

# Performance of the Health Care Delivery System for Dually Eligible Medicare Beneficiaries

**3M Clinical and Economic Research**

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## Executive Summary

Individuals who are eligible for Medicare and who qualify for Medicaid are referred to as dually eligible or “duals.” The objective of this study was to determine whether there are substantive differences in the care delivered to duals and non-dual Medicare beneficiaries based on measures of quality and delivery system effectiveness. Although the dual population is primarily a low-income population, it is composed of two very different subpopulations, which had to be accounted for in the analysis: the under-65 population of primarily disabled beneficiaries and the 65-and-over population having a substantial proportion of beneficiaries residing in nursing homes.

The care delivered to the dual and non-dual Medicare populations was measured based on six quality measures and three service volume measures. Using Medicare 2017-2018 fee-for-service data, the actual and risk-adjusted expected rates for the quality and service volume measures were determined for the 65-and-over and under-65 Medicare populations. The quality measures for both the under- and over-65 populations revealed a pattern of higher-than-expected risk-adjusted rates for duals, indicating poor performance (excess number of quality-of-care failures). Dual beneficiaries have more than expected per capita admissions and emergency department visits, more readmission and post-discharge returns to the emergency department and more inpatient complications.

For the service volume measures, dual beneficiaries are less likely to be admitted from the emergency department for low-severity medical care and have fewer physician or care management visits than non-dual beneficiaries, especially for duals residing in low socioeconomic areas. These results demonstrate substantive differences in the care delivered to Medicare dual and non-dual beneficiaries, and suggest that overall, the health care delivery system is performing at a less effective level for the dual Medicare population.

## Introduction

Individuals who are eligible for Medicare and who qualify for Medicaid are referred to as dually eligible or “duals.” An individual is eligible for Medicare if they are 65 years or older or are under 65 and qualify for Social Security Disability Insurance (SSDI) benefits. To qualify for SSDI, an individual must not be able to engage in any substantial gainful activity because of a medically determinable physical or mental impairment or have certain specified diseases such as amyotrophic lateral sclerosis or end-stage renal disease. To be eligible for Medicare, the individual must be entitled to SSDI benefits for at least 24 months. In addition, a child or widow(er) of an individual who qualifies for SSDI may also be eligible for Medicare coverage.

Medicaid provides health coverage for low-income people, families and children, pregnant women, the elderly, and people with disabilities. For the elderly population with low incomes, Medicaid is the primary payer for nursing home care that would otherwise be unaffordable. Medicaid programs receive federal support and must follow federal guidelines, but coverage and costs differ from state to state. In particular, Medicaid eligibility based on income varies from state-to-state and is usually expressed as a percent of the Federal Poverty Limit (FPL).

While the dual population is primarily a low-income population, it is composed of two very different subpopulations, with the under-65 population being primarily disabled beneficiaries and the 65-and-over population having a substantial proportion of beneficiaries residing in nursing homes.<sup>1</sup>

The objective of this study was to determine whether there are substantive differences in the care delivered to duals and non-dual Medicare beneficiaries based on measures of quality and delivery system effectiveness.

## Quality and Delivery System Effectiveness

The care delivered to the dual and non-dual Medicare populations was measured using the following six quality measures and three service volume measures:

### *Quality Measures*

- Per Capita Potentially Preventable Admissions (PPAs)<sup>2, 3</sup>
- Per Capita Potentially Preventable Emergency Department Visits (PPVs)<sup>4, 5</sup>
- Potentially Preventable Readmissions (PPRs)<sup>6, 7</sup>
- Potentially Preventable Return Emergency Department Visits (PPREDs)
- Inpatient Potentially Preventable Complications (PPCs)<sup>8, 9</sup>
- 30-Day Post-Inpatient Procedure Mortality<sup>10</sup>

### *Service Volume Measures*

- Per Capita Ambulatory Physician and Care Management Encounter (PCMEs)
- Non-Surgical, Short-Stay, Low-Severity Admissions from the Emergency Department
- Admission to a Skilled Nursing or Rehabilitation Facility within Four Days of Hospital Discharge<sup>11</sup>

The first five “potentially preventable” measures are widely used in Medicaid payment systems and by other major payers, and as the basis of extensive analysis in the health care research literature. Attachment A contains a detailed description of each measure. Attachment B contains a bibliography of published articles using these measures.

While the dual population is primarily a low-income population, it is composed of two very different subpopulations, with the under-65 population being primarily disabled beneficiaries and the 65-and-over population having a substantial proportion of beneficiaries residing in nursing homes.

To compare the performance of the health care delivery system for the dual and non-dual populations, it was first necessary to risk adjust for the mix of beneficiaries in each population. The nine performance measures were risk adjusted using All Patient Refined DRGs (APR DRGs)<sup>12, 13</sup> or Clinical Risk Groups (CRGs).<sup>14, 15</sup> Both methods of risk adjustment are categorical clinical models composed of mutually exclusive and exhaustive clinically meaningful risk categories. Each beneficiary can be assigned to only a single risk category. A categorical clinical model allows the rate of occurrence of a performance measure in each risk category to be compared to the rate of occurrence of the performance measure in a reference population (norm) such as a national database. Attachment C contains a detailed description of each of the risk adjustment methods and Attachment D includes a bibliography of published articles using these methods of risk adjustment. Table 1 contains a summary description of the measures.

**Table 1: Summary Description of Measures**

Performance Measure	Type	Methodology	Risk Adjustment
<b>Quality Measures</b>			
Per Capita Potentially Preventable Admissions	Population	Potentially Preventable Admissions (PPAs)	Clinical Risk Groups (CRGs)
Per Capita Potentially Preventable Emergency Department Visits	Population	Potentially Preventable Emergency Department Visits (PPVs)	Clinical Risk Groups (CRGs)
Potentially Preventable Readmissions	Post-Acute	Potentially Preventable Readmissions within 30 days of hospital discharge (PPRs)	Discharge APR DRG with Severity-of-Illness Subclasses
Potentially Preventable Return Emergency Department Visits	Post-Acute	Potentially Preventable ED Visit within 30 days of hospital discharge (PPREDs)	Discharge APR DRG with Severity-of-Illness Subclasses
Inpatient Potentially Preventable Complications	Inpatient	One or more Potentially Preventable Complications during a hospital admission (PPCs)	Admission APR DRG with Severity-of-Illness Subclasses
30-Day Post-Inpatient Procedure Mortality	Inpatient Post-Acute	Death within 30 days of an inpatient procedure	Admission APR DRG with Risk-of-Mortality Subclasses
<b>Service Volume</b>			
Per Capita Ambulatory Physician and Care Management Encounter	Population	Any non-ED ambulatory visit with an Evaluation and Management code (PCMEs)	Clinical Risk Groups (CRGs)
Non-Surgical, Short-Stay, Low-Severity Admissions from the Emergency Department	Emergency Department	Short-stay non-surgical low-severity hospital admissions from the ED	Admission APR DRG with Severity-of-Illness Subclasses
Admission to a Skilled Nursing or Rehabilitation Facility within Four Days of Hospital Discharge	Post-Acute	Admission to a skilled nursing or rehabilitation facility within four days of hospital discharge	Discharge APR DRG with Severity-of-Illness Subclasses

## Socioeconomic Status

In general, Medicaid eligibility guidelines determine low-income beneficiaries. However, the substantial variability in Medicaid income eligibility requirements across states makes dual status an inconsistent measure of relative income. In addition, a dual beneficiary may reside in a community of high or low socioeconomic status (SES) with potentially different health care delivery systems. The Centers for Disease Control (CDC) has developed the Social Vulnerability Index (SVI) that includes a measure of SES for geographic areas based on the following factors:<sup>16</sup>

- Below Poverty
- Unemployed
- Income
- No High School Diploma

The CDC publishes the SES rank for all counties in the U.S. Based on this ranking, the study identified beneficiaries residing in the 25% of counties with the lowest SES to further distinguish the dual population.

## Comparing Performance

Because the under-65 and 65-and-older dual populations are so different, a separate national norm was created for each population. The national norms contain the rate of occurrence of each performance measure for each risk category in the national data. For each performance measure, the expected value (E) for any subset of beneficiaries (e.g., dual beneficiaries) is the number of beneficiaries in each risk category times the national norm value for the risk category summed over all risk categories (indirect rate standardization). The difference between the actual value (A) and the expected value (E) represents lower-than-expected performance if (A-E) is negative (A<E) and higher-than-expected performance if (A-E) is positive (A>E). The  $\%(A-E)/E$  is the percent by which the actual performance is lower than expected ( $\%(A-E)/E$  is negative) or higher than expected ( $\%(A-E)/E$  is positive).

In general, Medicaid eligibility guidelines determine low-income beneficiaries. However, the substantial variability in Medicaid income eligibility requirements across states makes dual status an inconsistent measure of relative income.

The dual and non-dual populations are compared using the  $\%(A-E)/E$  for each of the nine measures. The potentially preventable measures and the 30-day post-inpatient procedure mortality measure are negative events which a well-functioning delivery system should seek to minimize. Higher-than-expected rates ( $\%(A-E)/E$  positive) of these measures are indicative of a delivery system that is not functioning as intended. The service volume measures can have multiple interpretations. A lower-than-expected service volume rate could be caused by underutilization (a quality-of-care problem) and a higher-than-expected rate could be caused by over utilization (unnecessary services).

## Data

The analysis used data in the Medicare Standard Analytic Files (Limited Data Set (LDS)) for calendar years 2017 and 2018. The LDS files contain 100% of Medicare fee-for-service (FFS) claims data for inpatient, outpatient, skilled nursing facilities and home health agencies. The LDS carrier file contains Medicare FFS claims data for professional providers, including physicians, physician assistants, clinical social workers, and nurse practitioners for a random sample of 5% of Medicare beneficiaries. The LDS Master Beneficiary Summary File (MBSF) contains enrollment data on all Medicare beneficiaries enrolled in or entitled to Medicare within a given calendar year.

Claims data for 2018 was used for the hospital and emergency department measures and includes only hospitals paid under the inpatient prospective payment system (IPPS). For the SES analysis, beneficiaries were assigned to a county based on their county of residence.

For the per capita population measures, it was necessary to build a complete longitudinal record of all FFS claims for each Medicare beneficiary. Because the LDS carrier file is limited to a 5% sample of Medicare beneficiaries, the data used for the per capita population measures was limited to the beneficiaries in the LDS carrier file. The carrier file is a sample of all types of beneficiaries, including

beneficiaries in Medicare Advantage plans. To create a sample of just FFS beneficiaries, MBSF data was used to apply the following edits:

- Exclude beneficiaries who were not enrolled in both Medicare Part A and B for the full year (i.e., newly enrolled, disenrolled or reported died)
- Exclude beneficiaries who were enrolled in a managed care plan for one or more months
- Exclude beneficiaries who were enrolled in hospice

Calendar year 2017 was used to assign the CRG risk category to each beneficiary and calendar year 2018 was used to assign the population measures to each beneficiary. Depending on the hospital performance measure, the admission APR DRG or discharge APR DRG was used with either the severity-of-illness subclasses or risk-of-mortality subclasses (see Table 1 for details).

## Results

Table 2 contains the characteristics of Medicare beneficiaries for the dual and non-dual populations in the under-65 and 65-and-over populations. The under-65 population makes up 20.0% of the Medicare FFS population. Overall, 16.7% of the Medicare FFS population is dually eligible. A much higher percent of the under-65 population are duals (65.5%) compared to the 65-and-over population (12.4%). In both the under-65 and 65-and-over populations, the percent of duals living in low SES counties is roughly the same at 19.2% and 18.2%, respectively. The average age of the 65-and-over population is 74.1 years compared to 56.9 for the under-65 population. For non-duals, a higher percent of the under-65 population are minority beneficiaries (22.9%) compared to the 65-and-over population (13.4%). For dual beneficiaries, a slightly lower percent of the under-65 population are minority beneficiaries (34.2%) compared to the 65-and-over population (40.3%).

**Table 2: Characteristics of the dual and non-dual populations**

	Age 65 or Greater			Age Less Than 65		
	Non-Duals	Duals	Duals Low SES	Non-Duals	Duals	Duals Low SES
Enrollees	27,410,353	3,404,303	655,221	4,662,749	3,054,119	557,310
Overall % Enrollees	71.1	8.8	1.7	12.1	7.9	1.4
Within % Enrollees	100.0	12.4	19.2	100.0	65.5	18.2
% FPL	100.0	105.7	90.6	99.2	104.1	90.1
Average Age	74.1	75.7	75.3	56.9	49.2	50.2
% White	86.6	59.7	58.3	77.1	65.8	58.4
% Black	6.6	15.9	22.1	13.5	22.2	29.2
% Hispanic	1.0	8.2	9.7	3.0	5.9	6.9
% Asian	1.4	9.4	3.8	1.7	1.8	1.1
% Native Am	0.4	1.2	3.0	0.7	1.4	2.5
% Oth/Unkn race	3.9	5.6	2.9	3.9	2.9	2.0

The income eligibility limit for Medicaid varies from state to state and can be expressed as a percent of the federal poverty level (FPL). To examine the impact of this variation, each beneficiary was assigned the eligibility limit for a family of three to qualify for full Medicaid eligibility in their state of residence, expressed as a percent of the FPL for 2018.<sup>17</sup> In Table 2, the row labeled “Eligibility %FPL” contains the average Medicaid eligibility percent FLP. Dual beneficiaries residing in low SES

counties have a %FLP of about 90%. This means that dual beneficiaries who live in counties with lower SES tend to live in states with lower Medicaid eligibility income limits, making it more difficult to qualify for Medicaid from an income perspective.

**Performance for the 65-and-over population**

Using the 65-and-over population and computing expected performance based on the 65-and-over national norm, the %(A-E)/E for each measure for duals and non-duals is contained in Table 3. The last column in Table 3 further differentiates the dual population by identifying the subset of dual beneficiaries who reside in the 25% of counties with the lowest SES. Table 3 demonstrates that the actual Per Capita Potentially Preventable Admission rate for non-dual beneficiaries is 5.1% lower than the expected risk-adjusted rate and for dual beneficiaries is 25.4% higher than the expected risk-adjusted rate.

**Table 3: %(A-E)/E for Medicare Beneficiaries 65 and older**

Measure	Non-Duals	Duals	Duals Low SES
<b>Quality Measures</b>			
Per Capita Potentially Preventable Admissions (PPAs)	-5.1	25.4	24.5
Per Capita Potentially Preventable Emergency Department Visits (PPVs)	-6.1	36.8	33.1
Potentially Preventable Readmissions (PPRs)	-4.3	16.2	17.2
Potentially Preventable Return Emergency Department Visits (PPREDs)	-5.3	20.2	29.3
Inpatient Potentially Preventable Complications (PPCs)	-1.8	8.2	5.7
30-day Post Inpatient Procedure Mortality	0.0	-0.2	14.3
<b>Service Volume</b>			
Per Capita Ambulatory Physician and Care Management Encounter (PCMEs)	0.5	-3.2	-9.6
Non-Surgical, Short-Stay, Low-Severity Admissions From the Emergency Department	2.8	-10.1	-17.8
Admission to a Skilled Nursing or Rehabilitation Facility Within Four Days of Hospital Discharge	-5.1	20.3	9.8

With the exception of 30-day Post-Inpatient Procedure Mortality, duals have a higher-than-expected risk-adjusted rate for all the quality measures, indicating poor performance (excess number of quality failure). There is virtually no difference between the actual and risk-adjusted expected rate for the 30-day Post-Inpatient Procedure Mortality rate for duals and non-duals except for duals residing in low SES areas who have a 14.3% higher-than expected rate. For the subset of duals residing in low SES areas, the higher-than-expected risk-adjusted rate is consistent with the overall dual population except for Potentially Preventable Return Emergency Department Visits (increases from 20.2 to 29.3% higher than expected) and 30-day Post-Inpatient Procedure Mortality (increases from -0.2 to 14.3% higher than expected).

Results for the service volume measures are less consistent than for the quality measures. For the Per Capita Ambulatory Physician and Care Management Encounters measure, there is only a small



difference between the actual and the expected risk-adjusted rate except for duals residing in low SES areas who have a 9.6% lower-than-expected rate. The Non-Surgical Short-Stay, Low-Severity Admissions from the Emergency Department measure shows lower-than-expected risk-adjusted rates with the expected risk-adjusted rates even lower for the subset of duals residing in low SES areas (actual rate 17.8% lower than expected). Thus, dual beneficiaries are less likely to be admitted to the hospital from the emergency department for low-severity medical care and have fewer physician or care management visits than non-dual beneficiaries, especially for the subset of duals residing in low SES areas. Results for the Admission to a Skilled Nursing or Rehabilitation Facility within Four Days of Hospital Discharge measure are somewhat surprising with duals having a higher-than-expected rate (20.3%). This may be associated with many of the 65-and-over duals residing in nursing homes and requiring post-hospital discharge skilled nursing care before returning to a nursing home. Unfortunately, the data did not identify beneficiaries residing in nursing homes so this hypothesis could not be directly tested.

**Performance for the under-65 population**

Using the under-65 population and computing expected performance based on an under-65 national norm, the %(A-E)/E for each measure for duals and non-duals is contained in Table 4. For the quality measures, the performance of the under-65 population was consistent with the 65-and-over population with duals having a higher-than-expected risk-adjusted rate for all the quality measures with the exception of the 30-day Post-Inpatient Procedure Mortality. While there was virtually no difference in the 30-day Post-Inpatient Procedure Mortality rate for duals and non-duals for the 65-and-over population, in the under-65 population the non-duals have a higher-than-expected rate (9.0% above expected) and the duals have lower-than-expected rate (7.4% below expected).

**Table 4: %(A-E)/E for Medicare Beneficiaries under 65**

Measure	Non-Duals	Duals	Duals Low SES
<b>Quality Measures</b>			
Per Capita Potentially Preventable Admissions (PPAs)	-4.6	2.8	9.8
Per Capita Potentially Preventable Emergency Department Visits (PPVs)	-29.9	19.3	10.9
Potentially Preventable Readmissions (PPRs)	-12.6	8.2	6.3
Potentially Preventable Return Emergency Department Visits (PPREDs)	-26.0	15.8	13.8
Inpatient Potentially Preventable Complications (PPCs)	-3.9	2.8	0.1
30-Day Post-Inpatient Procedure Mortality	9.0	-7.4	1.2
<b>Service Volume</b>			
Per Capita Ambulatory Physician and Care Management Encounter (PCMEs)	-0.8	0.5	-3.3
Non-Surgical, Short-Stay, Low-Severity Admissions From the Emergency Department	18.1	-8.9	-11.6
Admission to a Skilled Nursing or Rehabilitation Facility within Four Days of Hospital Discharge	-16.3	11.5	-0.9

In analyzing service volume measures for the under-65 population, there was virtually no difference between the dual and non-dual populations for Per Capita Ambulatory Physician and Care Management Encounters. Performance results for duals and non-duals for the under-65 population are consistent with the 65-and-over population for Non-Surgical, Short-Stay, Low-Severity Admissions from the Emergency Department and Admission to a Skilled Nursing or Rehabilitation Facility within Four Days of Hospital Discharge.

While the magnitude of the performance difference between duals and non-duals differed between the under-65 and 65-and-over populations, the pattern of above and below expected was quite consistent. The one exception was the 30-day Post-Inpatient Procedure Mortality rate. The overall pattern for duals in both the under- and over-65 populations is higher-than-expected rates for the quality measures indicating poor performance (excess number of quality failure), and with the exception of Admission to a Skilled Nursing or Rehabilitation Facility within Four Days of Hospital Discharge, to have lower-than-expected rates for the services volume measures (fewer than expected services).

## **Summary and Conclusions**

While the dual population is primarily a low-income population, it is composed of two very different subpopulations with the under-65 population being primarily disabled beneficiaries and the 65-and-over population having a substantial proportion of beneficiaries residing in nursing homes. The care delivered to the dual and non-dual Medicare populations was measured using six quality measures and three service volume measures. The quality measures for both the under- and over-65 populations reveal a pattern of higher-than-expected risk-adjusted rates indicating poor performance (excess number of quality-of-care failures). Dual beneficiaries have more than expected per capita admissions and emergency department visits, more readmission and post-discharge returns to the emergency department and more inpatient complications. The service volume measures indicate that dual beneficiaries are less likely to be admitted from the emergency department for low-severity medical care and have fewer physician or care management visits than non-dual beneficiaries, especially for duals residing in low socioeconomic areas. These results demonstrate that there are substantive differences in the care delivered to Medicare dual and non-dual beneficiaries. Overall, the analysis suggests that the health care delivery system is performing at a less effective level for the dual Medicare population.

## References

- <sup>1</sup> Walsh ED, Freiman M, Haber S, Bragg A, Ouslander J, Wiener JM. Cost Drivers for Dually Eligible Beneficiaries: Potentially Avoidable Hospitalizations from Nursing Facility, Skilled Nursing Facility, and Home and Community-based Services Waiver Programs. Report prepared for the Centers for Medicare & Medicaid Services. Office of Policy. RTI International. August 2010.
- <sup>2</sup> Averill, R.F., Fuller, R.L. & Mills, R.E. (2021, January). Geographic variation in hospital admission rates in the Medicare population. 3M Clinical and Economic Research. <https://multimedia.3m.com/mws/media/2044671O/geographic-variation-hospital-admission-rates.pdf>
- <sup>3</sup> 3M Health Information Systems. 3M Patient Classification Methodologies: Potentially Preventable Admissions (PPAs). Web page: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppa/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppa/)
- <sup>4</sup> Averill, R.F., Fuller, R.L. & Mills, R.E. (2021, March). Geographic variation in hospital emergency department visits in the Medicare population. 3M Clinical and Economic Research. <https://multimedia.3m.com/mws/media/2044668O/geographic-variation-emergency-department-visits.pdf>.
- <sup>5</sup> 3M Health Information Systems. 3M Patient Classification Methodologies: Potentially Preventable Emergency Department Visits (PPVs). Web page: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppv/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppv/)
- <sup>6</sup> Goldfield N, McCullough E, Hughes J, Tang A, Eastman B, Rawlins L, Averill R. Identifying potentially preventable readmissions. *Health Care Financ Rev.* 2008;30(1):75-91.
- <sup>7</sup> 3M Health Information Systems. 3M Patient Classification Methodologies: Potentially Preventable Readmissions (PPRs). Web page: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/pprs/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/pprs/)
- <sup>8</sup> Hughes JS, Averill RF, Goldfield NI, Gay JC, Muldoon J, McCullough E, Xiang J. Identifying potentially preventable complications using a present on admission indicator. *Health Care Financ Rev.* 2006;27(3):63-82.
- <sup>9</sup> 3M Health Information Systems. 3M Patient Classification Methodologies: Potentially Preventable Complications. Web page: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppcs/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppcs/)
- <sup>10</sup> Averill, R.F., Fuller, R.L. & Mills, R.E. (2020, September). Surgical mortality as a measure of hospital quality. 3M Clinical and Economic Research. <https://multimedia.3m.com/mws/media/2044672O/surgical-mortality-hospital-quality.pdf>
- <sup>11</sup> Averill, RF, Fuller, RL, Mills, RE. (2021, June). Geographic variation in post-acute care facility admissions. 3M Clinical and Economic Research. <https://multimedia.3m.com/mws/media/2051382O/report-geographic-variation-in-post-acute-care-facility-admissions.pdf>.

<sup>12</sup> Hughes JS, Averill RF, Eisenhandler J, Goldfield NI, Muldoon J, Neff JM, Gay JC. Clinical Risk Groups (CRGs): a classification system for risk-adjusted capitation-based payment and health care management. *Med Care*. 2004;42(1):81-90.

<sup>13</sup> 3M Health Information Systems. 3M Patient Classification Methodologies: Clinical Risk Groups (CRGs). Web page: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/crgs/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/crgs/)

<sup>14</sup> Averill RF, Goldfield NI, Muldoon J, Steinbeck BA, Grant TM. A closer look at All-Patient Refined DRGs. *J AHIMA*. 2002;73(1):46-49.

<sup>15</sup> 3M Health Information Systems. 3M Patient Classification Methodologies: All Patient Refined DRGs (APR DRGs). Web page: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/apr-drgs/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/apr-drgs/)

<sup>16</sup> Centers for Disease Control & Prevention (CDC). (2020, January 31). CDC SVI 2018 Documentation. CDC Agency for Toxic Substances and Disease Registry (ATSDR). [https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI\\_documentation\\_2018.html](https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI_documentation_2018.html)

<sup>17</sup> Kaiser Family Foundation (KFF). Medicaid Income Eligibility Limits for Parents, 2002-2022. Web page: <https://www.kff.org/medicaid/state-indicator/medicaid-income-eligibility-limits-for-parents/?currentTimeframe=0&selectedDistributions=january-2018&selectedRows=%7B%22states%22:%7B%22all%22:%7B%7D%7D,%22wrapups%22:%7B%22united-states%22:%7B%7D%7D%7D&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>

## Appendix A: Description of Performance Measures

### Potentially Preventable Admissions (PPAs)

Potentially Preventable Admissions (PPAs) are hospital admissions that can often be avoided. There are six broad categories of PPAs:

- Admissions for chronic disease management that could potentially have been managed in the outpatient setting (e.g., asthma)
- Admissions for acute diseases that could potentially have been managed in the outpatient setting (e.g., viral pneumonia)
- Admissions for a procedure that can be done in an outpatient setting (e.g., cardiac catheterization for non-acute disease such as atherosclerosis)
- Admissions for a procedure for which there is a less invasive alternative procedure (e.g., percutaneous coronary angioplasty with a stent instead of coronary bypass surgery)
- Admissions for a procedure that research has shown to be prone to overuse (e.g., spinal procedures for back pain)
- Admissions that could potentially have been avoided for residents of a residential care facility such as a skilled nursing facility (e.g., trauma due a fall)

The most prevalent PPAs are for medical management of chronic and acute diseases. These hospital admissions may result from hospital or ambulatory care inefficiency, lack of adequate access to outpatient care, or inadequate coordination of ambulatory care services. In many cases PPAs are for flare-ups of chronic conditions (e.g., heart failure) for which adequate monitoring and follow-up, such as proper medication management, could have avoided the need for hospitalization.

Potential preventability is assessed relative to the care given in the immediate period preceding a hospital admission (months). Conditions that require an extended period of coordinated and integrated care are not considered potentially preventable. For example, an admission for renal failure is not considered a PPA because it is not preventable unless appropriate care has been given for several years before the admission making it difficult to judge potential preventability based solely on the care given in the immediate period preceding the admission. Preventability is also assessed based on the relative acuteness of the reason for the admission. For example, an admission for a cardiac catheterization is considered potentially preventable for patients with a diagnosis of coronary atherosclerosis, but not preventable for patients with an acute myocardial infarction or unstable angina.

Medicare beneficiaries living in residential care facilities such as a SNF or nursing home generally are expected to be receiving a higher level of coordinated care than beneficiaries living at home. Many conditions such as fever, urinary tract infections, metabolic disturbances and pneumonia can often be managed in a residential care facility, thereby avoiding the need for hospitalization. Other conditions such as diseases of the skin and injuries due to falls should be more readily avoided in a residential care facility setting. In determining whether an admission is potentially preventable, PPAs apply a broader list of conditions that are considered potentially preventable when a beneficiary is living in a residential care facility. For more detail go to: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppa/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppa/)

## Potentially Preventable Emergency Department Visits (PPVs)

Potentially Preventable ED Visits. (PPVs) are ED visits that can often be avoided. There are five broad categories of PPVs:

- ED visits for chronic disease management that could potentially have been managed in the outpatient setting (e.g., asthma)
- ED visits for minor acute conditions that could potentially have been managed in the outpatient setting (e.g., constipation)
- ED visits for signs and symptoms that do not require urgent care (e.g., lumbago)
- ED visits for minor trauma (contusions)
- ED visits that could potentially have been avoided for residents of a residential care facility such as a skilled nursing facility (e.g., trauma due to a fall)

The most prevalent PPVs will be for minor trauma and pain. These hospital emergency department visits may result from lack of access to adequate primary care or inadequate coordination of ambulatory care services. PPVs also include chronic conditions (e.g., hypertension) for which adequate monitoring and follow-up, such as proper medication management, could have avoided the need for an ED visit. A comprehensive evaluation of potentially preventable ED visits can provide a more complete assessment of the continuity of care and of the functioning of the health care delivery. For more detail go to: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppv/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppv/)

## Potentially Preventable Complications (PPCs)

Potentially Preventable Complications (PPCs) are harmful events (accidental laceration during a procedure) or negative outcomes (hospital acquired pneumonia) that may result from the process of care and treatment rather than from a natural progression of underlying disease. There are 57 PPCs that encompass the full range of complications. For each PPC, the patients considered at risk for the PPC and the clinical circumstances under which the PPC could be considered potentially preventable are specified. Any patient who had one or more PPCs during their hospital stay is considered to have a PPC. For more detail go to: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppcs/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppcs/)

## Potentially Preventable Readmissions (PPRs)

Potentially Preventable Readmissions (PPRs) are return hospitalizations within 30 days following a prior hospitalization. PPRs may result from deficiencies in the process of care (readmission for a surgical wound infection) or inadequate post-discharge follow-up (prescription not filled) rather than unrelated events that occur post discharge (broken leg due to trauma). Readmissions may result from actions taken or omitted during the initial hospital stay, such as incomplete treatment or poor care of the underlying problem, or from poor coordination of services at the time of discharge and afterwards, such as incomplete discharge planning or inadequate access to care. The admissions considered at risk for a PPR and the clinical circumstances under which a subsequent readmission is considered potentially preventable are specified in the PPR logic. A PPR is assigned to any admission that was followed by one or more potentially preventable readmissions during the 30 days following a hospital discharge. For more detail go to:

[https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/pprs/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/pprs/)

## **Potentially Preventable Return Emergency Department Visits Following Hospital Discharge (PPRED)**

Potentially Preventable Return Emergency Department (ED) Visits Following Hospital Discharge (PPREDs) are return ED visits within 30 days following a prior hospitalization. PPREDs are identified using a modification of the PPR methodology to determine discharges at risk and potentially preventable ED visits. Similar to PPRs, PPREDs may result from deficiencies in the process of care (ED visit for a post-op infection) or inadequate post-discharge follow-up (no primary care follow-up) rather than unrelated events that occur post discharge (trauma). Return ED visits may result from actions taken or omitted during the initial hospital stay, such as incomplete treatment or poor care of the underlying problem, or from poor coordination of services at the time of discharge and afterwards, such as incomplete discharge planning or inadequate access to care. A PPRED is assigned to any patient who had at least one PPRED during the 30 days following a hospital discharge. For more detail go to: [https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/pprs/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/pprs/)

## **Surgical Mortality**

The surgical mortality measure is based on a 30-day post-procedure time period that includes in-hospital and community deaths. Patients for whom a hospital was not considered reasonably responsible for the patient outcome, such as patients who left against medical advice, were transferred in, were in critical condition at the time of admission (APR DRG admission risk of mortality level 4), were admitted for conditions that inherently have a high risk of mortality (extensive third-degree burns) or had a clinically unrelated readmission (a PPR) during the 30-day post-procedure period were excluded. However, hospitals were considered responsible for mortality during any clinically related readmissions (non PPRs) in the 30-day post-procedure period. Surgical patients who were not excluded are the at-risk population for the 30-day post-procedure measure. For more detail go to: <https://multimedia.3m.com/mws/media/2044672O/surgical-mortality-hospital-quality.pdf>

## **Post-Discharge Facility Admission**

The Post-discharge Facility Admission measure identifies patients who were admitted to a skilled nursing facility or rehabilitation facility within four days following a hospital discharge. Hospital discharges considered at risk are restricted to discharges for which home care may be a viable alternative to care provided in an institution. Patients for whom the hospital's intended PAC plan of care is inconsistent with a PAC facility admission (e.g., a patient with a discharge status of discharge to hospice) or a patient who has an unanticipated event during the PAC four-day window (e.g., a patient with a discharge status of home but who was admitted to hospice on the second day before being admitted to a PAC facility on the fourth day following hospital discharge) were excluded from the PAC facility admission measure. By eliminating such ambiguous situations, the patients included in the PAC facility admission measure represent patients whose anticipated post-hospital discharge plan of care is consistent with a PAC facility admission. For more detail go to: <https://multimedia.3m.com/mws/media/2051382O/report-geographic-variation-in-post-acute-care-facility-admissions.pdf>.

## **Site Neutral Procedures**

Site neutral procedures are inpatient surgical cases that could reasonably be performed in an outpatient setting. The procedures considered eligible to be shifted from inpatient to outpatient were required to meet four criteria:

- The procedure is currently performed in both an inpatient and outpatient site of service
- The combined inpatient and outpatient volume of the procedure is substantial
- For inpatients the procedure will cause payment to be increased

- It is possible to identify equivalent procedures using the inpatient and outpatient procedure code sets.

The patients considered eligible to be shifted from inpatient to outpatient were required to meet three criteria:

- For inpatients the procedure must be clinically consistent with the reason for hospital admission
- High severity-of-illness patients at the time of admission are excluded
- Complex patients with multiple distinct procedure are excluded

Patients who meet these criteria and have a procedure that meets the site neutral criteria are considered eligible to be shifted from inpatient to outpatient. The Site Neutral Measure is the fraction of site neutral procedures performed in an inpatient setting. For more detail go to: <https://multimedia.3m.com/mws/media/20928710/the-shift-to-outpatient-surgery-geographic-variation-and-site-neutral-payments.pdf>

### **Hospital Admissions from the Emergency Department**

The ED Admit measure identifies hospital admissions that are a low-severity medical admission from the Emergency Department. Patients who died, who were admitted for surgical procedures, who were admitted for conditions that are inherently high risk (e.g., AMI), who were at high severity (admission APR DRG severity of illness 3 or 4), who were covered by medical necessity considerations (e.g., behavioral health) and who had a length of stay of more than three days are excluded from the ED Admit measure. The ED visits that were not excluded are the at-risk-population for the ED Admit measure and represent low-severity medical admissions (chest pain, upper respiratory infections, etc) for which outpatient care may be a viable option. For the at-risk ED visits, the ED Admit rate is the sum of ED visits that were admitted divided by the sum of ED visits that were admitted plus the ED visits that were not admitted.

### **Physician and Care Management Encounters (PCMEs)**

The ambulatory visit measure is the per capita number of physician or care management encounters. The encounters are identified by the reporting of an Evaluation and Management (E&M) code on a professional service fee-for-service claim for services delivered in specific sites of service. Encounters that have a site of service of a residential facility or that do not include care management services were excluded, including hospital inpatient, emergency department, ambulatory surgery center, skilled nursing facility, inpatient rehabilitation facility, ambulance, immunization center and laboratory. Encounters that have a site of service of physician office, hospital outpatient clinic, home, assisted living, nursing home and other clinics and outpatient facilities were included.

### **Inpatient Length of Stay (LOS)**

Patients who died during the hospital stay, were transferred to another acute-care hospital or left a hospital against medical advice were excluded from the LOS measure because they do not represent the full course of treatment. The APR DRGs have low and high LOS outlier values for each APR DRG and severity-of-illness subclass. Patients with LOS below the low LOS outlier value are atypical and usually represent data errors and are excluded. Patients with LOS that exceeds the high LOS outlier are less likely to be data errors and more likely to reflect individual hospital variation. Patients with LOS that exceeds the high LOS outlier value have their LOS truncated and set at the high LOS outlier value. This allows a consistent pattern of long length of stays to contribute to the evaluation of LOS performance without having a small number of patients with an extreme LOS disproportionately impact the evaluation of LOS performance. The LOS measure is the arithmetic mean LOS



## **Appendix B: Bibliography of Publicly Available Articles and Reports – PPAs, PPVs, PPCs, PPRs, PPREDs**

All articles and reports are publicly available and are listed in chronological order. The opinions and conclusions in these articles and reports are solely those of the authors.

### **Potentially Preventable Admissions (PPAs)**

#### *Articles, Reports, and Book Chapters*

Fuller RL, Clinton S, Goldfield NI, Kelly WP. Building the affordable medical home. *J Ambul Care Manage.* 2010;33(1):71-80.

Goldfield N, Kelly W, Patel K. Potentially Preventable Events: an actionable set of measures for linking quality improvement and cost savings. *Qual Manage Health Care.* 2012;21(4):213-219.

Millwee B, Goldfield N, Averill R, Hughes J. Payment system reform: one state's journey. *J Ambul Care Manage.* 2013;36(3):199-208.

Medicare Payment Advisory Commission. Feasibility of measuring population-based outcomes: potentially preventable admissions and emergency department visits. Online Appendix 3A in Report to the Congress: Medicare and the Health Care Delivery System. Washington, DC: MedPAC, June 2014.

3M Health Information Systems. The 3M Value Index Score: Measurement and Evidence. Murray, UT: 3M HIS, 2015.

Bernstein AB. Potentially Preventable Events: Comparing Medicaid and Privately Insured Populations. Presentation to the Medicaid and CHIP Payment and Access Commission. Washington, DC: MACPAC, Dec. 15, 2015.

Minnesota Department of Health. An Introductory Analysis of Potentially Preventable Health Care Events in Minnesota. St. Paul. MN: MNDOH, 2015.

Minnesota Department of Health. An Introductory Analysis of Potentially Preventable Health Care Events in Minnesota: Supplemental Technical Information. St. Paul. MN: MNDOH, 2015.

DuBard CA. Key Performance Indicators of Cost and Utilization for Medicaid Recipients Enrolled in Community Care of North Carolina. *N C Med J.* 2016;77(4):297-300.

Quinn K, Weimar D, Gray J, Davies B. Thinking about clinical outcomes in Medicaid. *J Ambul Care Manage.* 2016;39(2).

Florida Agency for Health Care Administration. Analysis of Potentially Preventable Healthcare Events of Florida Medicaid Enrollees: July 2015 to June 2016. Tallahassee, FL: AHCA, Winter 2017.

Florida Agency for Healthcare Administration. Analyzing Potentially Preventable Healthcare Events of Florida Medicaid Enrollees. Tallahassee, FL: AHCA, Spring 2017.

Myers & Stauffer. Cost Effectiveness Study Report for Mississippi Coordinated Access Network (MississippiCAN). Report to the Mississippi Division of Medicaid. Windsor, CT: Myers & Stauffer, 2017.

University of Florida, Institute for Child Health Policy. Texas Medicaid Managed Care and CHIP Summary of Activities and Trends in Healthcare Quality. Tallahassee, FL: ICHP, 2017.

Florida Agency for Health Care Administration. Analysis of Potentially Preventable Healthcare Events of Florida Medicaid Enrollees 2015-2016 and 2016-2017. Tallahassee, FL: AHCA, Winter 2018.

North Carolina Department of Health and Human Services. Plan for Implementation of Hospital Quality Outcomes Program and PHP Quality Outcomes Program. Report to the Legislature. Raleigh, ND: NCDHHS, Sept. 28, 2018.

Fuller RL, Goldfield NI, Hughes JS, McCullough EC. Nursing home compare star rankings and the variation in potentially preventable emergency department visits and hospital admissions. *Popul Health Manage*. Epub ahead of print. July 30, 2018.

Millwee B, Goldfield N, Turnipseed J. Achieving improved outcomes through value-based purchasing in one state. *Am J Med Qual*. 2018;33(2):162-171.

Millwee B, Quinn K, Goldfield N. Moving toward paying for outcomes in Medicaid. *J Ambul Care Manage*. 2018;41(2):88-94.

Florida Agency for Health Care Administration. Analysis of Potentially Preventable Healthcare Events of Florida Medicaid Enrollees 2015-2016 and 2016-2017. Tallahassee, FL: AHCA, Winter 2018.

Texas External Quality Review Organization. Quality, Timeliness, and Access to Health Care for Texas Medicaid and CHIP Recipients: Summary of Activities Calendar Year 2017. Austin, TX: Texas EQRO, n.d.

### *Websites*

Pennsylvania Department of Human Services. Hospital Assessment Initiative. Fiscal Year (FY) 2018-2019 Hospital Quality Incentive (HQI) Program Statewide Results. Web document at [https://www.dhs.pa.gov/providers/Documents/Hospital%20Assessment%20Initiative/c\\_292435.pdf](https://www.dhs.pa.gov/providers/Documents/Hospital%20Assessment%20Initiative/c_292435.pdf). [Accessed May 18, 2020]

Pennsylvania Department of Human Services. Hospital Assessment Initiative. Hospital Quality Incentive (HQI) Program State Fiscal Year (SFY) 2017-2018 Q&As. Web document available at [https://www.dhs.pa.gov/providers/Documents/Hospital%20Assessment%20Initiative/c\\_266647.pdf](https://www.dhs.pa.gov/providers/Documents/Hospital%20Assessment%20Initiative/c_266647.pdf). [Accessed May 18, 2020]

3M Health Information Systems. 3M Patient Classification Methodologies. Webpage: [www.3m.com/his/methodologies](http://www.3m.com/his/methodologies). Accessed Sept. 28, 2020

Texas Health and Human Services Commission. [www.thlcportal.com](http://www.thlcportal.com). Accessed 2020

Superior Health Plan. [www.superiorhealthplan.com/providers/resources/provider-programs/3m-his.html](http://www.superiorhealthplan.com/providers/resources/provider-programs/3m-his.html). Accessed 2020

Superior Health Plan. 3M Health Information. Available at [https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP\\_20195046-3M-HIS-Resource-Guide-P-508-03202019.pdf](https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20195046-3M-HIS-Resource-Guide-P-508-03202019.pdf)

Superior Health Plan. 3M HIS Prospective Dashboard User Guide. Available at [https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP\\_20173928-3M-HIS-Dashboard-Training-P-05312018.pdf](https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20173928-3M-HIS-Dashboard-Training-P-05312018.pdf).

## **Potentially Preventable Emergency Department Visits (PPVs)**

### *Articles, Reports, and Book Chapters*

Goldfield N, Kelly W, Patel K. Potentially Preventable Events: an actionable set of measures for linking quality improvement and cost savings. *Qual Manage Health Care*. 2012;21(4):213-219.

Millwee B, Goldfield N, Averill R, Hughes J. Payment system reform: one state's journey. *J Ambul Care Manage*. 2013;36(3):199-208.

Medicare Payment Advisory Commission. Feasibility of measuring population-based outcomes: potentially preventable admissions and emergency department visits. Online Appendix 3A in Report to the Congress: Medicare and the Health Care Delivery System. Washington, DC: MedPAC, June 2014.

3M Health Information Systems. The 3M Value Index Score: Measurement and Evidence. Murray, UT: 3M HIS, 2015.

Bernstein AB. Potentially Preventable Events: Comparing Medicaid and Privately Insured Populations. Presentation to the Medicaid and CHIP Payment and Access Commission. Washington, DC: MACPAC, Dec. 15, 2015.

Minnesota Department of Health. An Introductory Analysis of Potentially Preventable Health Care Events in Minnesota. St. Paul. MN: MNDOH, 2015.

Minnesota Department of Health. An Introductory Analysis of Potentially Preventable Health Care Events in Minnesota: Supplemental Technical Information. St. Paul. MN: MNDOH, 2015.

Burns & Associates. External Quality Review of Indiana's Hoosier Lose Year Healthwise Program and Healthy Indiana Plan for The Review Year Calendar Year 2014. Report to the Indiana Office of Medicaid Policy and Planning. Phoenix, AZ: Burns & Associates, 2016.

Quinn K, Weimar D, Gray J, Davies B. Thinking about clinical outcomes in Medicaid. *J Ambul Care Manage*. 2016;39(2).

Florida Agency for Health Care Administration. Analysis of Potentially Preventable Healthcare Events of Florida Medicaid Enrollees: July 2015 to June 2016. Tallahassee, FL: AHCA, Winter 2017.

Florida Agency for Healthcare Administration. Analyzing Potentially Preventable Healthcare Events of Florida Medicaid Enrollees. Tallahassee, FL: AHCA, Spring 2017.

University of Florida, Institute for Child Health Policy. Texas Medicaid Managed Care and CHIP Summary of Activities and Trends in Healthcare Quality. Tallahassee, FL: ICHP, 2017.

Myers & Stauffer. Cost Effectiveness Study Report for Mississippi Coordinated Access Network (MississippiCAN). Report to the Mississippi Division of Medicaid. Windsor, CT: Myers & Stauffer, 2017.

Florida Agency for Health Care Administration. Analysis of Potentially Preventable Healthcare Events of Florida Medicaid Enrollees 2015-2016 and 2016-2017. Tallahassee, FL: AHCA, Winter 2018.

Fuller RL, Goldfield NI, Hughes JS, McCullough EC. Nursing home compare star rankings and the variation in potentially preventable emergency department visits and hospital admissions. *Popul Health Manage*. Epub ahead of print. July 30, 2018.

Millwee B, Quinn K, Goldfield N. Moving toward paying for outcomes in Medicaid. *J Ambul Care Manage*. 2018;41(2):88-94.

Millwee B, Goldfield N, Turnipseed J. Achieving improved outcomes through value-based purchasing in one state. *Am J Med Qual*. 2018;33(2):162-171.

North Carolina Department of Health and Human Services. Plan for Implementation of Hospital Quality Outcomes Program and PHP Quality Outcomes Program. Report to the Legislature. Raleigh, ND: NCDHHS, Sept. 28, 2018.

Burns & Associates. External Quality Review of Indiana's Care Programs: Hoosier Healthwise, Hoosier Care Connect and HIP Review Year Calendar 2017. Report to the Indiana Office of Medicaid Policy and Planning. Phoenix, AZ: Burns & Associates, 2019.

Florida Agency for Health Care Administration. Analysis of Potentially Preventable Healthcare Events of Florida Medicaid Enrollees 2015-2016 and 2016-2017. Tallahassee, FL: AHCA, Winter 2018.

New York Department of Health. DSRIP PAOP Meeting June 24, 2019. Presentation, available at [www.health.ny.gov/health\\_care/medicaid/redesign/dsrip/paop/meetings/2019/docs/2019-06-24\\_pm-ff.pdf](http://www.health.ny.gov/health_care/medicaid/redesign/dsrip/paop/meetings/2019/docs/2019-06-24_pm-ff.pdf).

Texas External Quality Review Organization. Quality, Timeliness, and Access to Health Care for Texas Medicaid and CHIP Recipients: Summary of Activities Calendar Year 2017. Austin, TX: Texas EQRO, n.d.

### *Websites*

3M Health Information Systems. 3M Patient Classification Methodologies. Webpage: [www.3m.com/his/methodologies](http://www.3m.com/his/methodologies). Accessed 2020.

New York Department of Health--consumer information. <https://health.data.ny.gov/>. Accessed 2020

Superior Health Plan. [www.superiorhealthplan.com/providers/resources/provider-programs/3m-his.html](http://www.superiorhealthplan.com/providers/resources/provider-programs/3m-his.html). Accessed 2020

Texas Health and Human Services Commission. [www.thlcportal.com](http://www.thlcportal.com). Accessed 2020

Excelsus BlueCross BlueShield. Potentially Preventable Emergency Room Visits in New York State. Available at [www.excellusbcbs.com/wps/wcm/connect/341d4367-74bd-48ef-b980-bffd2006ba44/ER+infographic-EX+FINAL+4-6-16.pdf?MOD=AJPERES&%20%20CACHEID=341d4367-74bd-48ef-b980-bffd2006ba44](http://www.excellusbcbs.com/wps/wcm/connect/341d4367-74bd-48ef-b980-bffd2006ba44/ER+infographic-EX+FINAL+4-6-16.pdf?MOD=AJPERES&%20%20CACHEID=341d4367-74bd-48ef-b980-bffd2006ba44). Accessed June 30, 2019.

New York Department of Health. DSRIP Stories of Meaningful Change in Patient Health. Albany, n.d. Available at:  
[www.health.ny.gov/health\\_care/medicaid/redesign/dsrip/2019/docs/stories.pdf](http://www.health.ny.gov/health_care/medicaid/redesign/dsrip/2019/docs/stories.pdf).

Superior Health Plan. 3M HIS Prospective Dashboard User Guide. Available at  
[https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP\\_20173928-3M-HIS-Dashboard-Training-P-05312018.pdf](https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20173928-3M-HIS-Dashboard-Training-P-05312018.pdf).

Superior Health Plan. 3M Health Information Systems Guide: Understanding the Domains and Metrics. Available at  
[https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP\\_20195046-3M-HIS-Resource-Guide-P-508-03202019.pdf](https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20195046-3M-HIS-Resource-Guide-P-508-03202019.pdf)

## **Potentially Preventable Complications (PPCs)**

### *Articles, Reports, and Book Chapters*

Hughes JS, Averill RF, Goldfield NI, Gay JC, Muldoon J, McCullough E, Xiang J. Identifying potentially preventable complications using a present on admission indicator. *Health Care Financ Rev.* 2006;27(3):63-82.

Averill R, Vertrees J, McCullough E, Hughes J, Goldfield N. Redesigning the Medicare inpatient PPS to adjust payment for post admission complications. *Health Care Financ Rev.* 2006.

Averill R, Hughes J, Goldfield N, McCullough E. Hospital complications: linking payment reduction to preventability. *Jt Comm J Qual Patient Saf.* 2009;35(5):283-285.

Fuller RL, McCullough EC, Bao MZ, Averill RF. Estimating the costs of potentially preventable hospital acquired conditions. *Health Care Financ Rev.* 2009;30(4):17-32.

Fuller RL, Clinton S, Goldfield NI, Kelly WP. Building the affordable medical home. *J Ambul Care Manage.* 2010;33(1):71-80.

Fuller RL, McCullough EC, Averill RF. A new approach to reducing payments made to hospitals with high complication rates. *Inquiry.* 2011;48:68-83.

Lagoe RJ, Johnson PE, Murphy MP. Inpatient hospital complications and lengths of stay--a short report. *BMC Research Notes.* 2011;4(135).

Calikoglu S, Murray R, Feeney D. Hospital pay-for-performance programs in Maryland produced strong results, including reduced hospital-acquired conditions. *Health Aff (Millwood).* 2012;31(12):2649-2658

Goldfield N, Kelly W, Patel K. Potentially Preventable Events: an actionable set of measures for linking quality improvement and cost savings. *Qual Manage Health Care.* 2012;21(4):213-219.

Lagoe R, Bick J. Reducing hospital inpatient complications: A four-year experience. *Advances in Bioscience and Biotechnology.* 2013;4:118-125.

Millwee B, Goldfield N, Averill R, Hughes J. Payment system reform: one state's journey. *J Ambul Care Manage.* 2013;36(3):199-208.

Texas Health and Human Services Commission. Potentially Preventable Complications in the Texas Medicaid Population SFY 2012. Austin, TX: HHSC, 2013.

Michlewski E, Patterson W, Conroy MB. New York State All Payer Hospital Inpatient Potentially Preventable Complication (PPC) Rates: 2009-2012. Statistical Brief No. 1. Albany, NY: New York Department of Health, 2014.

University of Florida, Institute for Child Health Policy. Potentially Preventable Complications in Texas Medicaid and CHIP Programs FY 2013. Report to the Texas Health and Human Services Commission. Tallahassee, FL: ICHP, 2014

Patel A, Rajkumar R, Colmers JM, Kinzer D, Conway PH, Sharfstein JM. Maryland's global hospital budgets--preliminary results from an all-payer model. *N Engl J Med*. 2015;373:1899-1901.

Averill RF, Hughes JS, Fuller RL, Goldfield NI. Quality improvement initiatives need rigorous evaluation: the case of pressure ulcers. *Am J Med Qual*. 2017;32(5):552-555. doi:10.1177/1062860616666672.

Fuller RL, Goldfield NI, Averill RF, Hughes JS. Is the CMS Hospital-Acquired Condition Reduction Program a valid measure of hospital performance? *Am J Med Qual*. 2016;32(3):254-260.

Quinn K, Weimar D, Gray J, Davies B. Thinking about clinical outcomes in Medicaid. *J Ambul Care Manage*. 2016;39(2).

University of Florida, Institute for Child Health Policy. Texas Medicaid Managed Care and CHIP Summary of Activities and Trends in Healthcare Quality. Tallahassee, FL: ICHP, 2017.

Maryland Health Services Cost Review Commission. Final Recommendation for the Maryland Hospital-Acquired Conditions Program for Rate Year 2020. Baltimore, MD: HSCRC, 2018.

Millwee B, Quinn K, Goldfield N. Moving toward paying for outcomes in Medicaid. *J Ambul Care Manage*. 2018;41(2):88-94.

Texas Department of State Health Services. Potentially Preventable Complications in Texas CY 2016 Report. Austin, TX: DSHS, 2018.

University of Florida, Institute for Child Health Policy. Hospital Quality-Based Program: Potentially Preventable Complications. Technical notes for state FY 2018. Tallahassee, FL: ICHP, 2019

Maryland Health Services Cost Review Commission. Final Recommendation for the Maryland Hospital Acquired Conditions Program for Rate Year 2018. Baltimore: HSCRC, 2016.

New York Department of Health. Delivery System Reform Incentive Payment (DSRIP) Amendment Request. Albany, NY: NYDOH, Sept. 17, 2019.

Texas External Quality Review Organization. Quality, Timeliness, and Access to Health Care for Texas Medicaid and CHIP Recipients: Summary of Activities Calendar Year 2017. Austin, TX: Texas EQRO, n.d.

### *Websites*

3M Health Information Systems. [www.3m.com/his/methodologies](http://www.3m.com/his/methodologies). *Overview of the 3M patient classification methodologies, with a link to a separate PPC sub-page.*

New York Department of Health. <https://health.data.ny.gov/>. *Consumer information website with charts and data sets showing PPC performance by hospital for multiple years*

Texas Department of State Health Services. <https://www.dshs.texas.gov/thcic/hospitals/Potentially-Preventable-Complications-Reports/>. *Reports on statewide all-payer PPC incidence*

Texas Health and Human Services Commission. [www.thlcpportal.com](http://www.thlcpportal.com). *Interactive webpage on PPC performance by hospital, by service delivery plan, and by managed care plan, with data for multiple years*

## Potentially Preventable Readmissions (PPRs)

### *Articles, Reports, and Book Chapters*

Medicare Payment Advisory Commission. Payment policy for inpatient readmissions. Chapter 5 in Report to the Congress: Promoting Greater Efficiency in Medicare. Washington, DC: MedPAC, June 2007.

Goldfield N, McCullough E, Hughes J, Tang A, Eastman B, Rawlins L, Averill R. Identifying potentially preventable readmissions. *Health Care Financ Rev.* 2008;30(1):75-91.

Feudtner C, Levin JE, Srivastava R, Goodman DM, Slonim AD, Sharma V, Shah SS, Pati S, Fargason C Jr, Hall M. How well can hospital readmission be predicted in a cohort of hospitalized children? A retrospective, multicenter study. *Pediatrics.* 2009;123(1):286-293.

Utah Department of Health. Potentially Preventable Hospital Readmissions. Health Status Update. Salt Lake City: Utah DOH,2010.

Vest JR, Gamm LD, Oxford BA, Gonzalez MI, Slawson KM. Determinants of preventable readmissions in the United States: a systematic review. *Implement Sci.* 2010;5:88.

Utah Department of Health. Readmissions to Utah Hospitals, 2005-2007. Salt Lake City,UT: 2010

Fuller RL, Clinton S, Goldfield NI, Kelly WP. Building the affordable medical home. *J Ambul Care Manage.* 2010;33(1):71-80.

Goldfield N. Strategies to decrease the rate of preventable readmission to hospital. *CMAJ.* 2010;182(6):538-539.

Boutwell AE, Jencks SF. It's Not Six of One, Half Dozen the Other: A Comparative Analysis of 3 Rehospitalization Measurement Systems for Massachusetts. Academy Health Annual Research Meeting; Seattle, WA. 2011.

Eisenhandler J, Averill R, Vertrees J, Quain A, Switalski J. A Comparison of the Explanatory Power of Two Approaches to the Prediction of Post-acute Care Resources Use. Report to CMS. Wallingford, CT: 3M Health Information Systems, 2011.

Goldfield N. How important is it to identify avoidable hospital readmissions with certainty? *CMAJ.* 2011;183(7):e368-369.

Barrett M, Raetzman S, Andrews R. Overview of Key Readmission Measures and Methods. 2012. HCUP Methods Series Report #2012-04. Rockville, MD: AHRQ, 2012.

Fuller R, Goldfield N, Averill R, Hughes J. Inappropriate use of payment weights to risk adjust readmission rates. *Am J Med Qual.* 2012;27(1):341-344.

Goldfield N, Kelly W, Patel K. Potentially Preventable Events: an actionable set of measures for linking quality improvement and cost savings. *Qual Manage Health Care.* 2012;21(4):213-219.

Texas Health and Human Services. Potentially Preventable Readmissions in the Texas Medicaid Population, State Fiscal Year 2012. Austin, TX: HHSC, 2013.

Texas Health and Human Services Commission. Potentially Preventable Readmissions in the Texas Medicaid Population, State Fiscal Year 2012. Austin, TX: HSSC, 2013.

Averill R, Goldfield N, Hughes JS. Medicare payment penalties for unrelated readmissions require second look. *Healthc Financ Manage*. 2013(October):96-98.

Berry JG, Toomey SL, Zaslavsky AM, Jha AK, Nakamura MM, Klein DJ, Feng JY, Shulman S, Chiang VW, Kaplan W, Hall M, Schuster MA. Pediatric readmission prevalence and variability across hospitals. *JAMA*. 2013;309(4):372-380.

Davies S, Saynina O, Schultz E, McDonald KM, Baker LC. Implications of metric choice for common applications of readmission metrics. *Health Serv Res*. 2013;48:1978–1995.

Fuller RL, Atkinson G, McCullough EC, Hughes JS. Hospital readmission rates: the impacts of age, payer, and mental health diagnoses. *J Ambul Care Manage*. 2013;36(2).

Millwee B, Goldfield N, Averill R, Hughes J. Payment system reform: one state's journey. *J Ambul Care Manage*. 2013;36(3):199-208.

Quinn K, Davies B. *Potentially Preventable Readmissions in Rhode Island*. Cranston, RI: Xerox State Healthcare, 2014.

McCoy KA, Bear-Pfaffendof K, Foreman JK, Daniels T, Zabel EW, Grangaard LJ, Trevis JE, Cummings KA. Reducing avoidable hospital readmissions effectively: a statewide campaign. *Jt Comm J Qual Patient Saf*. 2014;40(5):198-204.

Stratis Health. RARE Campaign Exceeds Goals, Prevents 7,975 Avoidable Hospital Readmissions in Minnesota [news release]. Available at <http://www.stratishealth.org/news/20140617.html>. Accessed Jan. 28, 2020

3M Health Information Systems. *The 3M Value Index Score: Measurement and Evidence*. Murray, UT: 3M HIS, 2015.

Minnesota Department of Health. *An Introductory Analysis of Potentially Preventable Health Care Events in Minnesota*. St. Paul. MN: MNDOH, 2015.

Minnesota Department of Health. *An Introductory Analysis of Potentially Preventable Health Care Events in Minnesota: Supplemental Technical Information*. St. Paul. MN: MNDOH, 2015.

North Carolina Community Care Networks, Inc. *Clinical Program Analysis*. Report to the North Carolina Department of Health and Human Services. Raleigh, NC: NCCC, 2015

Borzecki AM, Chen Q, Restuccia J, Mull HJ, Shwartz M, Gupta K, Hanchate A, Strymish J, Rosen A. Do pneumonia readmissions flagged as potentially preventable by the 3M PPR software have more process of care problems? A cross-sectional observational study. *BMJ Qual Saf*. 2015;24:753-763.

DuBard CA, Jacobsen Vann JC, Jackson C. Conflicting readmission rate trends in a high-risk population: implications for performance measurement. *Popul Health Manag*. 2015;18:351–357

Fuller RL, Atkinson G, Hughes JS. Indications of biased risk adjustment in the Hospital Readmission Reduction Program. *J Ambul Care Manage*. 2015;38(1):39-47.

Gay JC, Agrawal R, Auger KA, Del Beccaro MA, Egtesady P, Fieldston ES, Golias J, Han PD, McClead R, Morse RB, Neuman ML, Simon HK, Tejedor-Sojo J, Teufel RJ, Harris JM, Shah SS. Rates and impact of potentially preventable readmissions at children's hospitals. *J Pediatr*. 2015;166(3):615-619.e5



- Jackson C, Shahsahehi M, Wedlake T, DuBard CA. Timeliness of outpatient follow-up: an evidence-based approach for planning after hospital discharge. *Ann Fam Med*. 2015;13(2):155-122.
- Soong C, Bell C. Identifying preventable readmissions: an achievable goal or waiting for Godot? *BMJ Qual Saf* 2015;24:741–743. doi:10.1136/bmjqs-2015-004484
- DuBard CA. Key Performance Indicators of Cost and Utilization for Medicaid Recipients Enrolled in Community Care of North Carolina. *N C Med J*. 2016;77(4):297-300.
- Goldfield N, Averill R, Fuller R, Hughes J. Misinterpretation of meaning and intended use of potentially preventable readmissions. *BMJ Qual Saf*. 2015;25(3):207–8.
- Lago R, Kronenberg P, Littau S. Readmissions by hospital inpatient service at the community level. *Intern Med Rev*. 2016;2.10.18103/imr.v2i9.234.
- Nakagawa K, Ahn HJ, Taira DA, Miyamura J, Sentel TL. Ethnic comparison of 30-day potentially preventable readmissions after stroke in Hawaii. *Stroke*. 2016;47:2611-2617
- Quinn K, Weimar D, Gray J, Davies B. Thinking about clinical outcomes in Medicaid. *J Ambul Care Manage*. 2016;39(2).
- Florida Agency for Health Care Administration. Analysis of Potentially Preventable Healthcare Events of Florida Medicaid Enrollees: July 2015 to June 2016. Tallahassee, FL: AHCA, Winter 2017.
- Florida Agency for Healthcare Administration. Analyzing Potentially Preventable Healthcare Events of Florida Medicaid Enrollees. Tallahassee, FL: AHCA, Spring 2017.
- Medicare Payment Advisory Commission. Health Care Spending and the Medicare Program: A Data Book (June 2017). Washington, DC: MedPAC, 2017.
- Medicare Payment Advisory Commission. Hospital inpatient and outpatient services. Chapter 3 in Report to the Congress: Medicare Payment Policy. Washington, DC: MedPAC, March 2017
- Myers & Stauffer. Cost Effectiveness Study Report for Mississippi Coordinated Access Network (MississippiCAN). Report to the Mississippi Division of Medicaid. Windsor, CT: Myers & Stauffer, 2017.
- University of Florida, Institute for Child Health Policy. Texas Medicaid Managed Care and CHIP Summary of Activities and Trends in Healthcare Quality. Tallahassee, FL: ICHP, 2017.
- Burns & Associates. External Quality Review of Indiana’s Care Programs: Hoosier Healthwise, Hoosier Care Connect and HIP 2.0 Review Year Calendar 2016. Report to the Indiana Office of Medicaid Policy and Planning. Phoenix, AZ: Burns & Associates, 2018.
- Florida Agency for Health Care Administration. Analysis of Potentially Preventable Healthcare Events of Florida Medicaid Enrollees 2015-2016 and 2016-2017. Tallahassee, FL: AHCA, Winter 2018.
- Medicare Payment Advisory Commission. Mandated report: The effects of the Hospital Readmissions Reduction Program. Chapter 1 in Report to the Congress: Medicare Payment Policy. (Washington, DC: MedPAC, June 2018)

North Carolina Department of Health and Human Services. Plan for Implementation of Hospital Quality Outcomes Program and PHP Quality Outcomes Program. Report to the Legislature. Raleigh, ND: NCDHHS, Sept. 28, 2018.

Texas Department of State Health Services. Potentially Preventable Readmissions in Texas: Calendar Year 2016 Report. Austin, TX: DSHS, 2018.

Fuller RL, Hughes JS, Goldfield NI, Averill RF. Will hospital peer grouping by patient socioeconomic status fix the Medicare hospital readmission reduction program or create new problems? *Jt Comm J Qual Patient Saf.* 2018;44:177-185.

McCoy RG, Peterson SM, Borkenhagen LS, Takahashi PY, Thorsteinsdottir B, Chandra A, Naessens JM. Which readmissions may be preventable? Lessons learned from a posthospitalization care transitions program for high-risk elders. *Med Care.* 2018;56(8):693–700.

Millwee B, Goldfield N, Turnipseed J. Achieving improved outcomes through value-based purchasing in one state. *Am J Med Qual.* 2018;33(2):162-171.

Millwee B, Quinn K, Goldfield N. Moving toward paying for outcomes in Medicaid. *J Ambul Care Manage.* 2018;41(2):88-94.

Mississippi Division of Medicaid. Quality Incentive Payment Program Potentially Preventable Readmissions Methodology Supplement. Jackson, MS: Mississippi Division of Medicaid, 2019. Available at <https://medicaid.ms.gov/wp-content/uploads/2020/01/MS-QIPP-Readmissions-Methodology-Supplement-2019-09.pdf>

New York Department of Health. DSRIP PAOP Meeting June 24, 2019. Presentation, available at [https://www.health.ny.gov/health\\_care/medicaid/redesign/dsrip/paop/meetings/2019/docs/2019-06-24\\_pm-ff.pdf](https://www.health.ny.gov/health_care/medicaid/redesign/dsrip/paop/meetings/2019/docs/2019-06-24_pm-ff.pdf).

Averill RF, Fuller RL, Mills RE. Financial Impact of Geographic Variation in Hospital Quality Performance in Medicare. Murray, UT: 3M Health Information Systems, 2019.

Burns & Associates. External Quality Review of Indiana’s Care Programs: Hoosier Healthwise, Hoosier Care Connect and HIP Review Year Calendar 2017. Report to the Indiana Office of Medicaid Policy and Planning. Phoenix, AZ: Burns \* Associates, 2019.

Florida Agency for Health Care Administration. Analysis of Potentially Preventable Healthcare Events of Florida Medicaid Enrollees 2015-2016 and 2016-2017. Tallahassee, FL: AHCA, Winter 2018.

Medicare Payment Advisory Commission. The effects of the Hospital Readmissions Reduction Program. Chapter 1 in Medicare and the Health Care Delivery System. Report to Congress. Washington, DC: MedPAC, June 2018.

New York Department of Health. Delivery System Reform Incentive Payment (DSRIP) Amendment Request. Albany, NY: NYDOH, Sept. 17, 2019.

Calsolaro V, Antognoli R, Pasqualetti G, Okoye C, Aquilini F, Cristofano M, Briani S, Monzani F. 30-day potentially preventable hospital readmissions in older patients: clinical phenotype and health care related risk factors. *Clin Interv Aging.* 2019;14:1851–1858.

Mississippi Division of Medicaid. DOM to phase in quality incentive payment program (QIPP) for hospitals. *MS Medicaid Provider Bulletin.* 2019;25(3):pp. 1-2

New York Department of Health. Hospital Inpatient Potentially Preventable Readmission (PPR) Rates by Hospital (SPARCS): Beginning 2009 [webpage].  
<https://healthdata.gov/dataset/hospital-inpatient-potentially-preventable-readmission-ppr-rates-hospital-sparcs-beginning>. Accessed Aug. 14, 2020.

Maryland Health Services Cost Review Commission. Final Recommendation for the Readmission Reduction Incentive Program for Rate Year 2022. Baltimore, MD: HSCRC, March 2020

Averill RF, Fuller RL, Mills RE. Geographic Variation in Hospital Quality Performance in Medicare by Disease and Procedure Categories. Supplement to the report: Financial Impact of Geographic Variation in Hospital Quality Performance in Medicare. Murray, UT: 3M Health Information Systems, 2020.

Zafar SN, Shah AA, Nembhard C, Wilson LL, Habermann EB, Raoof M, Wasif N. Readmissions after complex cancer surgery: analysis of the Nationwide Readmissions Database. *J Oncol Pract*. 2018;14(6):e335-345

Lindsey M, Patterson W, Ray K, Roohan P. Potentially Preventable Hospital Readmissions among Medicaid Recipients with Mental Health and/or Substance Abuse Health Conditions Compared with All Others: New York State, 2007. Statistical Brief No. 3. Albany, NY: NY Department of Health, n.d.

Patterson W, Lindsey M. Potentially Avoidable Hospitalizations: New York State Medicaid Program, 2009. Statistical Brief #6. Albany, NY: NY Department of Health, n.d.

New York Department of Health. DSRIP Stories of Meaningful Change in Patient Health. Albany, n.d. Available at:  
[www.health.ny.gov/health\\_care/medicaid/redesign/dsrip/2019/docs/stories.pdf](http://www.health.ny.gov/health_care/medicaid/redesign/dsrip/2019/docs/stories.pdf).

Texas External Quality Review Organization. Quality, Timeliness, and Access to Health Care for Texas Medicaid and CHIP Recipients: Summary of Activities Calendar Year 2017. Austin, TX: Texas EQRO, n.d.

### *Websites*

3M Health Information Systems. 3M Patient Classification Methodologies. Webpage:  
[www.3m.com/his/methodologies](http://www.3m.com/his/methodologies). Accessed Sept. 28, 2020

Florida Agency for Health Care Administration--consumer information.  
[www.floridahealthfinder.gov](http://www.floridahealthfinder.gov). Accessed 2020

New York Department of Health--consumer information. <https://health.data.ny.gov/>. Accessed 2020

Ohio Department of Medicaid Modernize Hospital Payments.  
<https://medicaid.ohio.gov/RESOURCES/Reports-and-Research/-Modernize-Hospital-Payments>. Accessed 2020

Texas Department of State Health Services--readmissions.  
[www.dshs.texas.gov/thcic/hospitals/Potentially-Preventable-Readmission-Reports/](http://www.dshs.texas.gov/thcic/hospitals/Potentially-Preventable-Readmission-Reports/). Accessed 2020

Texas Health and Human Services Commission. [www.thlcportal.com](http://www.thlcportal.com). Accessed 2020

Superior Health Plan. 3M Health Information. Available at [https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP\\_20195046-3M-HIS-Resource-Guide-P-508-03202019.pdf](https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20195046-3M-HIS-Resource-Guide-P-508-03202019.pdf)

Superior Health Plan. 3M HIS Prospective Dashboard User Guide. Available at [https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP\\_20173928-3M-HIS-Dashboard-Training-P-05312018.pdf](https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20173928-3M-HIS-Dashboard-Training-P-05312018.pdf).

## **Potentially Preventable Return Visits to the Emergency Department (PPREDS)**

### *Articles, Reports, and Book Chapters*

Averill RF, Fuller RL, Mills RE. Financial Impact of Geographic Variation in Hospital Quality Performance in Medicare. Murray, UT: 3M Health Information Systems, 2019. Available at [www.3mhiscer.com](http://www.3mhiscer.com).

Mississippi Division of Medicaid. Quality Incentive Payment Program Potentially Preventable Readmissions Methodology Supplement. Jackson, MS: Mississippi Division of Medicaid, 2019. Available at <https://medicaid.ms.gov/wp-content/uploads/2020/01/MS-QIPP-Readmissions-Methodology-Supplement-2019-09.pdf>

Averill RF, Fuller RL, Mills RE. Geographic Variation in Hospital Quality Performance in Medicare by Disease and Procedure Categories. Supplement to the report: Financial Impact of Geographic Variation in Hospital Quality Performance in Medicare. Murray, UT: 3M Health Information Systems, 2020.

Averill RF, Fuller RL, Mills RE. Geographic Variation in Hospital Admission Rates in the Medicare Population. Murray, UT: 3M Health Information Systems, 2021. Available at [www.3mhiscer.com](http://www.3mhiscer.com).

### *Websites*

3M Health Information Systems. 3M Patient Classification Methodologies. Webpage: [www.3m.com/his/methodologies](http://www.3m.com/his/methodologies). Accessed 2020.

## Appendix C: Risk Adjustment Methods

### All Patient Refined DRGs (APR DRGs)

All Patient Refined Diagnosis Related Groups (APR DRGs) are a categorical clinical model that is composed of base DRGs that are subdivided into four severity-of-illness levels based on the extent of physiologic decompensation or organ system loss of function and four risk of mortality subclasses. The underlying clinical principles of APR DRGs are that the severity of illness and risk of mortality are highly dependent on the patient's underlying clinical problems, and that patients with high severity of illness and risk of mortality are usually characterized by multiple serious illnesses. In the APR DRGs, the assessment of the severity of illness and risk of mortality of a patient is specific to the base APR-DRG to which a patient is assigned. In other words, the determination of the severity of illness and risk of mortality is disease specific. In APR DRGs, high severity of illness and risk of mortality are primarily determined by the interaction of multiple diseases. Patients with multiple comorbid conditions involving multiple organ systems represent difficult-to-treat patients who tend to have poor outcomes. The APR DRG is computed at the time of admission and at the time of discharge. For more detail go to:

[https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/apr-drgs/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/apr-drgs/)

### Clinical Risk Groups (CRGs)

The Clinical Risk Groups (CRGs) are a categorical clinical model that assigns each individual in a population to a single mutually exclusive risk group that relates the clinical and demographic characteristics of an individual to their outcomes and health care resource use. CRGs describe the health status and burden of chronic illness of individuals and are subdivided into up to six severity-of-illness levels. Each CRG and severity subgroup is used to describe the health status of groups of individuals with a similar burden of chronic illness. Individuals with severe chronic disease in multiple organ systems are the patients who are most difficult to treat, experience poorer outcomes, and consume a disproportionate share of health care resources.

The CRGs (Version 2.1) are composed of 332 base CRGs that describe the beneficiary's most significant chronic conditions and explicit severity levels that distinguish differences in disease burden due to severity of illness resulting in 1,414 individual CRGs. The individual CRGs are aggregated into nine health statuses ranging from catastrophic to healthy.

Status 1 – Healthy

Status 2 – History of Acute Disease e.g., Chest Pain

Status 3 – Single Minor Chronic Disease e.g., Migraine

Status 4 – Minor Chronic Disease in Multiple Organ Systems e.g., Migraine and BPH

Status 5 – Single Dominant or Moderate Chronic Disease e.g., CHF

Status 6 – Dominant or Moderate Chronic Disease in Multiple Organ Systems, e.g., CHF, COPD

Status 7 – Dominant Chronic Disease in Three or More Organ Systems, e.g., CHF, COPD, DM

Status 8 – Malignancy, Under Active Treatment, e.g., Lung Cancer

Status 9 – Catastrophic Conditions, e.g., Major Organ Transplant

Based on the severity levels of the chronic conditions that comprise each status, beneficiaries in the nine statuses are assigned a severity level between one and six resulting in 53 aggregated CRG risk categories. The CRGs are a transparent system with a definition manual available for inspection. For more detail go to:

[https://www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/crgs/](https://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/crgs/)

## Appendix D: Bibliography of Publicly Available Articles and Reports – CRGs, APR DRGs

All articles and reports are publicly available and are listed in chronological order. The opinions and conclusions in these articles and reports are solely those of the authors.

### Clinical Risk Groups (CRGs)

#### *Articles, Reports, and Book Chapters*

- Goldfield N, Averill R, Eisenhandler J, Hughes JS, Muldoon J, Steinbeck B, Bagadia F. The prospective risk adjustment system. *J Ambul Care Manage*. 1999;22(2):41-52.
- National Association of Children's Hospitals and Related Institutions. Summary Description of Clinical Risk Groups (CRGs). Washington, DC: NACHRI; 2000.
- Medicare Payment Advisory Commission. Report to the Congress: Improving Risk Adjustment in Medicare. Washington, DC: MedPAC, November 2000.
- Goldfield N, Averill R, Eisenhandler J. Payment and provider profiling of episodes of illness of clinical illnesses involving rehabilitation. *J Outcome Meas*. 2000;4(3):706-720.
- Majeed A, Bindman AB, Weiner JP. Use of risk adjustment in setting budgets and measuring performance in primary care I--how it works. *BMJ* 2001;323:604–607.
- Bethell C, Read D. Approaches to Identifying Children and Adults with Special Health Care Needs: A Resource Manual for State Medicaid Agencies and Managed Care Organizations. Report to CMS. Available at [www.childhealthdata.org](http://www.childhealthdata.org). 2002.
- Neff JM, Sharp VL, Muldoon J, Graham J, Popalisky J, Gay JC. Identifying and classifying children with chronic conditions using administrative data with the Clinical Risk Group classification system. *Ambul Pediatr*. 2002;2(1):71-79.
- Averill RF, Goldfield NI, Eisenhandler J, Muldoon JH, Hughes JS, Neff JM, Gay JG, Gregg LW, Gannon DE, Shafir BV, Bagadia FA, Steinbeck BA. Development and evaluation of Clinical Risk Groups. In: Goldfield N, Delivering High-Quality Cost-Effective Health Care to All: The Scientific and Political Ingredients for Success. Northampton, MA: Artichoke Publications, 2004.
- Goldfield N, Eisenhandler J, Gay G, McCullough E, Bao M, Neff J, Muldoon J, Hughes J, Mills R. Development of an episode of illness classification for population management using pharmacy data. *Dis Manag*. 2004;5(3).
- Hughes JS, Averill RF, Eisenhandler J, Goldfield NI, Muldoon J, Neff JM, Gay JC. Clinical Risk Groups (CRGs): a classification system for risk-adjusted capitation-based payment and health care management. *Med Care*. 2004;42(1):81-90.
- Neff JM, Sharp VL, Muldoon J, Graham J, Myers K. Profile of medical charges for children by health status group and severity level in a Washington State health plan. *HSR*. 2004;39(1):73-90.
- Berlinguet M, Preyra C, Dean S. Comparing the Value of Three Main Diagnostic Based Risk Adjustment Systems. Ottawa: ON: Canadian Health Services Research Foundation, 2005.
- Neff JM, Sharp VL, Popalisky J, Fitzgibbon T. Using medical billing data to evaluate chronically ill children over time. *J Am Care Manage*. 2006; 29(4):283-290.

Maine Health Information Center. Children in Out-of-Home Placement in New Hampshire Health Status, Utilization, Payments, and Preventive Visits, State Fiscal Year 2007. (Concord, NH: DHHS, 2009)

Bernstein RH. New arrows in the quiver for targeting case management: high-risk versus high-opportunity case identification. *J Ambul Care Manage.* 2007;30(1):39-51.

Alberta Health Quality Council. 2009 Measuring and Monitoring for Success. Calgary, AB: AHQC, 2009.

Kelly WP, Wendt SW, Vogel BB. Guiding principles for payment system reform. *J Ambul Care Manage.* 2010;33(1):29-34.

Neff JM, Clifton H, Park KJ, Goldenberg C, Popalisky J, Stout JW, Danielson BS. Identifying children with lifelong chronic conditions by using hospital discharge data. *Acad Pediatr.* 2010;10(6):417-423.

Eisenhandler J, Averill R, Vertrees J, Quain A, Switalski J. A Comparison of the Explanatory Power of Two Approaches to the Prediction of Post Acute Care Resources Use. Report to CMS. Wallingford, CT: 3M Health Information Systems, 2011.

New Hampshire Department of Health and Human Services. New Hampshire Medicaid Annual Report State Fiscal Year 2010. Concord, NH: DHHS, 2011.

Children's Hospital Association. Defining Children with Medical Complexities. Alexandria, VA: CHA, 2013.

3M Health Information Systems. The Impact of Disability Measures on Expected Medicare Payments and Expected Provider Charges for Event-Based Episodes that Include Post-Acute Care. Salt Lake City, UT: 3M HIS, 2013.

Medicare Payment Advisory Commission. Approaches to bundling payment for post-acute care. Chapter 3 in Report to the Congress: Medicare and the Health Care System. Washington, DC: MedPAC, June 2013.

Onpoint Health Data. Children's Health Insurance Programs in New Hampshire: Access, Prevention, Care Management, Utilization, & Payments (State Fiscal Year 2011). Report to DHHS. Concord, NH: DHHS, 2013

Schone E, Brown RS. Risk Adjustment: What Is the Current State of the Art, and How Can It Be Improved? Princeton, NJ: Robert Wood Johnson Foundation, 2013

Vertrees J, Averill R, Eisenhandler J, Quain A, Switalski J, Gannon D. The Ability of Event-Based Episodes to Explain Variation in Charges and Medicare Payments for Various Post-acute Service Bundles. Report to MedPAC. Wallingford, CT: 3M Health Information Systems, 2013.

Vigen G, Coughlin S, Duncan I. Measurement and Performance Healthcare Quality and Efficiency: Resources for Healthcare Professionals. Third update. Society of Actuaries, 2013.

Berry J, Hall M, Hall DE, Kuo DZ, Cohen E, Agrawal R, Mandl KD, Clifton H, Neff J. Inpatient growth and resource use in 28 children's hospitals. *JAMA Pediatrics.* 2013;167(2):170-177.

Fuller R, Goldfield N, Averill R, Eisenhandler J, Vertrees J. Adjusting Medicaid managed care payments for changes in health status. *Med Care Res Rev.* 2013;70(1):68-83.

Lion KC, Rafton SA, Shafii J, Brownstein D, Michel E, Tolman M, Ebel BE. Association between language, serious adverse events, and length of stay among hospitalized children. *Hosp Pediatr*. 2013;3(3): 219-225. <https://doi.org/10.1542/hpeds.2012-0091>

Vertrees J, Averill R, Eisenhandler, J, Quain, A, Switalski J. Bundling Post-Acute Care Services into MS-DRG Payments. *Medicare Medicaid Res Rev*. 2013;3(3):E1-E19

3M Health Information Systems. *The 3M Value Index Score: Measurement and Evidence*. Murray, UT: 3M HIS, 2015.

Johnson TL, Brewer D, Estracio R, Vlasimsky T, Durfee MJ, Thompson KR, Everhart RM, Rinehart DJ, Batal H. Augmenting predictive modeling tools with clinical insights for care coordination. *eGEMs (Generating Evidence & Methods to Improve Patient Outcomes)*. 2015;3(1).

## **All Patient Refined Diagnosis Related Groups (APR DRGs)**

### *Articles, Reports, and Book Chapters*

Jones P. A case study in APR DRGs: the Greater Southeast Community Hospital Experience. *Manage Care Q*. 1994;2(3):48-56.

Averill RF, Muldoon JH, Vertrees JC, Goldfield NI, Mullin RL, Finneran EC, Zhang MC, Steinbeck B, Grant T. The evolution of case mix measurement using Diagnosis Related Groups. In: Goldfield N. *Physician profiling and risk adjustment*. 2nd ed. Gaithersburg, MD: Aspen; 1999. p. 391-454.

Franklin PD, Legault JP. Using data to evaluate hospital inpatient mortality. *J Nurs Care Qual*. 1999;14(1):55-66.

Muldoon J. Structure and performance of different DRG classification systems for neonatal medicine. *Pediatrics*. 1999;103(1 Suppl E):302-18.

Goldfield N, Averill R. On "Risk-adjusting acute myocardial infarction mortality: are APR DRGs the right tool?" *Health Serv Res*. 2000;34(7):1491-1495; discussion 1495-1498.

Romano PS, Chan BK. Risk-adjusting acute myocardial infarction mortality: are APR DRGs the right tool? *Health Serv Res*. 2000;34(7):1469-1489

Averill RF, Goldfield NI, Muldoon J, Steinbeck BA, Grant TM. A closer look at All-Patient Refined DRGs. *J AHIMA*. 2002;73(1):46-49.

Lorenzoni I, Cisbani I, Manzoli I, Fantini MP. The evaluation of neonatal case mix using Medicare DRG and APR DRG classification systems. *Italian Journal of Pediatrics*. 2002;28:225-229.

Fantini MP, Cisbani L, Manzoli L, Vertrees J, Lorenzoni I. On the use of administrative databases to support planning activities. The case of the evaluation of neonatal casemix in the Emilia-Romagna region using DRG and APR DRG classification systems. *Eur J Public*. 2003;13(2):138-145.

Shen Y. Applying the 3M All Patient Refined Diagnosis Related Groups Grouper to measure inpatient severity in the VA. *Med Care*. 2003;41(6 Suppl):1103-10

Zhan C, Miller MR. Excess length of stay, charges, and mortality attributable to medical injuries during hospitalization. *JAMA*. 2003;290(14):1868-1874.



Sedman AB, Bahl V, Bunting E, Bandy K, Jones S, Nasr SZ, Schulz K, Campbell DA. Clinical redesign using All Patient Refined Diagnosis Related Groups. *Pediatrics*. 2004;114:975-969.

Fontaine P, Licoppe C, D'Andrea R. International-Refined (IR-DRG) versus 3M All Patient Refined DRG (APR DRG) to describe and predict costs of patients in 42 Belgium hospitals. Proceedings, WHO Family of International Classifications, Tokyo Meeting. <http://www3.who.int/icd/tokyomeeting/documentlist> (June 2005), P2-9.

Medicare Payment Advisory Commission. Physician-Owned Specialty Hospitals. Report to Congress. Washington, DC: MedPAC, March 2005.

Davis MP, Walsh D, LeGrand SB, Lagman RI, Harrison SB, Rybicki L. The financial benefits of acute inpatient palliative medicine: an inter-institutional comparative analysis by All Patient Refined-Diagnosis Related Group and case mix index. *J Support Oncol*. 2005;3(4):313-316.

Pirson M, Martins D, Jackson T, Dramaix M, Leclercq P. Prospective casemix-based funding, analysis and financial impact of cost outliers in All-Patient Refined Diagnosis Related Groups in three Belgian general hospitals. *Eur J Health Econ*. 2006;7(1):55-65.

Pirson, M., Dramaix, M., Leclercq, P., Jackson, T.: Analysis of cost outliers within APR-DRGs in a Belgian general hospital: two complementary approaches. *Health Policy*. 2006;76(1):13-25.

Wynn BO, Scott M. Evaluation of Severity-adjusted DRG Systems: Addendum to the Interim Report. Santa Monica, CA: RAND, 2007.

Fay MD, Jackson DA, Vogel BB. Implementation of a severity-adjusted diagnosis-related groups payment system in a large health plan: implications for pay for performance. *J Ambul Care Manage*. 2007;30(3):211-217.

Hayes KJ, Pettengill J, Stensland J. Getting the price right: Medicare payment rates for cardiovascular services. *Health Aff (Millwood)*. 2007;26(1):124-136.

Baram D, Daroowalla F, Garcia R, Zhang G, Chen JJ, Healy E, Riaz SA, Richman P. Use of the All Patient Refined-Diagnosis Related Group (APR-DRG) Risk of Mortality score as a severity adjustor in the medical ICU. *Clin Med Circ Respir Pulm Med*. 2008;2:19-25.

Baram D, Daroowalla F, Garcia R, Zhang G, Chen JJ, Healy E, Riaz SA, Richman P. Use of the All Patient Refined-Diagnosis Related Group (APR-DRG) Risk of Mortality score as a severity adjustor in the medical ICU. *Clin Med Insights Circ Respir Pulm Med*. 2008;2:(1-25).

Quinn K. New directions in Medicaid payment methods for hospital care. *Health Aff (Millwood)*. 2008;27(1):269-80.

Talsma A, Bahl V, Campbell D. Exploratory analyses of the "failure to rescue" measure: evaluation through medical record review. *J Nurs Care Qual*. 2008;2(3):202-210.

Averill R, McCullough E, Hughes J, Goldfield N, Vertrees J, Fuller R. Redesigning the Medicare inpatient PPS to reduce payments to hospitals with high readmission rates. *Health Care Financ Rev*. 2009;30(4):1-15.

Feudtner C, Levin JE, Srivastava R, Goodman DM, Slonim AD, Sharma V, Shah SS, Pati S, Fargason C Jr, Hall M. How well can hospital readmission be predicted in a cohort of hospitalized children? A retrospective, multicenter study. *Pediatrics*. 2009;123(1):286-293.

Kernisan LP, Lee SJ, Boscardin WJ, Landefeld CS, Dudley RA. Association between hospital-reported Leapfrog safe practices scores and inpatient mortality. *JAMA*. 2009;301(13):1341-1348.

Kozower BD, Ailawadi G, Jones DR, Pates RD, Lau CL, Kron IL, Stukenborg GJ. Predicted risk of mortality models: surgeons need to understand limitations of the University HealthSystems Consortium models. *J Am Coll Surg*. 2009;209(5):551-556

Lavernia CJ, Laoruengthana A, Contreras JS, Rossi MD. All-Patient Refined Diagnosis-Related Groups in primary arthroplasty. *J Arthroplasty*. 2009 Sep;24(6 Suppl):19-23.

Goldfield N. The evolution of diagnosis-related groups (DRGs): from its beginnings in case-mix and resource use theory, to its implementation for payment and now for its current utilization for quality within and outside the hospital. *Qual Manage Health Care*. 2010;19(1)3-16.

Kelly WP, Wendt SW, Vogel BB. Guiding principles for payment system reform. *J Ambul Care Manage*. 2010;33(1):29-34.

Shahian M, Wolf RE, Iezzoni LI, Kirle L, Normand ST. Variability in the measurement of hospital-wide mortality rates. *New Engl J Med*. 2010;363(26):2530-2539.

Puget Sound Health Alliance. 2011 Report: Use of Resources in High-Volume Hospitalizations. [https://wahealthalliance.org/wp-content/uploads/2013/11/puget\\_sound\\_health\\_alliance\\_resource\\_use\\_report\\_2011.pdf](https://wahealthalliance.org/wp-content/uploads/2013/11/puget_sound_health_alliance_resource_use_report_2011.pdf)

Mills R, Butler R, McCullough E, Bao M, Averill R. Impact of the transition to ICD-10 on Medicare inpatient hospital payments. *Medicare Medicaid Res Rev*. 2011;2(2);E1-E13.

Quinn K, Davies B. Variation in Payment for Hospital Care in Rhode Island. Report to the Office of Health Insurance Commissioner. Cranston, RI: Xerox State Healthcare; 2012.

Myers RP, Hubbard JN, Shaheen AAM, Dixon E, Kaplan GG. Hospital performance reports based on severity adjusted mortality rates in patients with cirrhosis depend on the method of risk adjustment. *Ann Hepatol*. 2012;11(4):526-535

Shine D. Risk-adjusted mortality: problems and possibilities. *Comput Math Methods Med*

Iezzoni, LI. Coded data from administrative sources. In Iezzoni LI, ed., *Risk Adjustment for Measuring Healthcare Outcomes*. 4th ed. Chicago: Health Administration Press, 2013

Vertrees J, Averill R, Eisenhandler J, Quain A, Switalski J, Gannon D. The Ability of Event-Based Episodes to Explain Variation in Charges and Medicare Payments for Various Post Acute Service Bundles. Report to MedPAC. Wallingford, CT: 3M Health Information Systems, 2013.

Vigen G, Coughlin S, Duncan I. *Measurement and Performance Healthcare Quality and Efficiency: Resources for Healthcare Professionals*. Third update. Society of Actuaries, 2013.

Xerox State Healthcare. *Medi-Cal DRG Project Policy Design Document*. Report to the California Department of Health Care Services. Atlanta: Xerox, 2013.

Berry JG, Toomey SL, Zaslavsky AM, Jha AK, Nakamura MM, Klein DJ, Feng JY, Shulman S, Chiang VW, Kaplan W, Hall M, Schuster MA. Pediatric readmission prevalence and variability across hospitals. *JAMA*. 2013;309(4):372-380.

Mull HJ, Chen Q, O'Brien WJ, Shwartz M, Borzecki AM, Hanchate A, Rosen AK. Comparing 2 methods of assessing 30-day readmissions: what is the impact on hospital profiling in the Veterans Health Administration? *Med Care*. 2013;51(7):589-96.

Pirson M, Schenker L, Martins D, Duong D, Chale JJ, Leclercq P. What can we learn from international comparisons of costs by DRG? *Eur J Health Econ*. 2013;14(1):67-73.

Vertrees J, Averill R, Eisenhandler, J, Quain, A, Switalski J. Bundling Post-Acute Care Services into MS-DRG Payments. *Medicare Medicaid Res Rev*. 2013;3(3):E1-E19

Averill R, Fuller R. Low-cost outliers as alternatives to the two-midnight rule. *Healthc Financ Manage*. 2014(December)

McCullough EC, Sullivan C, Banning P, Goldfield NI, Hughes JS. Challenges and benefits of adding laboratory data to a mortality risk adjustment method. *Qual Manage Health Care*. 2011;20(4):253-262.

Quinn K. After the revolution: DRGs at age 30. *Ann Intern Med*. 2014;160:426-429.

Quinn K, Davies B. Applicability of Hospital-Specific Relative Value (HSRV) DRG Weights. Memorandum to California Department of Health Care Services. West Sacramento, CA: Xerox State Healthcare, 2015.

Mellinger JL, Richardson CR, Mathur AK, Volk ML. Variation among United States hospitals in inpatient mortality for cirrhosis. *Clin Gastroenterol Hepatol*. 2015;13(3):577-584.

Mills R, Bulter R, Averill R, McCullough E, Fuller R, Bao, M. The impact of the transition to ICD-10 on Medicare inpatient hospital payments. *J AHIMA*. 2015(February).

Quinn K. The 8 basic payment methods in health care. *Ann Intern Med*. 2015;163(4):300-306.

Villwock JA, Goyal P. Early versus delayed treatment of primary epistaxis in the United States. *Int Forum Allergy Rhinol*. 2014;4:69-75.

Wissoker D, Garrett B. Designing a Unified Prospective Payment System for Postacute Care. Contractor report. Washington, DC: MedPAC, 2016

Averill RF, Fuller RL. Implementing a site-neutral PPS. *Healthc Financ Manag*. 2016(April).

Fuller RL, Averill RF, Muldoon JH, Hughes JS. Comparison of the properties of regression and categorical risk-adjustment models. *J Ambul Care Manage*. 2016;39(2):157-165.

Fuller RL, Averill RF, Muldoon JH, Hughes JS. Response to commentaries on "Comparison of the properties of regression and categorical risk-adjustment models." *J Ambul Care Manage*. 39(2):175-177. doi:10.1097/JAC.0000000000000147.

Leyenaar JK, Ralston SL, Shieh M, Pekow PS, Mangione-Smith R, Lindenauer PK. Epidemiology of pediatric hospitalizations at general hospitals and freestanding children's hospitals in the United States. *J Hosp Med*. 2016;11(11):743-749.

Medicaid and CHIP Payment and Access Commission. Comparing Medicaid Hospital Payment Across States and to Medicare. Washington, DC: MACPAC, 2017.

California Department of Health Care Services. Review of SFYs 2013-14 and 2014-15 Utilization and Payment. Sacramento, CA: DHCS, 2017.

- Navigant Inc. Arkansas DRG Conversion Plan. Report to the Arkansas Department of Human Services. Chicago: Navigant, 2017.
- Alaska Department of Health and Social Services. AK DHSS Annual Medicaid Reform Report FY 2018. Anchorage, AK: DSS, 2018.
- Fuller R. An Analysis of Real Price Effects Resulting from Charge Setting Practices in the US Hospital Sector. Highland, MD: Jayne Koskinas Ted Giovanis Foundation for Health and Policy, 2018.
- Marks T, Gifford K, Perlin S, Byrd M, Beger T. Factors Affecting the Development of Medicaid Hospital Payment Policies--Findings from Structured Interviews in Five States. Report to MACPAC. Lansing, MI: HMA, 2018.
- Medicaid and CHIP Payment and Access Commission. State Medicaid Payment Policies for Inpatient Hospital Services. Available at <https://www.macpac.gov/publication/macpac-inpatient-hospital-payment-landscapes/>
- Fuller RL, Hughes JS, Goldfield NI, Atkinson G. Are we confident of across-hospital mortality comparisons? *Am J Med Qual.* 2018;33(6):662-664.
- McCormick PJ, Lin HM, Deiner SG, Levin MA. Validation of the All Patient Refined Diagnosis Related Group (APR-DRG) risk of mortality and severity of illness modifiers as a measure of perioperative risk. *J Med Syst.* 2018;42(5):81.
- Deschepper M. Using standard available hospital-wide data in the interpretation and prediction of outcome indicators. Doctoral dissertation, Ghent University. Faculty of Medicine and Health Sciences; 2019.
- Averill RF, Fuller RL, Mills RE. Financial Impact of Geographic Variation in Hospital Quality Performance in Medicare. Murray, UT: 3M Health Information Systems, 2019.
- Medicare Payment Advisory Commission. The effects of the Hospital Readmissions Reduction Program. Chapter 1 in Medicare and the Health Care Delivery System. Report to Congress. Washington, DC: MedPAC, June 2018.
- U.S. Agency for Health Care Research and Quality. AHRQ Quality Indicators: Quality Indicator Empirical Methods. Rockville, MD: AHRQ, 2019.
- Fuller RL, Hughes JS, Atkinson G, Aubry BS. Problematic risk adjustment in National Healthcare Safety Network Measures. *Am J Med Qual.* 2019:1-8.
- Lawrence YR, Golan T, Urban D, Hammer L, Amit U, Catane R, Bar J, Goldstein J, Symon Z, Urban G. Effect of hospital volume on mortality rates amongst neutropenic cancer patients within the United States. *J Clin Onc.*2016;34:15\_sup 6600\
- Souza J, Santos JV, Canedo VB, Betanzos A, Alves D, Freitas A. Importance of coding co-morbidities for APR-DRG assignment: focus on cardiovascular and respiratory diseases. *Health Inf Manag.* 2019; doi: 10.1177/1833358319840575. [Epub ahead of print]
- Averill RF, Fuller RL, Mills RE. Surgical Mortality as a Measure of Hospital Quality. Murray, UT: 3M Health Information Systems, 2020.
- Fuller R, Hughes J. DNR orders known at the time of admission can improve hospital mortality ratings [abstract]. *HSR.* 2020;55(51):96

## Websites

Washington Health Alliance. Inpatient Spending Trends in Washington State (February 2020). Webpage: <https://www.wacommunitycheckup.org/highlights/inpatient-spending-trends-in-washington-state-february-2020/>. Accessed Sept. 28, 2020.

Washington Health Alliance. Variation of Pricing for Inpatient Treatments in Washington State. 2019. webpage: <https://www.wacommunitycheckup.org/highlights/variation-of-pricing-for-inpatient-treatments-in-washington-state/>. Accessed Sept. 28, 2020.

Illinois DRG Pricing Calculator. <https://www.illinois.gov/hfs/MedicalProviders/hospitals/hospitalratereform/Pages/default.aspx>. Accessed 2020

Montana Medicaid Inpatient Pricing Calculator. <https://medicaidprovider.mt.gov/01#186035117-fee-schedules---hospital---apr-drg>. Accessed 2020

RI Medicaid APR-DRG Pricing Calculator. <http://www.eohhs.ri.gov/ProvidersPartners/GeneralInformation/ProviderDirectories/Hospitals.aspx>. Accessed 2020

3M Health Information Systems. 3M Patient Classification Methodologies. Webpage: [www.3m.com/his/methodologies](http://www.3m.com/his/methodologies). Accessed Sept. 28, 2020

Arizona Health Care Cost Containment System. AZ APR-DRG Pricing Calculator FY 2020. Available at: [www.azahcccs.gov/PlansProviders/RatesAndBilling/FFS/APRDRGrates.html](http://www.azahcccs.gov/PlansProviders/RatesAndBilling/FFS/APRDRGrates.html)

Colorado Department of Health Care Policy and Financing. Inpatient Hospital Payment. [Webpage]. <https://www.colorado.gov/pacific/hcpf/inpatient-hospital-payment>. Accessed Aug. 14, 2020

Connecticut Department of Social Services. Medicaid Hospital Reimbursement. Webpage: [www.ctdssmap.com/CTPortal/Hospital%20Modernization/tabId/143/Default.aspx](http://www.ctdssmap.com/CTPortal/Hospital%20Modernization/tabId/143/Default.aspx). Accessed Sept. 28, 2020.

District of Columbia Department of Health Care Finance. Rates and Reimbursements. Webpage: <https://dhcf.dc.gov/page/rates-and-reimbursements>. Accessed Aug. 22, 2020.

Indiana Department of Health. Hospital Discharge Data [webpage]. [www.in.gov/isdh/20624.htm](http://www.in.gov/isdh/20624.htm)

Minnesota Department of Human Services. Payment Methodology for Inpatient Hospitals. Webpage: <https://mn.gov/dhs/partners-and-providers/policies-procedures/minnesota-health-care-programs/provider/types/payment-methodology-for-inpatient-hospitals.jsp>. Accessed Sept. 28, 2020

Mississippi Division of Medicaid. Inpatient Hospital Payment Method for Mississippi Medicaid [webpage]. <https://medicaid.ms.gov/providers/reimbursement/>. Accessed Aug. 14, 2020.

Texas Medicaid and Healthcare Partnership. Acute Care Hospital Reimbursement [webpage]. <http://www.tmhp.com/resources/rate-and-code-updates/acute-care-hospital-reimbursement>. Accessed Oct. 29, 2020..

Washington HealthCareCompare [webpage]. <https://www.wahealthcarecompare.com/>. Accessed Aug. 17, 2020.

Wisconsin Department of Health Services. ForwardHealth Rates and Weights [webpage]. <https://www.forwardhealth.wi.gov/WIPortal/Tab/42/icscontent/Provider/Medicaid/hospital/drg/drg.htm.spage#>. Accessed Aug. 14, 2020.

California Department of Health Care Services. <https://www.dhcs.ca.gov/provgovpart/Pages/DRG.aspx>. Accessed 2020

Florida Agency for Health Care Administration--consumer information. [www.floridahealthfinder.gov](http://www.floridahealthfinder.gov). Accessed 2020

Illinois Department of Healthcare and Family Services . [www.illinois.gov/hfs/MedicalProviders/MedicaidReimbursement/Pages/DRGHICalcuWorksheet.aspx](http://www.illinois.gov/hfs/MedicalProviders/MedicaidReimbursement/Pages/DRGHICalcuWorksheet.aspx). Accessed 2020

New York Department of Health--consumer information. <https://health.data.ny.gov/>. Accessed 2020

New York Department of Health--Medicaid. <https://www.health.ny.gov/facilities/hospital/reimbursement/apr-drg/>. Accessed 2020

Indiana Medicaid Diagnosis-Related Group Inpatient Reimbursement. <https://www.in.gov/medicaid/providers/669.htm>. Accessed 2020

Ohio Department of Medicaid Hospital Payment Policy. <https://medicaid.ohio.gov/Provider/ProviderTypes/HospitalProviderInformation/HospitalPaymentPolicy>. Accessed 2020

North Carolina Community Care Networks, Inc. Clinical Program Analysis. Report to the North Carolina Department of Health and Human Services. Raleigh, NC: NCCC, 2015

Berry JG, Hall M, Cohen E, O'Neill M, Feudtner C. Ways to identify children with medical complexity and the importance of why. *J Pediatr*. 2015;167(2):229-237. HSR. 20014;39(1):73-

DuBard CA, Jacobsen Vann JC, Jackson C. Conflicting readmission rate trends in a high-risk population: implications for performance measurement. *Popul Health Manag*. 2015;18:351–357

Jackson C, Shahsahehi M, Wedlake T, DuBard CA. Timeliness of outpatient follow-up: an evidence-based approach for planning after hospital discharge. *Ann Fam Med*. 2015;13(2):155-122.

Jones C, Finison K, McGraves-Lloyd, Tremblay T, Mohlman MK, Tanzman B, Hazard M, Maier, Samuelson J. Vermont's community-oriented all-payer medical home model reduces expenditures and utilization while delivering high-quality care. *Popul Health Manag*. 2015. DOI: 10.1089/pop.2015.0055.

Neff JM, Clifton H, Popalisky J, Zhou C. Stratification of children by medical complexity. *Acad Pediatr*. 2015;15(2):191-196.

Pfister DG, Rubin DM, Elkin EE, Neill US, Duck E, Radzyner M, Bach PB. Risk adjusting survival outcomes in hospitals that treat patients with cancer without information on cancer stage. *JAMA Oncol*. 2015;1(9):1303-1310.

Quinn K. The 8 basic payment methods in health care. *Ann Intern Med*. 2015;163(4):300-306.

- Florida Agency For Healthcare Administration. Analyzing the Disease Burden of Florida Medicaid Enrollees Using Clinical Risk Groups. Tallahassee, FL: AHCA, Winter 2016.
- Hileman G, Steele S. Accuracy of Claims-Based Risk Scoring Models. Schaumburg, IL: Society of Actuaries, 2016.
- DuBard CA. Key Performance Indicators of Cost and Utilization for Medicaid Recipients Enrolled in Community Care of North Carolina. *N C Med J*. 2016;77(4):297-300.
- Fuller RL, Goldfield N. Paying for on-patent pharmaceuticals: limit prices and the emerging role of a pay for outcomes approach. *J Ambul Care Manage*. 2016;39(2):143-149.
- Fuller RL, Goldfield N. Response to commentaries on “Paying for on-patent pharmaceuticals: limit prices and the emerging role of a pay for outcomes approach”. *J Ambul Care Manage*. 2016;39(2):155-156.
- Fuller RL, Hughes JS, Goldfield NI. Adjusting population risk for functional health status. *Popul Health Manage*. 2016;19(2):136-144.
- Gareau S, Lopez-De Fede A, Loudermilk BL, Cummings TH, Hardin JW, Picklesimer AH, Crouch E, Covington-Kolb S. Group prenatal care results in Medicaid savings with better outcomes: a propensity score analysis of CenteringPregnancy participation in South Carolina. *Matern Child Health J*. 2016;20(7):1384–1393.
- Juhnke C, Bethge S, Mühlbacher AC. A review on methods of risk adjustment and their use in integrated healthcare systems. *Int J Integr Care*. 2016;16(4):1–18
- Mohlman MK, Tanzman B, Finison K, Pinette M, Jones C. Impact of medication-assisted treatment for opioid addiction on Medicaid expenditures and health services utilization rates in Vermont. *J Subst Abuse Treat*. 2016;67: 9–14
- Finison K, Mohlman M, Jones C, Pinette M, Jorgenson D, Kinner A, Tremblay T, Gottlieb D. Risk-adjustment methods for all-payer comparative performance reporting in Vermont. *BMC Health Serv Res*. 2017;17.
- Bednar WR, Axene JW, Lilledahl RL. An Analysis of End-of-Life Costs for Terminally Ill Medicare Fee-for-Service (FFS) Cancer Patients. Schaumburg, Society of Actuaries, 2018.
- Fuller RL, Goldfield NI, Hughes JS, McCullough EC. Nursing home compare star rankings and the variation in potentially preventable emergency department visits and hospital admissions. *Popul Health Manage*. Epub ahead of print. July 30, 2018.
- Averill RF, Fuller RL, Mills RE. Financial Impact of Geographic Variation in Hospital Quality Performance in Medicare. Murray, UT: 3M Health Information Systems, 2019.
- Connecticut Department of Social Services. Connecticut State Innovation Model Operational Plan Award Year 4. Hartford, CT: DSS, 2019.
- Vermont Agency of Human Services. Annual Report on The Vermont Blueprint for Health. Report to the Legislature. Burlington, VT; Agency of Human Services, 2020
- Vermont Agency of Human Services. Community Health Profiles [webpage]. <https://blueprintforhealth.vermont.gov/community-health-profiles>. Accessed Aug. 17, 2020.

Andrews AL, Bettenhausen J, Hoefgen E, Richardson T, Macy ML; Zima BT, Colvin J; Hall M; Shah SS, Neff NM, Auger KA. Measures of ED Utilization in a National Cohort of Children. *Am J Manag Care*. 2020;26(6):267-272.

3M Health Information Systems. 3M Patient Classification Methodologies. Webpage: [www.3m.com/his/methodologies](http://www.3m.com/his/methodologies). Accessed Sept. 28, 2020

Vermont Agency of Human Services. Hub and Spoke Profiles [webage]. . Annual Report on The Vermont Blueprint for Health. Report to the Legislature. Burlington, VT; Agency of Human Services, 2020

Superior Health Plan. 3M Health Information. Available at [https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP\\_20195046-3M-HIS-Resource-Guide-P-508-03202019.pdf](https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20195046-3M-HIS-Resource-Guide-P-508-03202019.pdf)

Superior Health Plan. 3M HIS Prospective Dashboard User Guide. Available at [https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP\\_20173928-3M-HIS-Dashboard-Training-P-05312018.pdf](https://www.superiorhealthplan.com/content/dam/centene/Superior/Provider/PDFs/SHP_20173928-3M-HIS-Dashboard-Training-P-05312018.pdf).





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