



# Racial, Ethnic, and Payer Disparities in Adverse Safety Events: Are there Differences across Leapfrog Hospital Safety Grades?

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# RACIAL, ETHNIC, AND PAYER DISPARITIES IN ADVERSE SAFETY EVENTS

Understanding whether hospitals achieve low rates of adverse safety events by delivering inpatient care uniformly to patient populations is critical to designing and evaluating policies and programs that aim to improve overall hospital quality. The Leapfrog Group calculates Hospital Safety Grades, A, B, C, D, and F, for general acute care hospitals twice per year to reflect how well they keep patients safe from preventable harm (i.e., rates of in-hospital accidents, errors, injuries, and infections). To date, little is known about the association between Hospital Safety Grades and the delivery of safe care specific to a patient’s racial-ethnic background or insurance. Further, no evidence indicates whether safer overall care is associated with narrowing disparities in patient safety among patients with different racial-ethnic backgrounds or among patients with different types of insurance coverage.

Leapfrog Hospital Safety Grades are determined, in part, using the patient safety indicators (PSIs) developed by the Agency for Healthcare Research and Quality (AHRQ). Safety Grades are based on aggregated PSI measures across all Medicare fee-for-service discharges, calculated and published by the Centers for Medicare and Medicaid Services (CMS). In this study, we use complete patient-level hospital discharge records from 15 states in 2019 to assess rates of adverse safety events by patient racial and ethnic background (non-Hispanic white, non-Hispanic Black, or Hispanic patients).<sup>1</sup> Rates of adverse safety events were calculated for four “general” PSIs (adverse safety events that most hospital patients are at risk for) and seven surgery-related PSIs (adverse safety events occurring during or after a surgical procedure) by three hospital Safety Grade cohorts (i.e., A hospitals, B hospitals, and C/D/F hospitals).<sup>2</sup> The Black-white and Hispanic-white differences were compared between the three Safety Grade cohorts. We also assessed differences in rates of adverse safety events between privately insured patients and patients with Medicare and, separately, Medicaid coverage by the same three hospital cohorts.

This study provides two insights. First, the Leapfrog Group Hospital Safety Grades are a useful resource for patients irrespective of their racial and ethnic backgrounds. For most measures, Black patients can expect safer care in A-graded hospitals than in C/D/F-graded hospitals—this is also true for white and Hispanic patients. Thus, a hospital’s Safety Grade provides a signal of the quality of care for distinct racial-ethnic backgrounds. Second, the hospital’s Safety Grade does not ensure that any disparity in the quality of care delivered to different patient populations will be minimized. In other words, these findings suggest that the hospitals most adept at achieving safe care overall are no better at identifying and narrowing inequities in the delivery of that care. For certain measures, we observed that A-graded hospitals had the lowest Black-white or Hispanic-white

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<sup>1</sup> Throughout the remainder of the report, “Black” patients refers to patients identified as non-Hispanic Black and “white” patients refers to patients identified as non-Hispanic white.

<sup>2</sup> We combine all hospitals that receive a Leapfrog Hospital Safety Grade of C, D, and F. This results in similar sized Hospital Safety Grade cohorts.

differences in patient safety (e.g., pressure ulcers and postoperative pulmonary embolisms); for others, A-graded hospitals had the largest Black-white or Hispanic-white differences in patient safety (e.g., postoperative sepsis infections, perioperative hemorrhage). Similarly, we observed no pattern between the hospital Safety Grade cohorts and differences in the delivery of safe care delivered to patients with public coverage (i.e., Medicare or Medicaid) relative to patients with private coverage.

## Key Findings

- For most PSIs, white patients, Black patients, and Hispanic patients all receive safer care in the A and B hospital cohorts. For each racial-ethnic patient group, rates of adverse safety events are typically highest in hospitals with lower Safety Grades (the C/D/F hospital cohort).
- Across the 11 PSIs, relative to white patients, Black patients had significantly higher rates of adverse safety events on 5 PSIs, statistically similar rates of adverse safety events on 4 PSIs, and significantly lower (or better) rates of adverse safety event on 2 PSIs. Black-white differences were most notable among surgery-related PSIs, with Black patients experiencing rates of postoperative sepsis infections, perioperative pulmonary embolisms, and postoperative respiratory failure that are 34 percent, 51 percent, and 17 percent higher than the rates for white patients.
- Across the 5 PSIs for which Black patients had significantly higher rates of adverse safety events relative to white patients, no overall pattern emerged between the Hospital Safety Grade cohorts and the size in the Black-white safety disparity.
- Relative to white patients, Hispanic patients had significantly higher rates of adverse safety events on 2 of 11 PSIs, statistically similar rates of adverse safety events on 5 PSIs, and significantly lower rates of adverse safety events on 4 PSIs. We again observe little to no pattern between hospital's overall letter grade and the magnitude of the Hispanic-white difference in adverse safety events.
- Relative to privately insured patients, Medicare patients averaged significantly higher rates of adverse safety events on 10 of 11 PSIs and statistically similar rates on 1 PSI. Relative to privately insured patients, Medicaid patients had significantly higher rates of adverse safety events on 8 of 11 PSIs and statistically similar rates on the remaining 3 PSIs. Again, we observed little pattern between a hospital's overall letter grade and the size of the difference in adverse safety events between patients with Medicare or Medicaid coverage and those with private insurance.

# BACKGROUND

Patient safety is the cornerstone of quality care and therefore unequal access to safe hospital care reflects unequal access to quality hospital care in the US (Institute of Medicine 2000; Mitchell 2008). Past research has documented higher rates of hospital-acquired illness and injuries among Black patients than among white patients (e.g., AHRQ 2021; Hasnain-Wynia et al. 2007; Metersky et al. 2011; Shen et al. 2016). For select measures, Hispanic patients also experience higher rates of adverse inpatient safety events relative to non-Hispanic patients (e.g., AHRQ 2021). Recent studies have shown that, relative to white patients, Black patients in the US are more likely to receive care at institutions that have higher rates of adverse safety events and are more likely to experience adverse safety events, even when admitted to the same hospital as white patients (Gangopadhyaya 2021a, 2021b).

Evidence also indicates that patients with different types of insurance coverage systematically receive differential care quality, with privately insured patients having lower rates of inpatient mortality rates relative to patients with Medicare or Medicaid coverage (Spencer, Gaskin, and Roberts 2013). Insurers reimburse hospital services at different rates, with private insurers paying higher rates than Medicare, which, in turn, reimburses hospitals at higher rates than Medicaid (Selden 2020). It has long been recognized that variation in payment rates could create financial incentives for hospitals to deliver differential care to patients on the basis of payer type, particularly if maintaining high-quality and safe care is costly (Institute of Medicine 2003).

Because eligibility pathways for public insurance programs are based primarily on income, disability, or age, investigating differences in adverse safety events among patients with distinct payer types could highlight another area of inequitable delivery of care. Specifically, comparing differences in rates of adverse safety events between Medicaid and privately insured patients helps highlight disparities in the incidence of adverse safety events by socioeconomic or disability status. In contrast, comparing differences in these rates between Medicare and privately insured patients serves to assess the differences in the quality of hospital care delivered to elderly versus nonelderly patients (although we note that many Medicare patients receiving hospital care may be nonelderly and disabled as well). Insurance type is also related to patient racial-ethnic background, with Black or Hispanic patients significantly more likely to have Medicaid coverage than white patients.<sup>3</sup> Thus, examining differences in safe hospital care delivery by payer type highlights a potential mechanism through which racial and ethnic disparities may widen.

Leapfrog Hospital Safety Grades were developed in 2012 to summarize hospitals' overall performance in patient safety (Austin et al. 2014). The grade is calculated on the basis of process and structural measures, such as the efficacy of a hospital's computerized physician ordering system in alerting prescribers to fatal

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<sup>3</sup> See figure 2 in Samantha Artiga, Latoya Hill, and Anthony Damico, "Health Coverage by Race and Ethnicity, 2010–2021," KFF, December 20, 2022, <https://www.kff.org/racial-equity-and-health-policy/issue-brief/health-coverage-by-race-and-ethnicity/>.

medication order errors, as well as outcome measures, such as health care associated infections and PSIs.<sup>4</sup> These outcome measures are key elements of CMS quality data reporting programs, including the Hospital-Acquired Condition (HAC) Reduction Program. The Hospital Safety Grade methodology uses this publicly available data, as well as data collected via the annual voluntary Leapfrog Hospital Survey, to calculate letter grades for hospitals across the country. This letter grade allows patients to quickly compare hospitals' safety records. The provision of equitable care is not currently measured in the Hospital Safety Grade, but patients might expect higher-graded hospitals to provide safer care than lower-graded hospitals.

In this study, we sought to assess whether hospitals achieving better Leapfrog Safety Grades deliver, on average, safer care to all patients, including patients with different racial-ethnic backgrounds and coverage types. We further investigated differences in the delivery of safe care among patients of distinct racial-ethnic backgrounds and coverage types. We hypothesized that hospitals with higher grades would be in the best position to narrow inequities in care by applying standardized, effective hospital safety protocols across all patients. Evaluating this hypothesis is fundamental to understanding whether policies aimed at improving overall hospital quality are also effective at narrowing well-documented racial and ethnic differences.

## METHODS

To investigate whether Leapfrog Safety Grades correspond with more equitable safety outcomes, we acquired complete hospital discharge data from 15 states through the State Inpatient Databases processed by the AHRQ Healthcare Cost and Utilization Project. We selected all states that had available data for 2019 and included identifiers that enabled hospitals to be matched to their Leapfrog Hospital Safety Grades. The state databases included in this analysis are Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin.<sup>5</sup> The included states are geographically diverse and represent both small and large populations.

These data represent the universe of patient-level discharge records for each state and include information on patient age, sex, racial and ethnic background, insurer type, diagnostic condition, procedure codes, and more. Using AHRQ-developed software (version 2022) for PSIs, we identified discharge records reporting adverse safety events among 11 measures.<sup>6</sup> The AHRQ software also identifies all discharges at risk for experiencing each adverse safety event, and we use these hospitalizations as denominators to construct rates of adverse safety events. We classified these 11 measures into 4 general patient safety measures (adverse events most

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<sup>4</sup> For more information on the methodology used to construct the grades, see "About the Grade," Leapfrog Hospital Safety Grade, <https://www.hospitalsafetygrade.org/your-hospitals-safety-grade/about-the-grade>.

<sup>5</sup> Analysis for all states except California was led by the Urban Institute. Analysis of California discharge databases was conducted by the Armstrong Institute for Patient Safety and Quality at Johns Hopkins University.

<sup>6</sup> The 11 measures selected are the ones used by CMS in evaluating the Hospital-Acquired Conditions Reduction Program. For more information on calculating PSIs, see "Patient Safety Indicator Measures," AHRQ, [https://qualityindicators.ahrq.gov/measures/psi\\_resources](https://qualityindicators.ahrq.gov/measures/psi_resources).



patients are at risk for in hospital settings) and 7 surgery-related patient safety measures (measures related to adverse events occurring during or shortly after surgical procedures). These are clinically validated measures of injuries or illnesses patients acquire that are unrelated to the primary diagnoses that initiated the hospital admission (Romano et al. 2009). Therefore, the adverse safety events measured by AHRQ's PSIs represent events that all hospitals should seek to minimize.

All short-term acute care hospitals with enough publicly available data are eligible to receive a Hospital Safety Grade twice per year. In our analysis, we restricted discharges to hospitals that received a spring 2022 Hospital Safety Grade. Further, PSIs are measured for adult patients only, so we excluded all patients under age 18. In our assessment of racial and ethnic disparities, we defined white patients as the historically advantaged patient group and compared differences in overall rates of adverse safety events between Black and white patients, as well as between Hispanic and white patients. In our assessment of payer-type disparities, we defined patients who had private insurance as their primary payer as the advantaged group and compared differences in overall rates of adverse safety events between Medicare-insured and privately insured patients, as well as between Medicaid-insured-and privately insured patients.

We investigated unadjusted overall differences in adverse patient safety events, but in recognizing that patient populations differ in ways that affect susceptibility to adverse safety events, we further assessed differences after adjusting for patient age, sex, indicators for state of residence, quartile of income based on zip code of residence, and indicators for racial-ethnic background (in payer disparities analysis only) and payer type (in racial-ethnic disparities analysis only). Several of these controls could drive underlying disparities in access to quality hospitals, and controlling for them could underreport total disparities. However, in our comparisons of unadjusted versus adjusted estimates, estimated differences are generally *wider* in adjusted models, indicating that unadjusted models underestimate underlying patient safety disparities in ways not accounted for when excluding these controls (Clemans-Cope, Garrett, and McMorrow 2023).

## RESULTS

Table 1 presents rates of adverse safety events by Hospital Safety Grade for each PSI. We further tested whether rates of adverse safety events in B- and C/D/F-graded hospitals are statistically different from those in A-graded hospitals. This table validates accurate matching of patient-level discharge records to Hospital Safety Grades. As we should generally expect, given that the Hospital Safety Grades are in part based on PSIs among Medicare beneficiaries, A-graded hospitals had the lowest rates (with two small exceptions in rates of pressure ulcers and perioperative hemorrhage that are slightly higher than B-graded hospitals). Adverse safety events in B-graded hospitals were slightly higher than rates in A-graded hospitals, but for most measures these rates were not statistically different between these two groups of hospitals. C/D/F-graded hospitals had the highest rates of adverse safety events across most measures, and several differences between rates of adverse safety events in C/D/F-graded hospitals and A-graded hospitals were statistically significant.

Table 1 also highlights that the four general patient safety events occur less frequently than the seven surgery-related PSIs. The rate of in-hospital falls with hip fractures was less than 0.1 per 1,000 at-risk discharges and the rate of pressure ulcers was 0.6 per 1,000 at-risk discharges, compared with 6.6 incidences of postoperative respiratory failure, 4.0 incidents of postoperative sepsis infections, and 3.2 incidents of perioperative pulmonary embolism per 1,000 at-risk discharges.

**Table 1. Rates of General Patient Safety Events and Surgery-Related Patient Safety Events by Leapfrog Hospital Safety Grade, 2019**

	All Hospitals	A Hospitals	B Hospitals	C/D/F Hospitals
<b>General Patient Safety Indicators</b>				
Pressure Ulcer	0.620	0.521	0.520	0.802*
Iatrogenic Pneumothorax	0.173	0.168	0.172	0.180
Central venous catheter-related bloodstream infection	0.100	0.081	0.099	0.125*
In-hospital fall with hip fracture	0.065	0.064	0.063	0.067
<b>Surgery-Related Patient Safety Indicators</b>				
Perioperative Hemorrhage	2.261	2.181	2.123	2.458
Postoperative acute kidney injury requiring dialysis	1.006	0.942	0.976	1.130
Postoperative respiratory failure	6.550	5.660	7.134*	7.607*
Perioperative pulmonary embolism or deep vein thrombosis	3.224	2.985	3.257	3.535*
Postoperative sepsis	3.952	3.483	4.085	4.633*
Postoperative wound dehiscence	1.634	1.470	1.710	1.805*
Abdominopelvic accidental puncture or laceration	1.006	0.985	0.989	1.046

**Source:** Agency for Healthcare Research and Quality, State Inpatient Databases for Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin, 2019, <https://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp>.

**Note:** Estimates indicate rates per 1,000 at-risk discharges.

\*indicates estimate is significantly different from the rate at A hospitals. Standard errors are robust clustered at the hospital-level.

## Adjusted Rates of Adverse Safety Events by Patient Race and Ethnicity

Tables 2 and 3 present adjusted *averages* for the four general PSIs and the seven surgery-related PSIs by patient racial and ethnic background—we present and discuss estimates of the *differences* in adverse safety events by patient racial and ethnic background in tables 4 and 5. Tables 2 and 3 show that, for each patient group, A-graded and B-graded hospital cohorts had lower rates of adverse safety events. This is particularly true when comparing A-graded hospitals with C/D/F-graded hospitals, with a small number of exceptions. White patients, Black patients, and Hispanic patients experience, on average, lower rates of pressure ulcers, in-hospital falls with hip fracture, postoperative respiratory failure, and postoperative sepsis infections if they can access A-graded hospitals rather than C/D/F-graded hospitals.

**Table 2. Adjusted Rates of General Patient Safety Events by Patient Race and Ethnicity and by Leapfrog Hospital Safety Grade**

	All Hospitals	A Hospitals	B Hospitals	C/D/F Hospitals
<b>Pressure ulcer</b>				
White	0.602	0.528	0.476	0.793*
Non-Hispanic Black	0.775	0.669	0.653	1.003*
Hispanic	0.623	0.486	0.646*	0.690*
<b>Iatrogenic pneumothorax</b>				
White	0.192	0.186	0.198	0.197
Non-Hispanic Black	0.164	0.152	0.172	0.170
Hispanic	0.151	0.140	0.148*	0.167*
<b>Central venous catheter–related bloodstream infection</b>				
White	0.100	0.080	0.100	0.131
Non-Hispanic Black	0.118	0.088	0.132	0.152
Hispanic	0.075	0.056	0.052*	0.112*
<b>In-hospital fall with hip fracture</b>				
White	0.080	0.079	0.078	0.085*
Non-Hispanic Black	0.043	0.033	0.034	0.063*
Hispanic	0.054	0.043	0.055*	0.063*

**Source:** Agency for Healthcare Research and Quality, State Inpatient Databases for Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin, 2019, <https://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp>.

**Notes:** Estimates indicate rates per 1,000 at-risk discharges. Rates are adjusted for a quadratic function of age and indicators for sex, state of residence, quartile of household income based on the zip code of residence, and indicators for payer type (private coverage, Medicare, Medicaid, other insurance, or uninsured).

\* indicates estimate is significantly different from the rate at A hospitals.

**Table 3. Adjusted Rates of Surgery-Related Patient Safety Events by Patient Race and Ethnicity and by Leapfrog Hospital Safety Grade**

	All Hospitals	A Hospitals	B Hospitals	C/D/F Hospitals
<b>Perioperative hemorrhage</b>				
White	2.169	2.012	2.029	2.512*
Non-Hispanic Black	2.763	2.799	2.643	2.823
Hispanic	2.254	2.409	2.165	2.226
<b>Postoperative acute kidney injury requiring dialysis</b>				
White	1.011	0.934	1.027	1.137
Non-Hispanic Black	1.215	1.092	1.068	1.493
Hispanic	1.172	1.125	1.017	1.317
<b>Postoperative respiratory failure</b>				
White	6.434	5.511	7.063*	7.640*
Non-Hispanic Black	7.549	6.751	7.490	8.743*
Hispanic	7.810	5.959	9.453	9.169*
<b>Perioperative pulmonary embolism or deep vein thrombosis</b>				
White	3.131	2.873	3.216	3.480*
Non-Hispanic Black	4.730	4.216	4.735	5.387*
Hispanic	2.979	2.911	2.800	3.159
<b>Postoperative sepsis</b>				
White	3.628	3.126	3.795	4.417*
Non-Hispanic Black	4.851	4.461	4.333	5.686*
Hispanic	4.869	4.397	5.958	4.875
<b>Postoperative wound dehiscence</b>				
White	1.873	1.679	1.961	2.115
Non-Hispanic Black	1.854	1.780	1.960	1.922
Hispanic	1.266	0.995	1.303	1.611
<b>Abdominopelvic accidental puncture or laceration</b>				
White	1.029	1.005	1.050	1.055
Non-Hispanic Black	1.081	0.931	1.110	1.263
Hispanic	0.927	0.816	0.812	1.115

**Source:** Agency for Healthcare Research and Quality, State Inpatient Databases for Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin, 2019, <https://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp>.

**Notes:** Estimates indicate rates per 1,000 at-risk discharges. Rates are adjusted for a quadratic function of age and indicators for sex, state of residence, quartile of household income based on the zip code of residence, and indicators for payer type (private coverage, Medicare, Medicaid, other insurance, or uninsured).

\* indicates estimate is significantly different from the rate at A hospitals.

## Adjusted Differences in Rates of Adverse Safety Events by Patient Race and Ethnicity

Tables 4 and 5 present adjusted Black-white and Hispanic-white differences in rates of adverse safety events by Hospital Safety Grade cohorts. Differences are based on the same models used in tables 2 and 3, however, we now estimate Black-white and Hispanic-white differences in adverse safety events and assess whether these differences are significant within each Hospital Safety Grade cohort. Estimates report the adjusted difference in adverse safety events between patients historically disadvantaged in the health care system (i.e., non-Hispanic Black or Hispanic patients) relative to white patients. Positive differences indicate a higher (worse) adverse patient safety event rate for Black or Hispanic patients relative to white patients.

For general PSIs, Black-white and Hispanic-white differences in adverse safety event rates are typically small and not systematic in direction (table 4). Black patients have statistically significant higher rates of adverse safety events on one of the four measures (pressure ulcers), statistically similar rates on one of the four measures, and significantly *lower* rates on two of the four measures (iatrogenic pneumothorax and in-hospital falls with hip fracture) relative to white patients. Hispanic patients have statistically similar rates of adverse safety events on one of the four measures (pressure ulcers) and significantly lower rates on the remaining three of four measures relative to white patients. Our findings suggest that, in 2019, across the 15 states studied here, there is not strong evidence for persistent, large Black-white and Hispanic-white disparities in quality of care among these four measures of patient safety.

However, for pressure ulcers, the only measure that Black patients experience at significantly higher rates relative to white patients, the Black-white difference is large. Across all hospitals, the rate of pressure ulcers is higher by 0.173 per 1,000 at-risk discharges for Black patients relative to white patients (i.e., 28 percent higher than the overall average reported in table 1). When assessing differences by Hospital Safety Grade, we observe that the difference remains large and significant in A-graded hospitals, B-graded hospitals, and C/D/F-graded hospitals. That is, we observe no pattern between a hospital's overall Safety Grade and the magnitude of the Black-white disparity in this measure.

**Table 4. Adjusted Differences in General Patient Safety Events by Patient Race and Ethnicity and by Leapfrog Hospital Safety Grade**

Reference group: Non-Hispanic White Patients	All Hospitals	A Hospitals	B Hospitals	C/D/F Hospitals
<b>Pressure ulcer</b>				
Non-Hispanic Black	+0.173*	+0.141*	+0.177*	+0.210*
Hispanic	+0.021	-0.042	+0.170*	-0.103
<b>Iatrogenic pneumothorax</b>				
Non-Hispanic Black	-0.028*	-0.034	-0.026	-0.027
Hispanic	-0.041*	-0.046*	-0.050	-0.030
<b>Central venous catheter–related bloodstream infection</b>				
Non-Hispanic Black	+0.018	+0.008	+0.032	+0.021
Hispanic	-0.025*	-0.024	-0.048*	-0.019
<b>In-hospital fall with hip fracture</b>				
Non-Hispanic Black	-0.037*	-0.046*	-0.044*	-0.022
Hispanic	-0.026*	-0.036*	-0.023	-0.022

**Source:** Agency for Healthcare Research and Quality, State Inpatient Databases for Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin, 2019, <https://hcup-us.ahrq.gov/db/state/sidddbdocumentation.jsp>.

**Notes:** Estimates indicate rates per 1,000 at-risk discharges. A positive estimate (+) indicates a higher rate when compared with Non-Hispanic white patients. Standard errors are robust clustered at the hospital level. Differences are adjusted for a quadratic function of age and indicators for sex, state of residence, quartile of household income based on the zip code of residence, and payer type (private coverage, Medicare, Medicaid, other insurance, or uninsured).

\* indicates estimate is significantly different from the rate among white patients in the same Hospital Safety Grade cohort.

Among the seven surgery-related PSIs, Black patients had significantly higher rates of adverse safety events on four measures and statistically similar rates on three measures relative to non-Hispanic white patients (table 5). For measures that had higher incident rates for Black patients relative to white patients, the size of these differences is clinically large. For example, Black patients experience rates of postoperative respiratory failure that are 1.1 per 1,000 at-risk discharges higher (i.e., 17 percent higher relative to overall averages). Perioperative pulmonary embolism and postoperative sepsis infections occur 1.6 and 1.2 per 1,000 at-risk discharges more frequently for Black patients relative to white patients (i.e., 51 percent and 34 percent higher, respectively).

For each of the four measures for which Black patients have significantly higher rates of adverse safety events relative to white patients, these disparities persist and remain significant in A-graded hospitals. That is, in gaining access to a hospital with a higher Safety Grade, a Black patient has no assurance that the quality of care received relative to a white patient will be any better than lower-rated hospitals. In fact, Black-white differences in postoperative respiratory failure and postoperative sepsis infections are narrowest among B-graded hospitals. Rates of perioperative hemorrhage are higher for Black patients relative to white patients in A- and B-graded hospitals but not C/D/F-graded hospitals. Black-white disparities in perioperative pulmonary embolism are large and significant across all Hospital Safety Grade cohorts.

Overall, Hispanic patients had significantly higher rates of adverse safety events on two of the seven surgery-related measures, statistically similar rates of adverse safety events on four of the seven measures, and significantly lower rates of adverse safety events on one of the seven measures. Hispanic patients experience postoperative respiratory failure at a rate that is 1.4 per 1,000 at-risk discharges higher than white patients.

However, among A-graded hospitals, this difference is much smaller and statistically indistinguishable from 0. The Hispanic-white differences for this measure are larger and statistically significant in B-graded and C/D/F-graded hospitals. This provides some limited evidence that perhaps the quality of care delivered to Hispanic patients may be similar to that for white patients in hospitals with better overall Hospital Safety Grades. However, Hispanic patients are also observed to experience significantly higher rates of postoperative sepsis infections relative to non-Hispanic white patients. These large and significant differences are concentrated among A-graded and B-graded hospitals and are statistically insignificant and small in C/D/F-graded hospitals. Altogether, the evidence in table 5 suggests no clear pattern between hospital overall Hospital Safety Grades and the underlying size of Black-white and Hispanic-white disparities in patient safety.

**Table 5. Adjusted Differences in Surgery-Related Patient Safety Events by Patient Race and Ethnicity and by Leapfrog Hospital Safety Grade**

Reference group: Non-Hispanic White Patients	All Hospitals	A Hospitals	B Hospitals	C/D/F Hospitals
<b>Perioperative hemorrhage</b>				
Non-Hispanic Black	+0.594*	+0.787*	+0.614*	+0.311
Hispanic	+0.085	+0.397*	+0.136	-0.286
<b>Postoperative acute kidney injury requiring dialysis</b>				
Non-Hispanic Black	+0.204	+0.158	+0.041	+0.356
Hispanic	+0.161	+0.191	-0.010	+0.18
<b>Postoperative respiratory failure</b>				
Non-Hispanic Black	+1.115*	+1.240*	+0.427	+1.103*
Hispanic	+1.376*	+0.448	+2.390*	+1.529*
<b>Perioperative pulmonary embolism or deep vein thrombosis</b>				
Non-Hispanic Black	+1.599*	+1.343*	+1.519*	+1.907*
Hispanic	-0.152	+0.038	-0.416	-0.321
<b>Postoperative sepsis</b>				
Non-Hispanic Black	+1.223*	+1.335*	+0.538	+1.269*
Hispanic	+1.241*	+1.271*	+2.163*	+0.458
<b>Postoperative wound dehiscence</b>				
Non-Hispanic Black	-0.019	+0.101	-0.001	-0.193
Hispanic	-0.607*	-0.684*	-0.658*	-0.504*
<b>Abdominopelvic accidental puncture or laceration</b>				
Non-Hispanic Black	+0.052	-0.074	+0.060	+0.208
Hispanic	-0.102	-0.189	-0.238*	+0.060

**Source:** Agency for Healthcare Research and Quality, State Inpatient Databases for Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin, 2019, <https://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp>.

**Notes:** Estimates indicate rates per 1,000 at-risk discharges. A positive estimate (+) indicates a higher rate when compared with Non-Hispanic white patients. Standard errors are robust clustered at the hospital level. Differences are adjusted for a quadratic function of age and indicators for sex, state of residence, quartile of household income based on the zip code of residence, and payer type (private coverage, Medicare, Medicaid, other insurance, or uninsured).

\* indicates estimate is significantly different from the rate among white patients in the same hospital Safety Grade cohort.

## Adjusted Differences in Rates of Adverse Safety Events by Payer Type

Tables 6 and 7 present regression-adjusted estimates of differences in rates of adverse safety events between Medicare- and privately insured patients and Medicaid- and privately insured patients (adjusted averages for each outcome by payer type and by Leapfrog Hospital Safety Grade are reported in tables A.1 and A.2). We chose privately insured patients as the advantaged reference group. Positive estimates indicate higher (worse) estimates for either Medicare- or Medicaid-insured patients relative to privately insured patients.



**Table 6. Adjusted Differences in General Patient Safety Events by Payer Type and by Leapfrog Hospital Safety Grade**

Reference group: Privately insured patients	All Hospitals	A Hospitals	B Hospitals	C/D/F Hospitals
<b>Pressure ulcer</b>				
Medicare	+0.102*	+0.069	+0.074	+0.101
Medicaid	+0.164*	+0.131*	+0.098	+0.190*
<b>Iatrogenic pneumothorax</b>				
Medicare	+0.007	+0.038*	+0.020	-0.051
Medicaid	-0.014	-0.007	+0.001	-0.048
<b>Central venous catheter–related bloodstream infection</b>				
Medicare	+0.048*	+0.053*	+0.061*	+0.033
Medicaid	+0.053*	+0.035*	+0.046	+0.070*
<b>In-hospital fall with hip fracture</b>				
Medicare	+0.020*	+0.025*	+0.023	+0.010
Medicaid	+0.026*	+0.015	+0.033*	+0.030*

**Source:** Agency for Healthcare Research and Quality, State Inpatient Databases for Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin, 2019, <https://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp>.

**Notes:** Estimates indicate rates per 1,000 at-risk discharges. A positive estimate (+) indicates a higher rate when compared to privately insured patients. Differences are adjusted for a quadratic function of age and indicators for sex, state of residence, quartile of household income based on the zip code of residence, and patient racial-ethnic background (white, Black, Hispanic, non-Hispanic and of other racial background or multiracial).

\* indicates estimate is significantly different from the rate among privately insured patients.

Across all hospitals, both Medicare- and Medicaid-insured patients have higher rates of surgery-related adverse safety events relative to privately insured patients (table 7). Most of these differences are large and significant. Public-private pay differences in adverse safety event rates are highest for postoperative sepsis and postoperative respiratory failure. For instance, for all hospitals, the postoperative respiratory failure rate is 1.9 and 2.2 per 1,000 at-risk discharges higher for Medicare- and Medicaid-insured patients, respectively, relative to privately insured patients.

Table 7 indicates that disparities in adverse safety events between public and privately insured patients are prevalent in all Hospital Safety Grade cohorts. We discern little systematic pattern throughout this analysis. Differences in postoperative respiratory failure rates between Medicare-insured patients and privately insured patients clearly increase as Hospital Safety Grade falls (but remain large and significant across all grades), but we fail to see a similar pattern with all other measures. Similarly, we see little to no pattern in differences between rates of adverse safety events in the Medicaid-insured and privately insured patient cohorts by Hospital Safety Grade cohort. Broadly, we find that disparities between privately and publicly insured patient cohorts are large, significant, and fairly common across all hospitals irrespective of their Hospital Safety Grade.

**Table 7. Adjusted Differences in Adverse Safety Rates of Surgery-Related Patient Safety Events by Payer Type and by Leapfrog Hospital Safety Grade**

Reference group: Privately insured patients	All Hospitals	A Hospitals	B Hospitals	C/D/F Hospitals
<b>Perioperative hemorrhage</b>				
Medicare	+0.401*	+0.264*	+0.677*	+0.419*
Medicaid	+0.109	+0.083	-0.159	+0.271
<b>Postoperative acute kidney injury requiring dialysis</b>				
Medicare	+0.348*	+0.327*	+0.215	+0.465*
Medicaid	+0.266*	+0.353	+0.348	+0.161
<b>Postoperative respiratory failure</b>				
Medicare	+1.861*	+1.119*	+1.422*	+3.223*
Medicaid	+2.183*	+2.029*	+2.438*	+2.068*
<b>Perioperative pulmonary embolism or deep vein thrombosis</b>				
Medicare	+0.313*	+0.396*	-0.048	+0.418*
Medicaid	+1.192*	+1.221*	+0.973*	+1.275*
<b>Postoperative sepsis</b>				
Medicare	+1.468*	+1.085*	+2.014*	+1.708*
Medicaid	+1.616*	+1.422*	+1.148*	+2.112*
<b>Postoperative wound dehiscence</b>				
Medicare	+1.110*	+1.125*	+0.827*	+1.247*
Medicaid	+0.793*	+0.519*	+1.062*	+0.856*
<b>Abdominopelvic accidental puncture or laceration</b>				
Medicare	+0.149*	+0.137	+0.192	+0.156
Medicaid	+0.007	+0.058	-0.164	+0.073

**Source:** Agency for Healthcare Research and Quality, State Inpatient Databases for Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin, 2019, <https://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp>.

**Notes:** Estimates indicate rates per 1,000 at-risk discharges. A positive estimate (+) indicates a higher rate when compared with privately insured patients. Standard errors are robust clustered at the hospital-level. Differences are adjusted for a quadratic function of age and indicators for sex, state of residence, quartile of household income based on the zip code of residence, and patient racial-ethnic background (white, Black, Hispanic, non-Hispanic and of other racial background or multiracial).

\* indicates estimate is significantly different from the rate among privately insured patients.

## DISCUSSION

In this study, we examined average rates of 11 adverse safety events by patient racial and ethnic background and by payer type across 15 states in 2019. We estimated these rates across all hospitals and separately by their Spring 2022 Leapfrog Hospital Safety Grade. We found that for most PSIs, Black patients, Hispanic patients, and white patients accessing hospitals with higher Hospital Safety Grades experience, on average, lower rates of adverse safety events—emphasizing Hospital Safety Grades’ usefulness in directing patients to safer care.

Across all hospitals, we found little evidence of systematic racial-ethnic disparities in rates of adverse safety events among the four general PSIs. However, among the sole measure that indicated substantially higher rates of adverse safety events for Black patients relative to white patients (pressure ulcers), we found that

Black-white differences were large and significant in all three Safety Grade hospital cohorts (A-graded hospitals, B-graded hospitals, and C/D/F-graded hospitals).

When examining the seven surgery-related PSIs, we found evidence that Black patients experience systematically higher rates of adverse safety events relative to white patients, consistent with previous research (AHRQ 2021; Gangopadhyaya 2021a, 2021b). Somewhat surprisingly, we observed little pattern between a hospital's Safety Grade and the size of the estimated Black-white disparity across these measures. Hispanic patients had higher rates of adverse safety events on two measures of the seven surgery-related PSIs, and we discerned no relationship between a hospital's Safety Grade and difference in these rates between Hispanic and white patients.

In our analysis assessing differences in rates of adverse safety events by patient insurance coverage type, we found consistently higher incident rates of adverse safety events among patients with public insurance (Medicare or Medicaid) relative to privately insured patients. Among surgery-related PSIs, most of these differences remained large and significant within each Safety Grade cohort (A-graded hospitals, B-graded hospitals, and C/D/F-graded hospitals), which suggests that Hospital Safety Grades are unrelated to payer-based disparities in patient safety.

Our analysis suggests that hospitals deliver safer care to white patients and patients with private insurance coverage. As we note in table 1, A-graded hospitals have the lowest average rates of adverse safety events. However, Black or Hispanic patients, or patients without private insurance, are still more likely to be harmed during their hospital stay compared with white patients or privately insured patients, irrespective of the hospital's Safety Grade. Leapfrog Hospital Safety Grades, therefore, cannot be used to convey information on the underlying disparity in safe inpatient care.

From a policy perspective, our findings indicate that Black and Hispanic patients and, separately, patients with public insurance would benefit from better tools to help them assess the additional risk that may accompany a hospital stay.<sup>7</sup> While publicly available hospital quality information is a good indication of the average quality of care a hospital delivers, this study illustrates that some patients systematically receive less safe care. Providing Hospital Safety Grades by patient racial and ethnic subgroups provides a clear solution, but we note that this may not be feasible for small patient subgroups with too few discharge observations from which to construct a reliable measure score. Nonetheless, a public-facing Hospital Safety Grade by patient racial and ethnic group may incentivize hospitals to narrow existing disparities.

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<sup>7</sup> One of the potential mechanisms through which Black-white and Hispanic-white differences in patient safety occur could be related to differences in insurance coverage types among white patients relative to Black and Hispanic patients. Similarly, one of the mechanisms through which payer-based differences in patient safety may occur is through discriminatory care delivered to Black and Hispanic patients relative to white patients. However, in our adjusted regressions examining racial-ethnic differences, we control for patient insurance type. And in our regressions examining payer-type differences, we control for a patient's racial-ethnic background. Thus, our evidence suggests that policies moving patients toward private insurance coverage are unlikely to close racial-ethnic differences in patient safety or differences by payer type.

Attempts to use federal policy to improve patient safety have had mixed results. In an attempt to improve overall patient safety in hospitals, CMS implemented the HAC Reduction Program, which penalizes hospitals with the worst total HAC scores.<sup>8</sup> The penalties require CMS to withhold Medicare reimbursements by 1 percent. Although the HAC Reduction Program aims to improve overall hospital patient safety, this study finds that clear racial-ethnic and payer-based disparities in major hospital-acquired illnesses and injuries persist well after the program went into effect in 2015—even in hospitals that may not have been penalized by the program (i.e., because they had low overall rates of adverse safety events). Findings from this study suggest that if the goal of policymakers is to narrow racial-ethnic and payer-based inequities in the quality of hospital care, policies cannot solely target the overall average score of hospitals; policy must also incorporate the differences in the quality of care hospitals deliver across their patient populations.

This study has several limitations that represent important areas for future research. First, our analysis is limited to states that (1) shared inpatient databases for release through the AHRQ distributor at the time of data collection and (2) permit linkage to the AHAIID hospital identifiers that enabled us to merge on Leapfrog’s Hospital Safety Grades. While this study encompasses millions of discharges from 15 states and includes several exceptionally populous states such as California and Florida, it does not represent hospitalizations for most states in the US. For that reason, our estimates may not generalize to the full population, although we note that most of our overall estimated disparities benchmark compared well with the 2021 AHRQ disparities report, which uses data from across all states.

Finally, in this report we classify patient racial and ethnic background based on information directly reported in the hospital discharge records, however the source and quality of this information can be inconsistent and inaccurate (Hasnain-Wynia and Baker 2006). Comparisons between discharge reported patient racial and ethnic background and self-reported Census data indicate high match rates between 86-90 percent (Zingmond et al. 2015). Nonetheless, we acknowledge the potential for misclassification of patient racial and ethnic background in our analysis – a study that more strongly relies self-reported racial and ethnic background would present a major advance in this evidence base.

Moreover, although PSIs are measures that are clinically validated and intended to represent objective measures of patient safety, it still may be possible that certain patient groups may be more likely to experience an adverse safety event than others in ways that are uncontrolled for in our adjusted regressions. For example, patients insured by Medicare are often older than privately insured patients, and this may put them at higher risk for acquiring an in-hospital infection relative to other patients—while we directly adjust for age in this

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<sup>8</sup> HAC scores are determined in part by a composite measure of patient safety that, in turn, is based on the 11 PSIs used in this analysis. For more information on the HAC Reduction Program and the measures used in calculating the total HAC score, see “Hospital-Acquired Condition Reduction Program,” CMS, <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/HAC/Hospital-Acquired-Conditions>.

analysis, related, unobserved, factors could also affect infection rates. Similarly, hospitalized patients insured by Medicaid may be more likely to have complex needs that could increase the number of procedures received and possibly the length of stay, both of which could place them at higher risk of exposure to adverse safety events. However, we note that equitable care is not the same as equal care, and that hospitals systems could be expected to recognize which patient groups are at highest risk for adverse safety events and allocate resources accordingly. Our analysis indicates that this has not been most hospitals' approach.

# APPENDIX A. ADJUSTED AVERAGE RATES FOR PATIENT SAFETY OUTCOMES

**Table A.1. Adjusted Rates of General Patient Safety Events by Payer Type and by Leapfrog Hospital Safety Grade**

	All Hospitals	A Hospitals	B Hospitals	C/D/F Hospitals
<b>Pressure Ulcer</b>				
Private Insurance	0.525	0.443	0.470	0.692*
Medicare	0.652	0.521	0.551	0.882*
Medicaid	0.645	0.589	0.530	0.745
<b>Iatrogenic pneumothorax</b>				
Private Insurance	0.143	0.125	0.119	0.189*
Medicare	0.214	0.218	0.220	0.205
Medicaid	0.107	0.091	0.100	0.123
<b>Central venous catheter-related bloodstream infection</b>				
Private Insurance	0.079	0.068	0.075	0.100
Medicare	0.101	0.080	0.106	0.124*
Medicaid	0.130	0.104	0.114	0.158*
<b>In-hospital fall with hip fracture</b>				
Private Insurance	0.032	0.031	0.030	0.035
Medicare	0.090	0.087	0.085	0.096
Medicaid	0.037	0.028	0.041	0.041

**Source:** Agency for Healthcare Research and Quality, State Inpatient Databases for Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin, 2019, <https://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp>.

**Notes:** Estimates indicate rates per 1,000 at-risk discharges. Rates are adjusted for a quadratic function of age and indicators for sex, state of residence, quartile of household income based on the zip code of residence, and indicators for patient racial and ethnic background.

\* indicates estimate is significantly different from the rate at A hospitals.

**Table A.2. Adjusted Rates of Surgery-Related Patient Safety Events by Payer Type and by Leapfrog Hospital Safety Grade**

	All Hospitals	A Hospitals	B Hospitals	C/D/F Hospitals
<b>Perioperative hemorrhage</b>				
Private insurance	2.218	2.199	1.991	2.401
Medicare	2.313	2.167	2.281	2.544
Medicaid	2.378	2.369	1.985	2.564
<b>Postoperative acute kidney injury requiring dialysis</b>				
Private insurance	0.606	0.549	0.606	0.713
Medicare	1.381	1.309	1.298	1.562
Medicaid	0.804	0.867	0.869	0.723
<b>Postoperative respiratory failure</b>				
Private insurance	4.348	3.879	5.089*	4.702*
Medicare	8.355	7.121	8.796*	10.114*
Medicaid	6.403	5.656	7.151	6.701*
<b>Perioperative pulmonary embolism or deep vein thrombosis</b>				
Private insurance	2.638	2.46	2.813	2.812*
Medicare	3.513	3.233	3.5	3.925*
Medicaid	3.676	3.578	3.654	3.764
<b>Postoperative sepsis</b>				
Private insurance	2.627	2.441	2.669	2.945*
Medicare	4.923	4.289	5.115	5.863*
Medicaid	4.552	4.239	4.113	5.002
<b>Postoperative wound dehiscence</b>				
Private insurance	1.021	0.857	1.29*	1.107*
Medicare	2.241	2.117	2.081	2.527
Medicaid	1.632	1.243	2.107	1.713
<b>Abdominopelvic accidental puncture or laceration</b>				
Private insurance	0.952	0.946	0.988	0.938
Medicare	1.093	1.017	1.118	1.187
Medicaid	0.912	0.965	0.769	0.939

**Source:** Agency for Healthcare Research and Quality, State Inpatient Databases for Arkansas, Arizona, California, Florida, Kentucky, Massachusetts, Maryland, Mississippi, North Carolina, New Jersey, Nevada, Oregon, Utah, Washington, and Wisconsin, 2019, <https://hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp>.

**Notes:** Estimates indicate rates per 1,000 at-risk discharges. Rates are adjusted for a quadratic function of age and indicators for sex, state of residence, quartile of household income based on the zip code of residence, and indicators for patient racial and ethnic background.

\* indicates estimate is significantly different from the rate at A hospitals.

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