

# Impact of Socioeconomic Status on Delivery System Effectiveness

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**Abstract:** The socioeconomic status (SES) component of the Social Vulnerability Index ranks US counties based on the SES of county residents and was used to evaluate the impact of SES on the performance of the health care delivery system. Using Medicare fee-for-service data, the performance of the health care delivery system was evaluated based on population measures such as per capita hospital admissions, quality of care measures such as surgical mortality, postacute care measures such as readmissions, and service volume measures such as posthospitalization nursing home and rehabilitation admissions. Substantial differences in delivery system performance across SES populations were observed. **Key words:** *delivery system performance, health equity, payment system reform, socioeconomic status*

**E**XTENSIVE research has demonstrated that an individual's socioeconomic status (SES) impacts the health care services provided (Begley et al., 2011; U.S. Department of Health and Human Services, 2015) health outcomes (Agardh et al., 2011; Bernheim et al., 2007; Janati et al., 2011), patient satisfaction (Foraker et al., 2011), and physi-

cian perception (Bernheim et al., 2008). Addressing the impact of SES will inevitably require additional resources and expenditures encompassing a wide range of areas from community resources (eg, better housing) to improvements in the functioning of health care delivery systems (eg, fewer readmissions). By identifying problems in health care delivery system performance that disproportionately impact low SES patients, targeted improvement efforts can be initiated. Payment system incentives focused on performance improvements that impact low SES patients can be used to provide additional funding to providers delivering care to low SES populations. The objective of this study is to identify delivery system and quality failures that are disproportionately impacted by the SES of patient population.

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## MEASURING SES ACROSS GEOGRAPHIC REGIONS

The Centers for Disease Control and Prevention (CDC) has developed the Social Vulnerability Index (SVI) to help “public health officials and local planners better

prepare communities to respond to emergency events” (CDC, 2020). The SVI includes a measure of SES based on the following factors:

- Below poverty
- Unemployed
- Income
- No high school diploma

The SVI SES measure was determined for each census tract and aggregated to the state and county level. For each SVI SES factor, the census tracts were assigned a percentile rank, with a higher ranking indicating greater vulnerability. The percentiles for the SVI SES factors were summed and the sum of the SVI SES factor percentiles was ranked to determine the overall SVI SES percentile rankings for each census tract, county, and state. This analysis used the SVI SES at the county level. The census tract level could not be used because the geographic location of patients reported on claims data could not be mapped down to the census tract level.

In the context of the SVI SES, greater vulnerability (a higher SVI SES percentile) means a lower SES. For readability, the SVI SES was resorted so that lower SVI SES values indicate a lower SES and higher SVI SES values indicate a higher SES. All subsequent references to SES refer to the resorted SVI SES.

## PERFORMANCE MEASURES

Delivery system performance was evaluated using 9 performance measures in 4 categories:

- *Population.* Per capita admissions, per capita emergency department visits
- *Postacute care.* Readmissions, return emergency department visits
- *Quality.* Inpatient complications, surgical mortality
- *Service volume.* Hospital admissions from the emergency department, admissions to a postacute facility, per capita ambulatory visits

To the extent possible, the study selected performance measures and risk adjustment methods that are actively being used for regulatory purposes such as payment. The

methodologies collectively referred to as potentially preventable events (PPEs) (Goldfield et al., 2012) were included as performance measures:

- Potentially preventable admissions (PPAs) (3M Health Information Systems, 2022b)
- Potentially preventable emergency department visits (PPVs) (3M Health Information Systems, 2022a)
- Potentially preventable readmissions (PPRs) (Goldfield et al., 2008)
- Potentially preventable return emergency department visits (PPREDS)
- Potentially preventable complications (PPCs) (Hughes et al., 2006)

The PPAs and PPVs were risk adjusted using Clinical Risk Groups (CRGs) (Hughes et al., 2004) and the PPRs, PPREDS, and PPCs were risk adjusted using All Patient Refined Diagnosis Related Groups (APR DRGs) (Averill et al., 2002). The APR DRGs are assigned at hospital admission and at discharge and have severity of illness subclasses and risk of mortality subclasses. The PPE measures, the CRGs, and the APR DRGs have substantial regulatory applications and have undergone the scrutiny associated with any regulatory implementation.

Integral to each PPE measure is a specification of the subset of patients considered “at risk.” Patients considered at risk for a PPE means the patient’s clinical circumstances are such that there is reasonable likelihood that the PPE could have been avoided. For example, following a discharge for coronary bypass surgery, a readmission for a complication of surgery such as a surgical site infection would be considered a PPR, but a readmission for appendicitis would not be considered a PPR. For each of the PPEs, there is an in-depth specification of the clinical circumstances under which the PPE would be considered potentially preventable. Identifying a PPE as potentially preventable does not mean that it is preventable for a specific patient. It means that if there were a systematic pattern of higher-than-expected occurrence of the PPE, there would be concerns regarding quality of care or delivery system effectiveness. Essentially, the occurrence of a PPE is an end manifestation or outcome

of an underlying quality or delivery system problem.

In addition to the PPEs, the study utilized a measure of 30-day post-inpatient procedure mortality (Averill et al., 2020). Like the PPEs, the 30-day post-inpatient procedure mortality measure only includes at-risk beneficiaries whose clinical circumstances make patient mortality an unexpected event. Thus, a systematic pattern of higher-than-expected mortality would raise concerns regarding quality of care or delivery system effectiveness.

The PPEs 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 of these measures are indicative of a delivery system that is not functioning as intended.

Three measures of service volume were also evaluated:

- Non-surgical, short-stay, low-severity admissions from the emergency department
- 4-day postacute admission to a skilled nursing or rehabilitation facility (Averill et al., 2021)
- Per capita ambulatory physician and care management visits

Unlike the PPEs and the 30-day post-inpatient procedure mortality measure, 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 overutilization (unnecessary expenditures). By simultaneously evaluating the PPEs, surgical mortality, and service volume measures, targeted insights into potential quality and delivery system problems can be identified. For example, a lower-than-expected rate of per capita ambulatory visits in the context of higher-than-expected rates of per capita hospital admissions and emergency department visits would raise questions concerning access to primary care.

Table 1 contains a summary overview of the PPEs, surgical mortality and service volume measures.

## RISK ADJUSTMENT AND EXPECTED VALUES

The 9 performance measures were risk adjusted using APR DRGs or CRGs. Both risk adjustment methods are categorical clinical models. A categorical clinical model is 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.

A national norm for each performance measure was calculated by summing the actual value of each performance measure in each risk category across Medicare beneficiaries who are at risk (referred to as the national norm value for the performance measure) and computing the mean rate per at-risk beneficiary. For each performance measure the expected value (E) for any subset of beneficiaries (eg, beneficiaries in low SES counties) is the number of at-risk 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 ( $A > E$ ).  $\%(A - E)/E$  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). Comparison to a reference norm is critical because even the best performing delivery systems that provide optimal care will have an underlying rate of performance issues.

A risk-adjusted expected value computed in this way assures that the comparison to actual performance is based on a performance level that is really achievable and not based on a theoretical standard performance level that may not be achievable. For PPEs and surgical mortality measures, limiting

Table 1. Description of Performance Measures

Performance Measure	Name	Methodology	Risk Adjustment
Population			
Hospital admissions ED visits	PPA PPV	Potentially preventable admission Potentially preventable emergency department visits	Clinical Risk Groups Clinical Risk Groups
Postacute care Readmissions	PPR	Potentially preventable readmissions within 30 d of hospital discharge	Discharge APR DRG with severity of illness subclasses
Return ED visits	PPRED	Potentially preventable ED visit within 30 d of hospital discharge	Discharge APR DRG with severity of illness subclasses
Quality			
Inpatient complications	PPC	One or more potentially preventable complications during a hospital admission	Admission APR DRG with severity of illness subclasses
Inpatient surgical mortality	Surg mort	Death within 30 d of an inpatient procedure	Admission APR DRG with risk of mortality subclasses
Service volume			
Hospital admission from the ED	ED admit	Short-stay non-surgical low severity hospital admissions from the emergency department	Admission APR DRG with severity of illness subclasses
Posthospital discharge PAC facility admission	PAC admit	Admission to a skilled nursing or rehabilitation facility within 4 d of hospital discharge	Discharge APR DRG with severity of illness subclasses
Physician and care management encounters	PMCE	Any non-ED ambulatory visit with an evaluation and management code	Clinical Risk Groups

Abbreviations: APR DRG, All Patient Refined Diagnosis Related Group; ED, emergency department.

the determination of performance differences to beneficiaries at risk for the performance measure being potentially preventable, and limiting performance differences to the difference between actual performance and expected performance based on comparison to a national risk-adjusted norm, identifies differences in performance that should be amenable to change and are real opportunities for delivery system improvement.

## DATA

The study 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.

For the hospital and emergency department measures, the 100% 2018 data were used. The hospitals included were limited to hospitals paid under the inpatient prospective payment system (IPPS). A beneficiary was assigned to a county based on the residence of the beneficiary and not the location of the hospital where the beneficiary was treated.

For the population measures it was necessary to build a complete longitudinal record of all FFS claims for each Medicare beneficiary. Because the LDS carrier file was limited to a 5% sample of Medicare beneficiaries, the data used for the population measures were limited to the beneficiaries in the LDS carrier file. The carrier file is a sample across all types of beneficiaries including beneficiaries in Medicare Advantage plans. To create a sample of FFS beneficiaries, the data in the MBSF were used to apply the following edits:

- Exclude beneficiaries who were not enrolled in both Parts A and B for the full year (ie, 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).

The 2018 SVI percentiles for each of 3140 counties for the SES theme were used to define the SES of the county in which each beneficiary resided. Beneficiaries for whom there was no match for the county reported in the MBSF and the counties in the SVI data were excluded from the analysis (3.5% of beneficiaries).

## RESULTS

The results are displayed by the counties in the SES quartiles plus the lower and upper 10% SES decile. Table 2 contains summary statistics for each of the SES percentiles. Relative to high SES counties, the low SES counties have fewer beneficiaries per county, fewer hospitals, more dual eligible enrollees, and more minority beneficiaries. The percent of dual eligible in low SES counties is nearly triple the percent of dual eligible in high SES counties. The percent of minorities in low SES counties is more than triple the percent of minorities in high SES counties.

The income eligibility limit for Medicaid varies from state to state and can be expressed as a percent of the federal poverty level (FPL). Each beneficiary was assigned the Medicaid eligibility limit for a family of 3 for full Medicaid eligibility in the state in which they reside, expressed as a percent of the FPL for 2018 (Kaiser Family Foundation,

**Table 2.** Summary Statistics for Counties by SES Percentile

Measure	Low SES				High SES	
	SES	SES	SES	SES	SES	SES
	0%-10%	0%-25%	25%-50%	50%-75%	75%-100%	90%-100%
Counties	314	785	785	785	785	315
Beneficiaries	2 375 138	7 050 145	16 917 507	19 853 911	16 778 787	7 054 670
Beneficiary/county	7 564	8 981	21 551	25 292	21 374	22 396
Hospitals	193	546	962	1 007	773	317
Dual eligible, %	33.0	27.8	22.3	16.9	12.1	10.5
White, %	67.9	72.5	74.0	81.8	85.0	87.2
Black, %	18.3	18.1	14.2	9.8	5.6	4.6
Hispanic, %	8.0	4.6	4.5	2.3	1.2	1.0
Eligibility FPL, %	88.2	88.5	96.5	102.1	108.9	113.2

Abbreviations: FPL, federal poverty level; SES, socioeconomic status.

n.d.). In Table 2, the row labeled “Eligibility FPL, %” contains the average Medicaid eligibility percent FPL for the beneficiaries in each SES percentile. Beneficiaries 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 MEASURES BY SES PERCENTILES**

Table 3 contains the  $\%(A - E)/E$  for each performance measure for the counties in each of the SES percentiles. The 7.5 in the bottom SES decile means that the number of potentially preventable hospital admissions is 7.5% higher than expected based on the risk-adjusted national rate. Conversely, the -4.5 in the top SES decile means that the number of potentially preventable hospital admissions is 4.5% lower than expected based on the risk-adjusted national rate.

For the PPEs and surgical mortality, beneficiaries in counties with lower SES experience higher-than-expected rates for these measures while beneficiaries in counties with higher SES experience lower-than-expected rates for these measures. The PPEs and surgical mortality are negative events that a well-functioning delivery system should seek to minimize. Beneficiaries in low SES counties have more per capita admissions and emer-

gency department visits, more readmission and postdischarge returns to the emergency department, more inpatient complications, and higher surgical mortality than beneficiaries in high SES counties. This is indicative of a health care delivery system not functioning as intended, thereby creating health care equity concerns.

For the service volume measures, the converse is observed with beneficiaries in counties with lower SES experiencing lower-than-expected rates for these measures while beneficiaries in counties with higher SES experienced higher-than-expected rates for these measures. Performance on the service volume measures can be due to under- or overuse of these services with multiple possible root causes including implicit bias, health insurance limitations, and maldistribution of health care services. Irrespective of the underlying root cause, beneficiaries in low SES counties are less likely to be admitted from the emergency department for low-severity medical care, less likely to be admitted to a skilled nursing facility or to a rehabilitation facility following hospital discharge and have fewer physician or care management visits than beneficiaries in high SES counties.

**DISCUSSION**

The data in Table 3 show that the performance of the health care delivery

**Table 3.** %(A – E)/E for Performance Measures by SES Percentile of Counties

Measure	Low SES				High SES	
	SES 0%-10%	SES 0%-25%	SES 25%-50%	SES 50%-75%	SES 75%-100%	SES 90%-100%
<b>Population</b>						
Hospital admissions (PPAs)	7.5	7.2	1.7	-2.0	-2.7	-4.5
ED visits (PPVs)	3.3	3.3	1.0	0.9	-3.5	-6.1
<b>Postacute care</b>						
Readmissions (PPR)	6.1	4.0	3.0	-0.8	-4.1	-5.1
Return to ED (PPRED)	5.9	6.9	0.3	0.9	-4.2	-5.7
<b>Quality</b>						
Inpatient complications (PPC)	1.8	1.4	1.5	-0.4	-1.7	-0.6
Surgical mortality	6.3	8.1	0.0	1.9	-5.8	-9.3
<b>Service volume</b>						
ED admits	-10.5	-10.0	-0.3	0.7	4.7	7.6
PAC facility admissions	-12.8	-9.3	-2.1	1.6	4.3	6.6
Ambulatory visits (PCME)	-6.0	-6.5	-1.2	2.4	1.3	2.6

Abbreviations: ED, emergency department; PPA, potentially preventable admission; PPV, potentially preventable emergency department visit; SES, socioeconomic status.

system is different for low SES and high SES geographic regions. The PPE and surgical mortality measures are limited to beneficiaries at risk for the performance measure being potentially preventable and performance differences are limited to the difference between actual performance and expected performance based on comparison to the national risk-adjusted rate. As a result, the differences in performance identified should be amenable to change and are real opportunities for delivery system improvement. It is important to recognize that this 2-tier filtering of beneficiaries for identifying performance differences is very different from comparing raw rates of measures like admissions and readmissions. This analysis focuses on performance differences that represent real performance improvement opportunities.

The performance issues identified for low SES geographic regions mean that the health care delivery system is not functioning as intended, thus creating health care equity concerns. Solutions will inevitably require greater financial investment in low SES areas. There are 2 approaches to providing greater financial investment in low SES areas:

1. Incorporate SES factors into the risk adjustment methodology thereby increasing the risk-adjusted payment levels for beneficiaries from low SES areas.
2. Incorporate an SES geographic payment adjustment factor into the payment system.

The first option is a beneficiary-specific payment adjustment and the second option is a geographic area-specific payment adjustment. Both approaches would provide additional funds for improving delivery system effectiveness (eg, open more primary care clinics). But there is no guarantee that the additional funds would be used for such purposes.

If risk adjustment incorporated SES factors, performance problems associated with the care given to lower SES beneficiaries would essentially be hidden, making poor performance (eg, higher readmission rates) appear acceptable for low SES beneficiaries. To achieve performance improvement for lower SES beneficiaries, it is essential that areas of poor performance be highlighted and not hidden within the risk adjustment methodology.

The geographic area-specific payment adjustment would be similar to the

Disproportionate Share Hospital (DSH) payment adjustment in the IPPS. Unlike the DSH payment adjustment, however, the additional SES funding should be contingent on performance improvement based on core performance measures like the performance measures used in this report. Given the somewhat limited success of some value-based incentive programs (U.S. Government Accountability Office, 2015), such an incentive-based approach would need to be carefully designed and incorporate the attributes of successful payment reform initiatives (Averill et al., 2011).

Based on the substantial delivery system performance differences across SES populations, targeted payment policy reforms have the potential to create financial incentives for improving the functioning of the health care delivery system in low socioeconomic areas.

SES was identified at the county level. Many counties can be composed of fairly diverse SES populations. For example, in Fairfield County, Connecticut, the median family income varies by a factor 7 across the county's cities and towns (Wikipedia, 2022). Because the analysis was performed at the county level and not the census tract level, the results likely underestimate the magnitude of

the performance difference associated with SES.

## SUMMARY AND CONCLUSIONS

Prior research has found that individuals' SES impacts the amount, type, and quality of health care services they receive. The SES component of the CDC's SVI was used to rank 3140 counties across the United States. Using 9 measures of performance, the study evaluated the functioning of the health care delivery system for low SES and high SES geographic regions. For negative events such as an avoidable hospital admission and surgical mortality, beneficiaries in counties with lower SES experience higher-than-expected rates. For the service volume measures such as ambulatory physician and care management visits, beneficiaries in counties with lower SES experience lower-than-expected rates. The performance issues identified for low SES geographic regions mean that the health care delivery system is not functioning as intended in low SES counties, thereby creating health care equity concerns. Targeted payment policy reforms have the potential to provide financial incentives to improve the functioning of the health care delivery system in low socioeconomic areas.

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## REFERENCES

- Agardh, E., Allebeck, P., Hallqvist, J., Moradi, T., & Sidorchuk, A. (2011). Type 2 diabetes incidence and socio-economic position: A systematic review and meta-analysis. *International Journal of Epidemiology*, *40*(3), 804-818.
- Averill, R., Hughes, J., & Goldfield, N. (2011). Paying for outcomes, not performance: Lessons from the Medicare inpatient prospective payment system. *The Joint Commission Journal on Quality and Patient Safety*, *37*(4), 184-192.
- Averill, R. E., Fuller, R. L., & Mills, R. E. (2020). *Surgical mortality as a measure of hospital quality*. *3M Clinical and Economic Research*. Retrieved from <https://multimedia.3m.com/mws/media/20446720/surgical-mortality-hospital-quality.pdf>
- Averill, R. F., Fuller, R. L., & Mills, R. E. (2021). *Geographic variation in post-acute care facility admissions*. *3M Clinical and Economic Research*. Retrieved from <https://multimedia.3m.com/mws/media/20513820/report-geographic-variation-in-post-acute-care-facility-admissions.pdf>
- Averill, R. F., Goldfield, N. I., Muldoon, J., Steinbeck, B. A., & Grant, T. M. (2002). A closer look at all-patient refined DRGs. *Journal of American Health Information Management Association*, *73*(1), 46-49.
- Begley, C., Basu, R., & Lairson, D. (2011). Socioeconomic status, health care use, and outcomes: Persistence of disparities over time. *Epilepsia*, *52*(5), 957-964.
- Bernheim, S. M., Ross, J. S., Krumholz, H. M., & Bradley, E. H. (2008). Influence of patients' socioeconomic status on clinical management decisions: A qualitative study. *Annals of Family Medicine*, *6*(1), 53-59.
- Bernheim, S. M., Spertus, J. A., & Reid, K. J. (2007). Socioeconomic disparities in outcomes after acute



- myocardial infarction. *American Heart Journal*, 153(2), 313–319.
- Centers for Disease Control and Prevention. (2020, January 1). *CDC SVI documentation 2018*. Retrieved from [www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI\\_documentation\\_2018.html](http://www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI_documentation_2018.html)
- Foraker, R. E., Rose, K. M., & Chang, P. P. (2011). Socioeconomic status and the trajectory of self-rated health. *Age and Ageing*, 40(6), 706–711.
- Goldfield, N., Kelly, W., & Patel, K. (2012). Potentially preventable events: An actionable set of measures for linking quality improvement and cost savings. *Quality Management in Health Care*, 21(4), 213–219.
- Goldfield, N., McCullough, E., Hughes, J., Tang, A., Eastman, B., Rawlins, L., ... Averill, R. (2008). Identifying potentially preventable readmissions. *Health Care Financing Review*, 30(1), 75–91.
- Hughes, J. S., Averill, R. F., Eisenhandler, J., Goldfield, N. I., Muldoon, J., Neff, J. M., ... Gay, J. C. (2004). Clinical Risk Groups (CRGs): A classification system for risk-adjusted capitation-based payment and health care management. *Medical Care*, 42(1), 81–90.
- Hughes, J. S., Averill, R. F., Goldfield, N. I., Gay, J. C., Muldoon, J., McCullough, E., ... Xiang, J. (2006). Identifying potentially preventable complications using a present on admission indicator. *Health Care Financing Review*, 27(3), 63–82.
- Janati, A., Matlabi, H., Allahverdipour, H., Gholizadeh, M., & Abdollahi, L. (2011). Socioeconomic status and coronary heart disease. *Health Promotion Perspectives*, 1(2), 105–110.
- Kaiser Family Foundation. (n.d.). *Medicaid income eligibility limits for parents, 2002-2022*. Retrieved from <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%22colld%22:%22Location%22,%22sort%22:%22asc%22%7D>
- 3M Health Information Systems. (2022a). *3M potentially preventable emergency department visits (PPVs)*. Retrieved from [www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppv/](http://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppv/)
- 3M Health Information Systems. (2022b). *3M potentially preventable admissions (PPAs)*. Retrieved from [www.3m.com/3M/en\\_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppa/](http://www.3m.com/3M/en_US/health-information-systems-us/drive-value-based-care/patient-classification-methodologies/ppa/)
- U.S. Department of Health and Human Services. (2015, May). *2014 National Healthcare Quality and Disparities Report*. Retrieved from <https://archive.ahrq.gov/research/findings/nhqdr/nhqdr14/2014nhqdr.pdf>
- U.S. Government Accountability Office. (2015, October 1). *Hospital value-based purchasing: Initial results show modest effects on medicare payments and no apparent change in quality-of-care trends*. Retrieved from <https://www.gao.gov/products/gao-16-9>
- Wikipedia. (2022, May 24). *List of Connecticut locations by per capita income*. Retrieved from [https://en.wikipedia.org/wiki/List\\_of\\_Connecticut\\_locations\\_by\\_per\\_capita\\_income#:~:text=Counties%20%20%20Rank%20%20%20,%20%20%2484%2C170%20%206%20more%20rows%20](https://en.wikipedia.org/wiki/List_of_Connecticut_locations_by_per_capita_income#:~:text=Counties%20%20%20Rank%20%20%20,%20%20%2484%2C170%20%206%20more%20rows%20)