_js.html. Accessed June 14, 2021.

Neumann PJ, Sanders GD, Russell LB, Siegel JE, Ganiats TG, editors. 2016. Cost-effectiveness in health and medicine. Oxford University Press.

RUTGERS

Center for State Health Policy

Center for State Health Policy
Rutgers, The State University of New Jersey
112 Paterson Street, 5th Floor
New Brunswick, NJ 08901

p. 848-932-3105 f. 732-932-0069
cshp_info@ifh.rutgers.edu
www.cshp.rutgers.edu