



Patient healthcare spending after the No Surprises Act: quasi-experimental difference-in-differences study

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ABSTRACT

OBJECTIVE

To estimate changes in healthcare spending in the US after implementation of the No Surprises Act (NSA) in 2022 among adults with direct purchase private insurance.

DESIGN

Quasi-experimental difference-in-differences study.

SETTING

24 US states.

PARTICIPANTS

Adults aged 19-64 years with direct purchase private insurance who participated in the Annual Social and Economic Supplement of the Current Population Survey 2019-24 and resided in states that gained NSA surprise billing protections (intervention states) or in states with comprehensive protections already in place (control states).

MAIN OUTCOME MEASURES

Inflation adjusted out-of-pocket spending, insurance premium spending, and high burden medical spending (defined as spending >10% of total family income on both out-of-pocket and premium costs).

RESULTS

The study population included 17 351 privately insured adults, with 8204 residing in the 18 intervention states and 9147 in the six control states. After implementation of the NSA, out-of-pocket spending showed a decline among privately insured adults in intervention states (from \$3674 (£2776; €3214) to \$2922, relative percentage change

–16.5%, 95% confidence interval (CI) –27.9% to –3.2%), but not among privately insured adults in control states (\$2704 to \$2550, 1.9%, –11.6% to 17.4%). A significant differential reduction was observed in out-of-pocket spending among privately insured adults in intervention states compared with control states after the NSA (relative percentage change –18.0%, –30.2% to –3.7%; absolute change –\$567, 95% CI –\$1031 to –\$102; P=0.02). In contrast, no differential changes were observed in premium spending (relative percentage change 1.9%, –13.9% to 20.7%; absolute change \$93, –\$737 to \$924; P=0.82) and in high burden medical spending (absolute percentage point change –1.0%, 95% CI –5.2% to 3.1%, P=0.62) between the two groups. These findings were consistent across sociodemographic characteristics, including sex, race/ethnicity, poverty status, education level, and employment status.

CONCLUSIONS

Substantial declines occurred in out-of-pocket spending among direct purchase privately insured adults who gained NSA surprise billing protections. In contrast, premium spending and high burden medical spending did not change. Additional policy efforts are needed to reduce healthcare related financial strain in the US.

Introduction

In the US, nearly one in five insured adults report receiving surprise medical bills after out-of-network emergency visits or in-network hospital admissions involving out-of-network providers.¹⁻³ Surprise bills reflect the difference between what providers charge and what insurers are willing to pay, and the remaining balances that patients are responsible for often exceed thousands of dollars because they are not subject to usual out-of-pocket limits.⁴⁻⁶ While federal protections from surprise billing for people with public health insurance have been longstanding, these same protections have not been universally applied to those with private insurance.⁷⁻⁹

In response to substantial concern among patients, health system leaders, and policy makers about the financial toxicity associated with surprise billing, the No Surprises Act (NSA) was enacted on 27 December 2020 and took effect on 1 January 2022.¹⁰ Box 1 provides details about the NSA and related concepts. The primary intent of this bipartisan law was to establish federal protections for privately insured patients by prohibiting surprise billing for emergency services, air ambulance transportation, and out-of-network non-emergency services at in-network facilities, and limiting cost sharing to in-network rates.^{10 11} The NSA also created the independent dispute resolution

WHAT IS ALREADY KNOWN ON THIS TOPIC

Nearly one in five insured adults in the US report receiving surprise medical bills for out-of-network care, often amounting to thousands of dollars in out-of-pocket costs

The No Surprises Act (NSA) was designed to protect privately insured patients from surprise medical bills and promote fair payment negotiations between providers and insurers for out-of-network services

Policy makers projected that the NSA could also reduce overall healthcare costs and patient premium spending by lowering provider payments

WHAT THIS STUDY ADDS

Findings of this study suggest that the NSA achieved its primary goal of shielding patients from surprise medical bills and reducing out-of-pocket spending among adults with direct purchase private insurance

Patient spending on insurance premiums did not change after the NSA, suggesting that opportunities to improve the payment negotiation process remain

The prevalence of high burden medical spending did not change, highlighting the need to build upon the law to protect patients from healthcare related financial strain in the US

process—a final offer arbitration system designed to determine fair payments for out-of-network services by resolving any disagreements between providers and insurers.¹⁰ The Congressional Budget Office projected that surprise billing protections and the independent dispute resolution process would lower overall healthcare costs and premium spending by directly reducing out-of-network payments and indirectly reducing in-network payments to providers.^{10–13} However, preliminary evaluations indicate that independent dispute resolution decisions have often resembled previous out-of-network amounts, raising the possibility that reductions in premium spending may not materialize.^{14 15}

Although the Department of Health and Human Services issued a 2023 report to Congress calling for rigorous evaluations of the NSA,¹⁶ little is known about how patient healthcare spending has changed since the law was implemented. Therefore, using a quasi-experimental difference-in-differences design, we comprehensively evaluated out-of-pocket, premium, and high burden medical spending among adults with direct purchase private insurance residing in states that gained surprise billing protections under the NSA compared with their counterparts residing in states with protections already in place.

Methods

Data source and study population

We used data from the 2019–24 Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS).¹⁷ The CPS ASEC is a national, population based survey used to monitor the social and economic state of the country, and it is relied upon to produce official poverty and health insurance estimates. The survey is administered jointly by the US Census Bureau and Bureau of Labor Statistics during February, March, and April. CPS ASEC response rates

during the study period ranged from 59–68%. The study population included adults aged 19–64 years who reported being covered by a direct purchase private insurance plan during the previous year. Older adults (≥ 65 years) were not included in the sample because they are nearly universally eligible for and covered by Medicare, which has provided longstanding surprise billing protections.^{7 18} Adults with direct purchase private insurance (hereafter, privately insured adults) include those who purchase coverage directly from a private company or health insurance exchange (eg, Affordable Care Act Marketplace plans).¹⁹ This group collectively represented 11.1% (33.8 million people) of the US population with insurance coverage in 2023.²⁰ Detailed information about participant age, sex, race/ethnicity, family income, education level, and employment status were also collected through the CPS ASEC using standard questionnaires.

Intervention

We defined the study exposure as residing in a state that gained surprise billing protections after the NSA (intervention states). States that already enacted laws providing comprehensive surprise billing protections before the NSA and during the study pre-period were designated as control states because they did not gain additional surprise billing protections after the NSA. Information about state level surprise billing laws was obtained from the Commonwealth Fund.⁸ The criteria for comprehensive protections included protections encompassing the emergency department and non-emergency care provided at in-network hospitals; protections applying to all types of insurance plans, including health maintenance organizations and preferred provider organizations; and protections that shield patients by both holding them harmless to excess charges and prohibiting providers from surprise billing.^{8 21} States with only partial surprise

Box 1: Key definitions and concepts related to the No Surprises Act

- Out-of-network care: Medical services received from providers or facilities that do not have a contract with an insurer
- Private insurance: Coverage provided by a private health insurance company rather than the government. Private insurance is a broad term inclusive of employer sponsored insurance and direct purchase insurance
- Employer sponsored insurance: Coverage by a health plan provided by an employer or by a union
- Self-insured plans: Type of employer sponsored insurance where the employer assumes the financial responsibility of providing benefits to their employees, instead of contracting with an insurance company to cover those costs. Self-insured plans are primarily regulated at the federal level under the Employee Retirement Income Security Act and were generally exempt from state surprise billing laws before the No Surprises Act
- Direct purchase insurance: Coverage by a health plan purchased directly from a private company or through a health insurance exchange, such as the federal health insurance marketplace or a state based marketplace
- Surprise bill: An unexpected bill for out-of-network costs that are not covered by a health insurance plan, such as care received at out-of-network hospitals or care received at in-network facilities involving out-of-network providers
- No Surprises Act (NSA): Federal law that protects individuals covered by private insurance from surprise billing related to emergency services, non-emergency services at in-network facilities, and air ambulance transportation. The NSA also established the independent dispute resolution process. The NSA was signed into law on 27 December 2020 and took effect on 1 January 2022
- Independent dispute resolution: a final offer arbitration process administered by a certified third party entity used to determine out-of-network payment rates when a provider and insurer cannot reach agreement during the 30 day open negotiation period

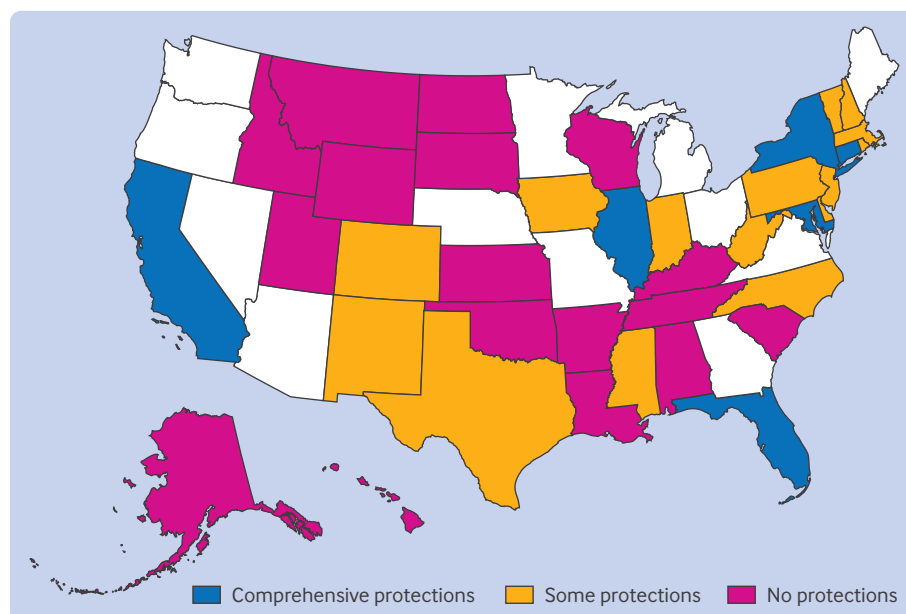


Fig 1 | State level surprise billing protections before the No Surprises Act in the US and during the study pre-period. Although states in yellow had some surprise billing protections during the study pre-period, these did not meet the comprehensive criteria for the entire pre-period. States in white gained surprise billing protections during the study pre-period and were excluded from the analysis

billing protections during the study pre-period that did not meet these comprehensive criteria were excluded from the main analysis. Figure 1 shows the 18 intervention states (Alabama, Alaska, Arkansas, Hawaii, Idaho, Kansas, Kentucky, Louisiana, Montana, Oklahoma, North Dakota, South Carolina, South Dakota, Tennessee, Utah, Washington DC, Wisconsin, and Wyoming) and six control states (California, Connecticut, Florida, Illinois, Maryland, and New York) included in the study. Participants who reported being covered by employer sponsored insurance were not included in this study because state surprise billing laws implemented before the NSA did not apply to self-insured plans—a large subset of employer sponsored insurance plans.^{16–22} Therefore, many adults with employer sponsored insurance gained surprise billing protections under the NSA in both intervention and control states.²³

Given that the NSA came into effect on 1 January 2022, the pre-policy period was defined using survey years 2019–21 (encompassing data from February 2018 to April 2021) and the post-policy period was defined using survey years 2023–24 (encompassing data from February 2022 to April 2024). We excluded the 2022 survey year as the data spanned both the pre-policy and post-policy periods.

Outcomes

The main outcomes were self-reported total family out-of-pocket spending, total family contributions to health insurance premiums, and high burden medical spending. All spending amounts were inflation adjusted to 2023 US dollars using the Consumer

Price Index. Out-of-pocket spending was defined as past year spending on medical care, diagnostic tests, prescription medicine, medical supplies, and non-prescription healthcare products. Premium spending was defined as past year spending on all health insurance premiums, inclusive of both comprehensive and supplemental plans. Finally, in line with previous studies, high burden medical spending served as a measure of financial strain and was defined as families spending more than 10% of their total income on both out-of-pocket and premium costs.^{24–25}

Statistical analysis

Descriptive statistics were used to summarize and compare the sociodemographic characteristics of privately insured adults residing in intervention and control states using unweighted frequencies, survey weighted percentages, and Rao-Scott χ^2 tests.

We used a difference-in-differences design to compare changes in outcomes before and after the NSA among privately insured adults residing in states that gained surprise billing protections (intervention states) versus those in states with protections already in place (control states). For continuous outcomes (out-of-pocket and premium spending), we used multivariable generalized linear models with log-link and gamma distribution to account for the right skewed distribution of the data (see supplementary fig 1).^{26–27} Difference-in-differences estimates were reported as relative percentage changes and as absolute changes in US dollars using average marginal effects.²⁸ For the binary outcome (high burden medical spending), we used multivariable linear probability models to

facilitate direct interpretation of interaction term coefficients.^{29 30} Difference-in-differences estimates were reported as absolute percentage changes. Our models included a binary indicator for whether a state gained surprise billing protections under the NSA (intervention or control state), a binary indicator for period (before (survey years 2019-21) or after (survey years 2023-24) the NSA), and an interaction term between the two indicators (the difference-in-differences estimate). We also included state and year fixed effects and adjusted for age, sex, race/ethnicity, poverty status, level of education, and employment status. The analysis of high burden medical spending did not adjust for poverty status because family income was used to define the outcome. The supplementary methods provide more information about model specification. To examine for heterogeneity, we added a three way interaction term between the core difference-in-differences interaction (policy indicator×time indicator) and a group indicator to assess whether NSA effects varied across sociodemographic characteristics. The parallel trends assumption was evaluated by visually inspecting pre-NSA data (survey years 2019-21) and by estimating a linear regression model with an interaction term between year and a binary indicator for residing in an intervention or control state (see supplementary figs 2-4).

We also conducted several sensitivity analyses. First, we expanded our control group to include states that had partial surprise billing protections during the

study pre-policy period, rather than limiting to only states with comprehensive protections. This resulted in the inclusion of an additional 15 control states (Colorado, Delaware, Indiana, Iowa, Massachusetts, Mississippi, New Hampshire, New Jersey, New Mexico, North Carolina, Pennsylvania, Rhode Island, Texas, Vermont, and West Virginia). Second, we repeated our main analysis after excluding data from the 2021 survey year given the possibility of acute shifts in healthcare spending related to declines in utilization after the onset of the covid-19 pandemic.^{31 32} Finally, we conducted a difference-in-difference-in-differences (triple difference) analysis that included Medicaid beneficiaries, a population protected from surprise billing under federal law before the NSA.⁷ These models included a three way interaction across a policy indicator, a time indicator, and a binary indicator for insurance group (private or Medicaid). The triple difference approach effectively adds a second control group, evaluating whether changes in healthcare spending among privately insured adults in intervention states compared with changes in healthcare spending among Medicaid beneficiaries in the same states differed from changes between these groups in control states.³³

Survey weights were incorporated to generate representative estimates, and replicate weights were used to generate standard errors that account for the complex survey design of the CPS ASEC. No values were missing for the spending outcomes. Analyses were

Table 1 | Characteristics of adults with direct purchase private insurance in states gaining surprise billing protections and in control states

Characteristics	No (%)*		P value†
	Intervention states (n=8204)	Control states (n=9147)	
Age (years)			
19-25	1106 (15.6)	1362 (16.4)	0.004
26-44	3185 (35.3)	3330 (36.1)	
45-64	3913 (49.1)	4455 (47.5)	
Sex			
Male	3860 (47.7)	4304 (48.4)	0.11
Female	4344 (52.3)	4843 (51.6)	
Race/ethnicity			
Asian‡	442 (4.1)	1368 (13.0)	<0.001
Black	670 (9.9)	710 (8.8)	
Hispanic	745 (7.1)	3301 (29.7)	
Other§	206 (2.2)	111 (1.3)	
White	6141 (76.8)	3657 (47.1)	
Poverty status			
Above federal poverty level	7351 (89.0)	8167 (88.9)	0.72
Below federal poverty level	853 (11.0)	980 (11.1)	
Education level			
Some college or more	5320 (63.7)	5995 (66.5)	<0.001
High school diploma or less	2884 (36.3)	3152 (33.5)	
Employment status			
Employed	5815 (69.9)	6309 (68.4)	<0.001
Unemployed	198 (2.6)	343 (3.9)	
Not in workforce¶	2191 (27.5)	2495 (27.7)	

*The study population included all participants who reported being covered by a direct purchase private insurance plan during the previous year. Numbers are unweighted and percentages are survey weighted.

†Comparisons were conducted using Rao-Scott X² tests.

‡Those who identify themselves as Asian, according to the Annual Social and Economic Supplement of the Current Population Survey. This category includes several subgroups (eg, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, or other Asian).

§Includes native American Indian, multiracial, and other unspecified racial and ethnic groups.

¶Includes those who are unable to work or retired.

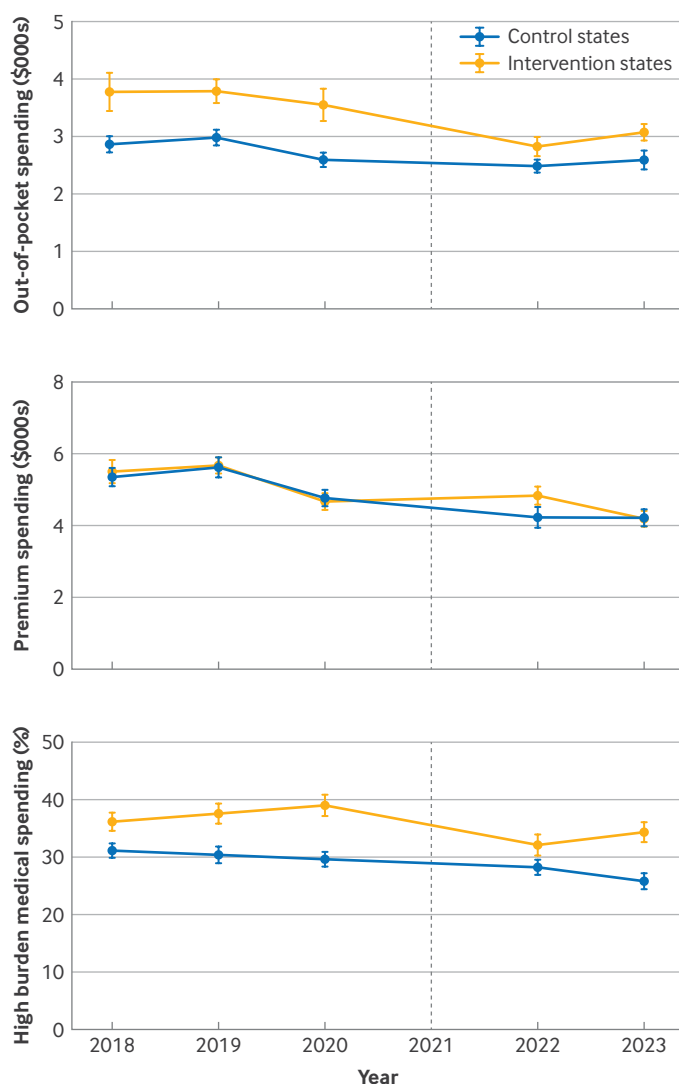


Fig 2 | Trends in out-of-pocket spending, premium spending, and high burden medical spending. Each survey year represents data from the previous calendar year. Spending values were converted to 2023 US dollars using the Consumer Price Index. High burden medical spending was defined as total medical spending (out-of-pocket and premium) exceeding 10% of annual family income. Error bars represent 95% confidence intervals. \$1.00 (£0.75; €0.86)

conducted using R version 4.4.3 and STATA version 18. A two sided $P < 0.05$ was considered statistically significant.

Patient and public involvement

Patients and members of the public were not directly involved in the planning, design, or conduct of this study because no funding was available to do so. However, our interaction with patients in the clinical setting and their experiences with surprise medical bills directly motivated the study question.

Results

The study sample consisted of 17 351 privately insured adults, with 8204 residing in the 18 intervention states that gained surprise billing protections after the

NSA, and 9147 residing in the six control states that already had protections in place. Table 1 shows the sociodemographic characteristics of the participants. Privately insured adults in intervention states were more likely to be white and have lower levels of education compared with their counterparts in control states.

Changes in healthcare spending after the No Surprises Act

Figure 2 shows the observed trends in annual out-of-pocket spending, premium spending, and high burden medical spending in the two groups.

After implementation of the NSA, out-of-pocket spending showed a decline among privately insured adults in intervention states (from \$3674 (£2776; €3214) to \$2922, relative percentage change -16.5% , 95% confidence interval (CI) -27.9% to -3.2%), but not among privately insured adults in control states (from \$2704 to \$2550, 1.9% , -11.6% to 17.4%) (table 2). A significant differential reduction was observed in out-of-pocket spending among privately insured adults in intervention states that gained surprise billing protections relative to those in control states with previous protections in place (relative percentage change -18.0% , -30.2% to -3.7% ; absolute change $-\$567$, 95% CI $-\$1031$ to $-\$102$; $P=0.02$). In contrast, privately insured adults in both intervention (from \$5328 to \$4539, relative percentage change -18.7% , -28.9% to -7.0%) and control states (from \$5280 to \$4208, -20.2% , -31.0% to -7.8%) reported comparable changes in premium spending after the NSA (relative percentage change 1.9% , -13.9% to 20.7% ; absolute change $\$93$, $-\$737$ to $\$924$; $P=0.82$). Similar patterns were also observed for the rate of high burden medical spending (absolute percentage point change -1.0% , 95% CI -5.2% to 3.1% , $P=0.62$). Our main findings were consistent across sociodemographic groups, including by sex, race/ethnicity, poverty status, education level, and employment status (table 3).

Sensitivity analyses

Supplementary figure 5 shows the observed trends in healthcare spending using the expanded control group that included states with partial surprise billing protections before the NSA. Analyses with this expanded control group were highly consistent with the main analysis, showing significant reductions in out-of-pocket spending after the NSA (relative percentage change -15.6% , -27.5% to -1.8% ; absolute change $-\$514$, $-\$975$ to $-\$53$; $P=0.03$) but no changes in premium spending (relative percentage change 6.1% , -7.7% to 22.0% ; absolute change $\$301$, $-\$411$ to $\$1014$; $P=0.41$) or high burden medical spending (absolute percentage point change -0.50% , -4.3% to 3.3% , $P=0.79$) (see supplementary table 1). The sensitivity analysis excluding 2021 data yielded a difference-in-differences estimate for out-of-pocket spending that was similar in magnitude to the main estimate, though the result was no longer statistically

Table 2 | Changes in out-of-pocket spending, premium spending, and high burden medical spending after the No Surprises Act (NSA)

	Pre-NSA (95% CI) (n=11 023)	Post-NSA (95% CI) (n=6328)	Relative percentage change (%)			Absolute change (\$)	
			Adjusted difference (95% CI)*	Adjusted difference-in-difference (95% CI)*	P value	Adjusted difference-in-difference (95% CI)*†	P value
Out-of-pocket spending (\$)							
Intervention states	3674 (3324 to 4024)	2922 (2688 to 3155)	−16.5 (−27.9 to −3.2)	−18.0 (−30.2 to −3.7)	0.02	−567 (−1031 to −102)	0.02
Control states	2704 (2542 to 2867)	2550 (2318 to 2781)	1.9 (−11.6 to 17.4)				
Premium spending (\$)							
Intervention states	5328 (4946 to 5710)	4539 (4142 to 4935)	−18.7 (−28.9 to −7.0)	1.9 (−13.9 to 20.7)	0.82	93 (−737 to 924)	0.82
Control states	5280 (4903 to 5656)	4208 (3780 to 4636)	−20.2 (−31.0 to −7.8)				
High burden medical spending (%)*‡							
Intervention states	36.9 (34.8 to 39.1)	33.1 (30.1 to 36.1)	−4.2 (−8.5 to 0.04)	−1.0 (−5.2 to 3.1)	0.62	—	—
Control states	29.4 (27.9 to 30.9)	26.0 (23.8 to 28.3)	−3.2 (−6.7 to 0.34)				—

\$ 1.00 (£0.75; €0.86).
CI=confidence interval.

*Models include year and state fixed effects and additionally adjust for age, sex, race/ethnicity, poverty status, education level, and employment status.

†Estimated using average marginal effects.

‡Models with high burden medical spending (total medical spending (out-of-pocket and premium) exceeding 10% of annual family income) as the outcome did not adjust for poverty status.
Estimates are percentage point changes rather than relative or absolute changes.

significant (see supplementary table 2). The triple difference analyses also support the robustness of the main study results (see supplementary table 3). For example, out-of-pocket spending decreased by \$403 (absolute change 95% CI -\$797 to -\$10, P=0.04) more among privately insured adults relative to Medicaid beneficiaries residing in intervention states than the comparable differences in control states.

Discussion

In this difference-in-differences study, we found statistically significant reductions in out-of-pocket spending among adults with direct purchase private insurance who gained surprise billing protections under the NSA. Declines in out-of-pocket spending did not vary across sociodemographic groups. In contrast, premium spending and high burden medical spending did not change after the NSA.

Our study findings support anecdotal reports that the NSA has successfully shielded patients from surprise billing. A national survey of 21 health insurance providers—representing 139 million commercial enrollees—estimated that the NSA prevented more than 10 million surprise bills during the first nine months of 2023.³⁴ Stakeholder interviews conducted by the Assistant Secretary for Planning and Evaluation and the Urban Institute revealed that consumer complaints to federal and state regulators related to surprise billing have declined considerably after implementation of the law.^{35 36} Notably, the estimated \$567 reduction in annual out-of-pocket spending attributed to the NSA is greater than cost savings associated with other major policies intended to reduce healthcare spending.³⁷⁻⁴⁰ For example, the expansion of Medicaid was linked to a \$152 reduction in annual out-of-pocket costs among adults with low income, and the drug related provisions under the Inflation Reduction Act are estimated to generate \$400 in annual savings for Medicare Part D enrollees.^{27 41}

We also found that premium spending remained unchanged after the NSA, which stands in contrast to projections by the Congressional Budget Office

that the NSA would reduce premiums by 0.5-1%. Policy makers believed that the independent dispute resolution process could reduce excessive charges and overall healthcare costs if negotiations between providers and insurers were primarily based on the median in-network rate—the so-called qualifying payment amount.³⁶ Reducing out-of-network reimbursement rates to qualifying payment amount levels was projected to lower in-network payments to providers by weakening their negotiating leverage with insurers.^{12 42} However, initial data released by federal agencies revealed that providers won 85% of resolved independent dispute resolution cases in the last quarter of 2023.¹⁵ Cases won by providers resulted in median payments that were more than three times higher than the qualifying payment amount, whereas cases won by insurers adhered closely to the qualifying payment amount. More than two thirds of independent dispute resolution cases were filed by providers backed by four private equity firms, who have higher case win rates and tend to extract larger monetary awards.^{11 43} Additional regulations are needed to prevent the shifting of this profiteering business model from patients to the broader insurance pool. Policy makers may consider increasing the role of the qualifying payment amount in the arbitration process or even implementing payment benchmarks based on negotiated prices between payers and providers that were recently mandated to be made publicly available through price transparency rules.⁴⁴⁻⁴⁶

Healthcare costs may have also remained stagnant if the NSA indirectly increased utilization or inflated prices. Perceived or real reductions in surprise billing may have assuaged financial concerns among patients and encouraged more utilization of healthcare.⁴⁷ One analysis of commercial claims found that previous state level bans on surprise billing were associated with small but statistically significant increases in emergency department visits.⁴⁸ Providers may have also responded to the NSA by raising in-network charges to recuperate lost revenue from previous surprise bills. Such price hikes are likely enabled by recent

Table 3 | Changes in healthcare spending after the No Surprises Act across sociodemographic characteristics

Characteristics	Out-of-pocket spending		Premium spending		High burden medical spending	
	Adjusted difference-in-difference-in-differences (95% CI)*	P value	Adjusted difference-in-difference-in-differences (95% CI)*	P value	Adjusted difference-in-difference-in-differences (95% CI)*†	P value
Sex						
Male	Reference	Reference	Reference	Reference	Reference	Reference
Female	−2.2 (−19.9 to 19.4)	0.83	−3.7 (−19.1 to 14.6)	0.67	−3.5 (−8.6 to 1.6)	0.18
Race/ethnicity						
Asian‡	Reference	Reference	Reference	Reference	Reference	Reference
Black	−4.9 (−62.2 to 139.6)	0.92	−23.4 (−66.5 to 75.1)	0.53	4.3 (−14.8 to 23.5)	0.66
Hispanic	48.3 (−41.5 to 276.0)	0.41	−3.3 (−47.9 to 79.3)	0.92	4.7 (−13.1 to 22.5)	0.60
Other§	42.7 (−56.9 to 372.3)	0.56	−54.7 (−84.9 to 36.2)	0.16	−11.0 (−46.6 to 24.6)	0.54
White	11.3 (−49.2 to 143.9)	0.79	3.7 (−39.4 to 77.2)	0.90	10.7 (−6.2 to 27.7)	0.22
Poverty status						
Above federal poverty level	Reference	Reference	Reference	Reference	Reference	Reference
Below federal poverty level	62.0 (−19.0 to 223.9)	0.17	10.9 (−38.6 to 100.2)	0.73	13.1 (−2.4 to 28.6)	0.10
Education level						
Some college or more	Reference	Reference	Reference	Reference	Reference	Reference
High school diploma or less	21.3 (−11.7 to 66.5)	0.23	−4.6 (−29.2 to 28.6)	0.76	−0.64 (−8.4 to 7.1)	0.87
Employment status						
Employed	Reference	Reference	Reference	Reference	Reference	Reference
Unemployed	51.0 (−40.9 to 286.0)	0.39	25.9 (−49.4 to 213.2)	0.62	−11.8 (−32.2 to 8.6)	0.26
Not in workforce¶	3.7 (−21.2 to 36.4)	0.80	24.9 (−5.7 to 65.5)	0.12	0.79 (−7.4 to 8.9)	0.85

CI=confidence interval.

*Models include year and state fixed effects and adjust for age, sex, race/ethnicity, poverty status, education level, and employment status. Estimates are relative percentage changes and correspond to the difference in the adjusted difference-in-differences estimates between groups.

†Models with high burden medical spending (total medical spending (out-of-pocket and premium) exceeding 10% of annual family income) as the outcome did not adjust for poverty status.

‡Estimates are percentage point changes rather than relative percentage changes.

§Those who identify themselves as Asian, according to the Annual Social and Economic Supplement of the Current Population Survey. This group includes several subgroups (eg, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, or other Asian).

¶Includes native American Indian, multiracial, and other unspecified racial and ethnic groups.

¶¶Includes those who are unable to work or retired.

market trends, including increasing health system consolidation and healthcare related acquisitions by private equity firms.⁴⁹⁻⁵³ Future research is needed to monitor the direct and indirect impacts of the NSA on healthcare utilization, prices, and health system organization.

Although the NSA successfully lowered out-of-pocket spending, the lack of reductions in high burden medical spending suggests that the law has not substantially alleviated population level financial strain associated with these costs. In 2020, nearly 18% of Americans had medical debt based on consumer credit reports, with the mean amount of debt estimated at \$429.⁵⁴ Medical debt is concentrated among the sickest and most socially disadvantaged patients, including populations with low income and racial and ethnic minority groups.⁵⁴⁻⁵⁶ The financial hardships associated with medical debt have been linked to poor health outcomes through direct harms on mental and physical health, delays in accessing necessary care, and exacerbation of other social determinants of health.⁵⁵⁻⁵⁸

Addressing gaps in the design and implementation of the NSA may help reduce financial toxicity associated with medical bills. For example, the law could be extended to cover ground ambulance transports—of which ~71% resulted in a potential surprise bill between 2013 and 2017.⁵⁹ Evidence is also emerging that many socially disadvantaged patients are still unaware of the protections available to them under

the NSA and may still be receiving unexpected surprise bills.^{35 36 60} Patients with low income and those with lower levels of education face substantial barriers recognizing and disputing unexpected medical bills owing to limited financial literacy and constraints on resources.⁶¹ The process of identifying billing errors and seeking appropriate recourse is complex, time intensive, and administratively burdensome.⁶² One recent study showed that the likelihood of receiving problematic medical bills did not differ across sociodemographic characteristics,⁶³ but that patients with lower levels of education who received such bills were far less likely to reach out to billing offices and ultimately report financial relief (eg, price reductions or bill cancellations). Therefore, efforts are required to increase public awareness of NSA related protections, assist patients with surprise billing complaints, and enforce penalties against providers who violate the law. Policy makers may also need to explore other strategies to alleviate the burden of high healthcare spending and medical debt, particularly among socioeconomically disadvantaged patients.⁶⁴⁻⁶⁶

Limitations of this study

This study has several limitations. First, healthcare spending outcomes were self-reported and thus susceptible to recall and response bias. However, previous research has shown that out-of-pocket and premium spending values reported in the CPS ASEC are highly consistent to those reported in other sources,

such as the Medical Expenditure Panel Survey and the Survey of Income and Program Participation.⁶⁷ Second, as with previous analyses of claims data,² this study could not identify which participants experienced surprise billing and the amount of corresponding surprise bills. Third, it is possible that the difference-in-differences approach was not able to account for all unmeasured confounders varying at the state-year level. However, the triple difference analysis did not reveal any evidence that other state level changes confounded study estimates because no differential reductions in out-of-pocket spending were observed among Medicaid beneficiaries residing in intervention versus control states. Fourth, this study may have lacked the power to detect differential changes in healthcare spending across sociodemographic groups owing to small sample sizes.⁶⁸ Finally, study results cannot be generalized to the broader population of privately insured adults given the exclusion of people covered by employer sponsored private insurance plans, which was required to establish an adequate control group.^{16 22}

Conclusions

In the US, out-of-pocket spending significantly decreased among adults with direct purchase private insurance who gained surprise billing protections after implementation of the NSA. In contrast, premium spending and high burden medical spending remained unchanged after the NSA. These findings suggest that the NSA successfully shielded patients from surprise medical bills in the US, though additional efforts are needed to alleviate healthcare related financial strain.

Contributors: ML and RKW conceived and designed the study. ML performed the statistical analyses and drafted the initial manuscript. All authors interpreted the data, critically revised the manuscript for important intellectual content, and approved the final manuscript. RKW supervised the study and is the guarantor. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

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Ethical approval: The study relied on publicly available data and was considered exempt from review by the institutional review board at the Beth Israel Deaconess Medical Center.

Data sharing: Data underlying the findings in this paper are openly and publicly available at <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/LUHNE5>. The code used to analyze data in the paper is available at https://github.com/Michael-liu22/No_Surprises.

Transparency: The study guarantor (RKW) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies are disclosed.

Dissemination to participants and related patient and public communities: The findings of this study will be disseminated to patients and members of the public in several ways. First, we intend to present this study at national and international conferences, including the 2025 AcademyHealth Annual Research Meeting. Second, we will work with our institutions (Brigham and Women's Hospital, Massachusetts General Hospital, Beth Israel Deaconess Medical Center, and Harvard Medical School) to prepare press releases when the paper is published, with the goal of spreading public awareness of the findings. Finally, members of the study team will make themselves available to respond to all inquiries from government agencies, researchers, and the broader patient community.

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- Cooper Z, Scott Morton F. Out-of-Network Emergency-Physician Bills - An Unwelcome Surprise. *N Engl J Med* 2016;375:1915-8. doi:10.1056/NEJMp1608571.
- Chhabra KR, Sheetz KH, Nuliyalu U, Dekhne MS, Ryan AM, Dimick JB. Out-of-Network Bills for Privately Insured Patients Undergoing Elective Surgery With In-Network Primary Surgeons and Facilities. *JAMA* 2020;323:538-47. doi:10.1001/jama.2019.21463.
- Pollitz K, Lopes L, Kearney A, et al, Kaiser Family Foundation. US Statistics on Surprise Medical Billing. *JAMA* 2020;323:498. doi:10.1001/jama.2020.0065.
- Fuse Brown EC, Trish E, Ly B, Hall M, Adler L. Out-of-Network Air Ambulance Bills: Prevalence, Magnitude, and Policy Solutions. *Milbank Q* 2020;98:747-74. doi:10.1111/1468-0009.12464.
- Sun EC, Mello MM, Moshfegh J, Baker LC. Assessment of Out-of-Network Billing for Privately Insured Patients Receiving Care in In-Network Hospitals. *JAMA Intern Med* 2019;179:1543-50. doi:10.1001/jamainternmed.2019.3451.
- Cooper Z, Nguyen H, Shekita N, Morton FS. Out-Of-Network Billing And Negotiated Payments For Hospital-Based Physicians. *Health Aff (Millwood)* 2020;39:24-32. doi:10.1377/hlthaff.2019.00507.
- Shen WW. Balance Billing: Current Legal Landscape and Proposed Federal Solutions. Congressional Research Service; 2019. <https://sgp.fas.org/crs/misc/LSB10284.pdf>
- Kona M. State Balance-Billing Protections. Commonwealth Fund. doi:10.26099/0x7j-7731
- Stephenson J. New Federal Rule Offers Patients Protection Against Surprise Medical Bills. *JAMA Health Forum* 2021;2:e212347. doi:10.1001/jamahealthforum.2021.2347.
- Chhabra KR, Fuse Brown E, Ryan AM. No More Surprises - New Legislation on Out-of-Network Billing. *N Engl J Med* 2021;384:1381-3. doi:10.1056/NEJMp2035905.
- Colla C. Surprise Billing-A Flashpoint for Major Policy Issues in Health Care. *JAMA* 2021;325:715-6. doi:10.1001/jama.2020.26779.
- Cooper Z, Scott Morton F, Shekita N. Surprise! Out-of-Network Billing for Emergency Care in the United States. *J Polit Econ* 2020;128:3626-77. doi:10.1086/708819.
- Duffy EL, Ly B, Adler L, Trish E. Policies to address surprise billing can affect health insurance premiums. *Am J Manag Care* 2020;26:401-4. doi:10.37765/ajmc.2020.88491
- Fiedler M, Adler L. A first look at outcomes under the No Surprises Act arbitration process. Brookings Institution. March 27, 2024. <https://www.brookings.edu/articles/a-first-look-at-outcomes-under-the-no-surprises-act-arbitration-process/>
- Hoadley J, Watts K, Baron Z. 2023 Data From The Independent Dispute Resolution Process: Select Providers Win Big. *Health Affairs Forefront*. doi:10.1377/forefront.20240815.699234
- Office of the Assistant Secretary for Planning and Evaluation. Evaluation of the Impact of the No Surprises Act on Health Care Market Outcomes: Baseline Trends and Framework for Analysis - Report One. ASPE. 6 Jul 2023. Accessed 17 Nov 2024. <https://aspe.hhs.gov/reports/no-surprises-act-report-one>
- US Census Bureau. Annual Social and Economic Supplements. Census.gov. Accessed 17 Nov 2024. <https://www.census.gov/data/datasets/time-series/demo/cps/cps-asec.html>

- 18 Hale J, Hong N, Hopkins B, Lyons S, Molloy E, The Congressional Budget Office Coverage Team. Health Insurance Coverage Projections For The US Population And Sources Of Coverage, By Age, 2024-34. *Health Aff (Millwood)* 2024;43:922-32. doi:10.1377/hlthaff.2024.00460.
- 19 Martin AB, Hartman M, Washington B, Catlin A, National Health Expenditure Accounts Team. National Health Expenditures In 2023: Faster Growth As Insurance Coverage And Utilization Increased. *Health Aff (Millwood)* 2025;44:12-22. doi:10.1377/hlthaff.2024.01375.
- 20 Keisler-Starkey K, Bunch LN. Health Insurance Coverage in the United States: 2023; 2024. <https://www2.census.gov/library/publications/2024/demo/p60-284.pdf>
- 21 Hoadley J, Lucia K, Kona M. State Efforts to Protect Consumers from Balance Billing. doi:10.26099/g10e-a246
- 22 King JS. Covid-19 and the Need for Health Care Reform. *N Engl J Med* 2020;382:e104. doi:10.1056/NEJMp2000821.
- 23 Meiselbach MK, Marr J, Wang Y. Enrollment Trends In Self-Funded Employer-Sponsored Insurance, 2015 And 2021. *Health Aff (Millwood)* 2024;43:91-7. doi:10.1377/hlthaff.2023.00690.
- 24 Bernard DM, Selden TM, Fang Z. The Joint Distribution Of High Out-Of-Pocket Burdens, Medical Debt, And Financial Barriers To Needed Care. *Health Aff (Millwood)* 2023;42:1517-26. doi:10.1377/hlthaff.2023.00604.
- 25 Banthin JS, Bernard DM. Changes in financial burdens for health care: national estimates for the population younger than 65 years, 1996 to 2003. *JAMA* 2006;296:2712-9. doi:10.1001/jama.296.22.2712.
- 26 Mihaylova B, Briggs A, O'Hagan A, Thompson SG. Review of statistical methods for analysing healthcare resources and costs. *Health Econ* 2011;20:897-916. doi:10.1002/hec.1653.
- 27 Gotanda H, Jha AK, Kominski GF, Tsugawa Y. Out-of-pocket spending and financial burden among low income adults after Medicaid expansions in the United States: quasi-experimental difference-in-difference study. *BMJ* 2020;368:m40. doi:10.1136/bmj.m40.
- 28 Williams R. Using the Margins Command to Estimate and Interpret Adjusted Predictions and Marginal Effects. *Stata J* 2012;12:308-31. doi:10.1177/1536867X1201200209.
- 29 Karaca-Mandic P, Norton EC, Dowd B. Interaction terms in nonlinear models. *Health Serv Res* 2012;47(1pt1):255-74. doi:10.1111/j.1475-6773.2011.01314.x.
- 30 Miller S, Wherry LR. Health and Access to Care during the First 2 Years of the ACA Medicaid Expansions. *N Engl J Med* 2017;376:947-56. doi:10.1056/NEJMs1612890.
- 31 Jeffery MM, O'Onofrio G, Paek H, et al. Trends in Emergency Department Visits and Hospital Admissions in Health Care Systems in 5 States in the First Months of the COVID-19 Pandemic in the US. *JAMA Intern Med* 2020;180:1328-33. doi:10.1001/jamainternmed.2020.3288.
- 32 Birkmeyer JD, Barnato A, Birkmeyer N, Bessler R, Skinner J. The Impact Of The COVID-19 Pandemic On Hospital Admissions In The United States. *Health Aff (Millwood)* 2020;39:2010-7. doi:10.1377/hlthaff.2020.00980.
- 33 Olden A, Møen J. The triple difference estimator. *Econom J* 2022;25:531-53. doi:10.1093/ectj/ucq010.
- 34 Blue Cross Blue Shield Association. New survey says-The No Surprises Act is working. Blue Cross Blue Shield Association. January 30, 2024. Accessed 15 Feb 2025. <https://www.bcbs.com/news-and-insights/article/new-survey-says-the-no-surprises-act-working>
- 35 Hoadley J, Lucia K, Volk J, Walsh-Alker E, Swindle R, Wengle E. No Surprises Act: Perspectives on the Status of the Consumer Protections Against Balance Billing. *Urban Institute*. Published online 18 Apr 2023. Accessed 17 Nov 2024. <https://www.urban.org/research/publication/no-surprises-act>
- 36 Office of the Assistant Secretary for Planning and Evaluation. Evaluation of the Impact of the No Surprises Act on Health Care Market Outcomes: Exploring Pre-Implementation Trends - Report Two. 21 Nov 2024. Accessed 8 Dec 2024. <https://aspe.hhs.gov/sites/default/files/documents/f306f739a9627c715a38996ac164075b/aspe-no-surprises-act-rtc-2.pdf>
- 37 Narasimmaraj PR, Oseran A, Tale A, et al. Out-of-Pocket Drug Costs for Medicare Beneficiaries With Cardiovascular Risk Factors Under the Inflation Reduction Act. *J Am Coll Cardiol* 2023;81:1491-501. doi:10.1016/j.jacc.2023.02.002.
- 38 Mein SA, Tale A, Rice MB, Narasimmaraj PR, Wadhwa RK. Out-of-Pocket Prescription Drug Savings for Medicare Beneficiaries with Asthma and COPD Under the Inflation Reduction Act. *J Gen Intern Med* 2025;40:1141-9. doi:10.1007/s11606-024-09063-4.
- 39 Wadhwa RK, Joynt Maddox KE, Fonarow GC, et al. Association of the Affordable Care Act's Medicaid Expansion With Care Quality and Outcomes for Low-Income Patients Hospitalized With Heart Failure. *Circ Cardiovasc Qual Outcomes* 2018;11:e004729. doi:10.1161/CIRCOUTCOMES.118.004729.
- 40 Wadhwa RK, Bhatt DL, Wang TY, et al. Association of State Medicaid Expansion With Quality of Care and Outcomes for Low-Income Patients Hospitalized With Acute Myocardial Infarction. *JAMA Cardiol* 2019;4:120-7. doi:10.1001/jamacardio.2018.4577.
- 41 Sayed BA, Finegold K, Olsen TA, et al. Medicare Part D Enrollee Out-Of-Pocket Spending: Recent Trends and Projected Impacts of the Inflation Reduction Act. Assistant Secretary for Planning and Evaluation; 2024. <https://aspe.hhs.gov/sites/default/files/documents/1b652899fb99dd7e6e0edebbc917cc8/aspe-part-d-oop.pdf>
- 42 Duffy EL, Biener A, Garmon C, Trish EE. Comparison of Estimated No Surprises Act Qualifying Payment Amounts and Payments to In-Network and Out-of-Network Emergency Medicine Professionals. *JAMA Health Forum* 2022;3:e223085. doi:10.1001/jamahealthforum.2022.3085.
- 43 Duffy EL, Garmon C, Adler L, Biener A, Trish E. No Surprises Act independent dispute resolution outcomes for emergency services. *Health Aff Sch* 2024;2:qxae132. doi:10.1093/haschl/qxae132.
- 44 Gordon AS, Liu Y, Chartock BL, Chi WC. Provider Charges And State Surprise Billing Laws: Evidence From New York And California. *Health Aff (Millwood)* 2022;41:1316-23. doi:10.1377/hlthaff.2021.01332.
- 45 Schulman KA, Richman B. Addressing Surprise Medical Bills and Out-of-Network Prices. *JAMA Intern Med* 2024;184:1405-6. doi:10.1001/jamainternmed.2024.4270.
- 46 Oseran AS, Ati S, Feldman WB, Gondi S, Yeh RW, Wadhwa RK. Assessment of Prices for Cardiovascular Tests and Procedures at Top-Ranked US Hospitals. *JAMA Intern Med* 2022;182:996-9. doi:10.1001/jamainternmed.2022.2602.
- 47 Selby JV, Fireman BH, Swain BE. Effect of a copayment on use of the emergency department in a health maintenance organization. *N Engl J Med* 1996;334:635-41. doi:10.1056/NEJM199603073341006.
- 48 William Encinosa P, Lane K, Cornelio N. How State Surprise Billing Protections Increased ED Visits, 2007-2018: Potential Implications for the No Surprises Act. 2022;28. Accessed 15 Feb 2025. <https://www.ajmc.com/view/how-state-surprise-billing-protections-increased-ed-visits-2007-2018-potential-implications-for-the-no-surprises-act>
- 49 Beaulieu ND, Chernew ME, McWilliams JM, et al. Organization and Performance of US Health Systems. *JAMA* 2023;329:325-35. doi:10.1001/jama.2022.24032.
- 50 Singh Y, Song Z, Polsky D, Bruch JD, Zhu JM. Association of Private Equity Acquisition of Physician Practices With Changes in Health Care Spending and Utilization. *JAMA Health Forum* 2022;3:e222886. doi:10.1001/jamahealthforum.2022.2886.
- 51 Bruch JD, Gondi S, Song Z. Changes in Hospital Income, Use, and Quality Associated With Private Equity Acquisition. *JAMA Intern Med* 2020;180:1428-35. doi:10.1001/jamainternmed.2020.3552.
- 52 Bhatla A, Bartlett VL, Liu M, Zheng Z, Wadhwa RK. Changes in Patient Care Experience After Private Equity Acquisition of US Hospitals. *JAMA* 2025;333:490-7. doi:10.1001/jama.2024.23450.
- 53 Bartlett VL, Liu M, Ati S, Yeh RW, Zheng Z, Wadhwa RK. Private Equity Acquisitions of Outpatient Cardiology Practices in the United States, 2013-2023. *J Am Coll Cardiol* 2024;84:953-6. doi:10.1016/j.jacc.2024.06.011.
- 54 Kluender R, Mahoney N, Wong F, Yin W. Medical Debt in the US, 2009-2020. *JAMA* 2021;326:250-6. doi:10.1001/jama.2021.8694.
- 55 Himmelstein DU, Dickman SL, McCormick D, Bor DH, Gaffney A, Woolhandler S. Prevalence and Risk Factors for Medical Debt and Subsequent Changes in Social Determinants of Health in the US. *JAMA Netw Open* 2022;5:e2231898. doi:10.1001/jamanetworkopen.2022.31898.
- 56 Wiltshire JC, Elder K, Kiefe C, Allison JJ. Medical Debt and Related Financial Consequences Among Older African American and White Adults. *Am J Public Health* 2016;106:1086-91. doi:10.2105/AJPH.2016.303137.
- 57 Sweet E, Nandi A, Adam EK, McDade TW. The high price of debt: household financial debt and its impact on mental and physical health. *Soc Sci Med* 2013;91:94-100. doi:10.1016/j.socscimed.2013.05.009.
- 58 Mendes de Leon CF, Griggs JJ. Medical Debt as a Social Determinant of Health. *JAMA* 2021;326:228-9. doi:10.1001/jama.2021.9011.
- 59 Chhabra KR, McGuire K, Sheetz KH, Scott JW, Nuliyalu U, Ryan AM. Most Patients Undergoing Ground And Air Ambulance Transportation Receive Sizable Out-Of-Network Bills. *Health Aff (Millwood)* 2020;39:777-82. doi:10.1377/hlthaff.2019.01484.
- 60 Callaghan T, Haeder SF, Sylvester S. Past experiences with surprise medical bills drive issue knowledge, concern and attitudes toward federal policy intervention. *Health Econ Policy Law* 2022;17:298-331. doi:10.1017/S1744133121000281.
- 61 Kyle MA, Frakt AB. Patient administrative burden in the US health care system. *Health Serv Res* 2021;56:755-65. doi:10.1111/1475-6773.13861.

- 62 Meyer MA. A Patient's Journey to Pay a Healthcare Bill: It's Way Too Complicated. *J Patient Exp* 2023;10:23743735231174759. doi:10.1177/23743735231174759.
- 63 Duffy EL, Frasco MA, Trish E. Disparate Patient Advocacy When Facing Unaffordable and Problematic Medical Bills. *JAMA Health Forum* 2024;5:e242744. doi:10.1001/jamahealthforum.2024.2744.
- 64 Chokshi DA, Beckman AL. A New Category of "Never Events"-Ending Harmful Hospital Policies. *JAMA Health Forum* 2022;3:e224703. doi:10.1001/jamahealthforum.2022.4703.
- 65 Uppal N, Woolhandler S, Himmelstein DU. Alleviating Medical Debt in the United States. *N Engl J Med* 2023;389:871-3. doi:10.1056/NEJMp2306942.
- 66 Shashikumar SA, Zheng Z, Joynt Maddox KE, Wadhera RK. Financial Burden of Health Care in the Privately Insured US Population. *JAMA Intern Med* 2024;184:843-5. doi:10.1001/jamainternmed.2024.1464.
- 67 Caswell KJ, O'Hara B. Medical Out-of-Pocket Expenses, Poverty, and the Uninsured. Census Working Papers. Published online 29 Dec 2010. Accessed 18 Nov 2024. <https://www.census.gov/library/working-papers/2010/demo/SEHSD-WP2010-17.html>
- 68 Burke JF, Sussman JB, Kent DM, Hayward RA. Three simple rules to ensure reasonably credible subgroup analyses. *BMJ* 2015;351:h5651. doi:10.1136/bmj.h5651.

Web appendix: Supplementary methods, figures 1-5, and tables 1-3