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State-Level Variation In Low-Value Care For Commercially Insured And Medicare Advantage Populations

ABSTRACT **Low-value care is a major source of health care inefficiency in the US. Our analysis of 2009–19 administrative claims data from OptumLabs Data Warehouse found that low-value care and associated spending remain prevalent among commercially insured and Medicare Advantage enrollees. The aggregated prevalence of twenty-three low-value services was 1,920 per 100,000 eligible enrollees, which amounted to $3.7 billion in wasteful expenditures during the study period. State-level variation in spending was greater than variation in utilization, and much of the variation in spending was driven by differences in average procedure prices. If the average price for twenty-three low-value services among the top ten states in spending were set to the national average, their spending would decrease by 19.8 percent (from $735,000 to $590,000 per 100,000 eligible enrollees). State-level actions to improve the routine measurement and reporting of low-value care could identify sources of variation and help design state-specific policies that lead to better patient-centered outcomes, enhanced equity, and more efficient spending.**

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Health services that provide little or no benefit, have the potential to cause harm, or lead to an economic burden through unnecessary costs and wasted resources[1,2] are often referred to as *low-value care*. To address health care inefficiency, multiple guidelines and initiatives during the past decade have increasingly focused on reducing low-value care. The Choosing Wisely campaign, for example, prompted conversations between patients and clinicians on more than 600 potentially overused services, catalyzed the development and implementation of measurement tools, and created a robust research infrastructure.[3] Studies have documented the prevalent use of low-value care among Medicare beneficiaries[4,5] and how the provision of such care has worsened health care disparities.[6] Other studies have examined how the delivery of low-value care did not differ much across payer types but varied across hospital referral regions.[7,8]

Regional variation in health care use and associated spending that cannot be completely explained by demographics, health status, or relative price differences could reflect efficiency differences among health care systems.[9,10] Researchers have highlighted persistent differences across regions in treatment patterns (for example, more frequent use of physician visits, hospital and intensive care, and tests and minor procedures)[11,12] and the use of treatments with unknown or marginal benefits (for example, prescribing potentially harmful drugs and using the prostate-specific antigen test for prostate cancer screening).[13,14]

Although a previous study quantified use of and spending on low-value care in four states,[15]

variation among all fifty states in utilization, prices, and associated spending has not been well examined, particularly among commercially insured populations. This study examined such variation across twenty-three low-value care measures using eleven years (2009–19) of administrative claims data from commercially insured populations, including Medicare Advantage enrollees.

Study Data And Methods

DATA AND STUDY POPULATION In this retrospective cross-sectional analysis, we analyzed deidentified administrative claims data from the period 2009–19 that were available from the OptumLabs Data Warehouse to create service-specific cross-sectional data for each year across fifty US states and Washington, D.C. (hereafter considered a state; $N = 51$) States with a small sample size (fewer than eleven counts) for a particular low-value service in the year of interest were excluded. The OptumLabs database contains longitudinal health information on medical and pharmacy claims, laboratory results, and enrollment records for more than 200 million commercial and Medicare Advantage enrollees, representing a mixture of ages and racial and ethnic groups.[16] Our study populations included people who were continuously enrolled in their health plan for at least one year before the index event (defined here as the date of the low-value service).

MEASURES OF LOW-VALUE CARE We selected twenty-three measures that could be accurately identified in claims data and classified each measure into one of six categories: cancer screening, diagnostic and preventive testing, preoperative testing, imaging, cardiovascular testing and procedures, and musculoskeletal surgeries and procedures.

On the basis of prior research and published eligibility criteria,[4,5,7,8] we identified the number of enrollees eligible for each of the twenty-three low-value care measures for each year (that is, denominators) based on demographic information and International Classification of Diseases, Ninth Revision (ICD-9), or International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Clinical Modification (ICD-10-CM), diagnostic codes. Each enrollee could be eligible for multiple low-value services in any given year, and thus eligible populations varied by year and specific low-value services. To identify enrollees who actually received a particular low-value service, we used the ICD-9/ICD-10-CM procedure coding system and current procedural terminology codes. We used the OptumLabs Crosswalk to accommodate the transition from ICD-9 to ICD-10 in 2015. Online appendix exhibit S1 provides eligibility criteria and associated billing codes used for twenty-three low-value services.[17]

ANALYSES We estimated utilization rates, average per unit procedure prices, and overall spending associated with each of twenty-three low-value services across fifty-one states during the period 2009–19. To estimate utilization, we divided the number of cumulative enrollees who received a specific low-value service during the period (the numerator, measured in person-years) by the number of cumulative enrollees eligible for the service (the denominator, also measured in person-years). For prices (that is, per unit payment made for a specific service, excluding physician and facility fees), we summed the average cost paid by health plans and patients' average out-of-pocket expense. To calculate overall spending, we multiplied the estimated utilization rate by the average price of the specific low-value service. For comparability across states, we present outcome measures per 100,000 eligible enrollees.

To characterize state-level variation for service categories and each low-value service, we stratified states into deciles for each of the three outcome measures (utilization, average prices, and overall spending) and calculated extreme decile ratios by dividing the average value of the outcome among states in the top 10 percent (top decile) by the average value among states in the bottom 10 percent (bottom decile). Decile ratios, which are widely used in health and economics research to quantify variation and inequality,[18,19] provided a simple and direct method for quantifying the variation for comparisons across the twenty-three low-value services. Higher extreme decile ratios indicated greater state-level variation.

Finally, we estimated the change in the magnitude of wasteful spending under the assumption that states with high overall spending on low-value services paid only the national average price for those services. This analysis helped us distinguish whether prices or use of low-value services was a key driver of overall spending.

LIMITATIONS Our study had some limitations. First, claims data often lack sufficient clinical detail to identify all possible instances of low-value care.[20] As a result, our selection was restricted to low-value services that were easily identifiable in claims data using a less sensitive but more specific algorithm. We may have undercaptured all relevant instances of low-value care procedures, but higher specificity reduced our chances of misclassifying high-value care as low-value care.[4] Second, deidentified claims data posed a challenge for adjusting for potential con-

Use of and spending on low-value care remain prevalent among commercially insured and Medicare Advantage enrollees.

founders at the state level, such as differences in economic and demographic characteristics (for example, race and ethnicity, income, education, and employment status). Third, our study population included commercially insured enrollees, who are mostly healthier and more affluent than the general population.[21] Our findings might not generalize to other populations (for example, traditional Medicare beneficiaries). Fourth, expenditures on low-value care did not include care cascades that were likely to have followed service use in many clinical instances; this led to an underestimate of spending. Also, the exclusion of physician and facility fees in our price estimation would substantially underestimate the overall wasteful spending associated with low-value care. Fifth, extreme decile ratios often require careful interpretation because substantially low denominator values (for example, utilization for the bottom decile) could result in excessive ratio estimates. In a sensitivity analysis, using extreme quintile ratios, we found that the levels of variation were slightly more stabilized, but the comparative differences in ranking remained the same (appendix exhibits S2, S4, and S6).[17] Finally, despite various guidelines on low-value care, there is no universally accepted definition of what constitutes *low-value care*. Our study relied on existing guidelines for identifying low-value care.[22]

Study Results

USE OF TWENTY-THREE LOW-VALUE SERVICES

The aggregated prevalence of the twenty-three low-value services across all US states was 1,920 per 100,000 eligible enrollees (636,489,349 eligible person-years during 2009–19). Low-value cancer screening was the most used low-value service category, where 9,900 per 100,000 eligible enrollees (19,028,659 eligible person-years) received a service from this category (exhibit 1). Within this category, routine cancer screenings (breast, prostate, cervical, and colorectal) for people with chronic kidney disease who were receiving dialysis and prostate-specific antigen screening for men age seventy-five and older had the highest utilization rates per 100,000 eligible enrollees.[23] The low-value preoperative testing category had the second-highest utilization rate, with 4,250 per 100,000 eligible enrollees (33,993,721 eligible person-years) receiving at least one low-value preoperative test. The category with the lowest utilization rate was low-value musculoskeletal surgeries and procedures, where spinal injections for lower back pain had the highest utilization rate within this service category.

STATE-LEVEL VARIATION IN UTILIZATION

Across all twenty-three low-value care measures, the utilization rate of low-value care in states in the top decile was more than twice that of states in the bottom decile (2,800 versus 1,360 per 100,000 eligible enrollees) (appendix exhibit S2).[17] As shown in exhibit 2, Alabama, Hawaii, Florida, New York, and New Jersey had the highest use rates of low-value services among OptumLabs commercially insured and Medicare Advantage enrollees, whereas Alaska, Montana, Oregon, Delaware, Maine, and Michigan had the lowest rates. Appendix exhibits S2 and S3 provide additional data reflecting state-level variation in utilization.[17] Results, including variation by each of the twenty-three low-value services, are also provided on our interactive, web-based tool.[24]

At the service category level, low-value diagnostic and preventive testing had the greatest state-level variation in use, where the average utilization rate among the top-decile states (Texas, Arizona, Florida, New York, and New Jersey) was 4.5 times greater than that of the bottom-decile states (Vermont, Maine, Montana, Minnesota, South Dakota, and Iowa). Low-value imaging services had the least variation, with an extreme decile ratio of 1.7. For low-value cancer screening, top-decile states (New Jersey, Florida, Georgia, Mississippi, and Louisiana) conducted 2.6 times more screenings than those in the bottom decile (Vermont, North Dakota, Minnesota, South Dakota, and Wisconsin) (appendix exhibit S2).[17]

Preoperative cardiac testing for cataract surgery within thirty days of the procedure exhibited the largest state-level variation, as top-decile states (Minnesota, Massachusetts, New York, New Jersey, and Maryland) tested 199 times more than states in the bottom decile (Alaska, Idaho, Montana, Nevada, Wyoming, and Oklahoma). Other low-value services with substantial state-level variation included percutaneous coronary intervention with balloon angio-

EXHIBIT 1

Eligible population size, utilization rate, per unit procedure price, and overall associated spending for 23 measures of low-value care in the US, by service category, 2009–19

Low-value care measures	Size of eligible population (person-years)	Average utilization rate (per 100,000)	Average per unit procedure price ($US)	Average overall spending ($US per 100,000)
All 23 low-value services aggregated	636,489,349	1,920	244	469,000
Cancer screenings	19,028,659	9,900	97.4	965,000
PSA testing for men ages 75+	1,975,801	26,900	23.7	638,000
Cervical cancer screening for women ages 65+	9,745,324	6,420	30.6	196,000
Colorectal cancer screening for adults ages 75+	6,992,368	8,710	256	2,230,000
Cancer screening for patients with CKD receiving dialysis	315,166	31,200	120	3,740,000
Diagnostic and preventive testing	112,942,856	2,270	39.8	90,200
Bone mineral density testing at frequent intervals	2,818,771	6,060	82.5	511,000
Homocysteine testing with no diagnoses of folate or B12 deficiencies	97,044,661	506	31.2	15,800
Hypercoagulability testing for patients with DVT	699,706	4,480	31.1	139,000
Total or free T3 level testing for patients with hypothyroidism	12,379,718	15,500	22.0	341,000
Preoperative testing	33,993,721	4,250	78.0	332,000
Preoperative chest radiography	7,824,857	12,200	23.4	285,000
Preoperative echocardiography	7,037,177	2,930	197	577,000
Preoperative pulmonary function testing	7,620,365	740	35.6	26,300
Preoperative stress testing	6,938,169	1,540	161	248,000
Preoperative cardiac tests for cataract surgery within 30 days	1,024,098	2,970	28.4	84,200
Imaging	122,563,565	3,540	152	538,000
Brain CT or MRI for uncomplicated headaches	104,757,817	1,310	243	318,000
Imaging for lower back pain without external causes of injury, trauma, cancer, IV drug abuse, neurologic impairment, intraspinal abscess, osteomyelitis, myelopathy, neuritis, and radiculopathy	10,466,704	12,600	171	2,160,000
Imaging for diagnosis of plantar fasciitis or heel pain	7,339,044	21,700	39.6	859,000
Cardiovascular testing and procedures	141,992,396	645	460	297,000
Stress testing for established diagnosis of acute MI	3,729,606	18,600	179	3,330,000
IVC filters to prevent pulmonary embolism	104,757,946	201	520	105,000
PCI with balloon angioplasty or stent for stable coronary disease	4,356,557	738	994	734,000
Renal/visceral angioplasty or stent for renal atherosclerosis or renovascular hypertension diagnosis	29,148,287	2.52	2,590	6,520
Musculoskeletal surgeries and procedures	212,335,607	490	1,080	529,000
Vertebroplasty or kyphoplasty for osteoporotic vertebral fractures	2,818,395	37.4	1,050	39,300
Arthroscopic surgery for knee osteoarthritis	104,759,394	166	2,180	362,000
Spinal injection for lower back pain	104,757,817	827	401	332,000

SOURCE Authors' analysis of data from deidentified administrative claims data from OptumLabs Data Warehouse for all 50 states and Washington, D.C. **NOTES** Values reflect the utilization rate, procedure price, and overall spending associated with 23 low-value care measures per 100,000 eligible enrollees across all 50 states and Washington, D.C. These values are rounded to three significant figures. PSA is prostate-specific antigen. CKD is chronic kidney disease. DVT is deep vein thrombosis. CT is computed tomography. MRI is magnetic resonance imaging. MI is myocardial infarction. IVC is inferior vena cava. PCI is percutaneous coronary intervention.

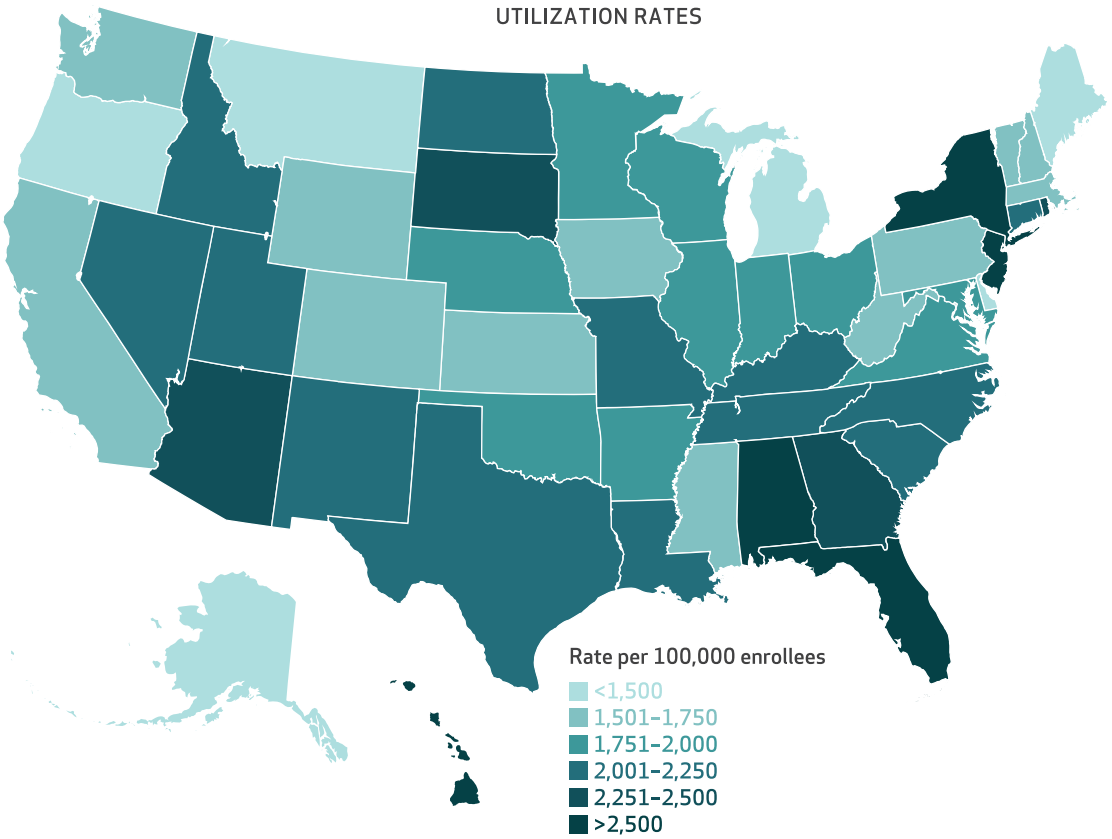
plasty or stent for stable coronary disease (extreme decile ratio: 50.9), unnecessary preoperative pulmonary function testing (extreme decile ratio: 37.7), and bone mineral density testing at frequent intervals (extreme decile ratio: 19.7) (appendix exhibit S2).[17]

WASTEFUL SPENDING ON LOW-VALUE SERVICES The overall use of the twenty-three low-value services across all fifty-one states amounted to $3.7 billion (data not shown) in wasteful spending during 2009–19. Low-value cancer screening was the largest contributor to wasteful spending, costing, on average, $965,000 per 100,000 eligible enrollees (exhibit 1). Despite the relatively low average price per procedure ($97.40) compared with the other low-value service categories, its high overall spending was primarily driven by its high utilization rate (9,900 per 100,000 eligible enrollees). Within this category, cancer screening for patients receiving dialysis for chronic kidney disease contributed the most to wasteful spending per 100,000 eligible enrollees, followed by colorectal cancer screening for adults ages seventy-five and older. Although low-value musculoskeletal surgeries and procedures had the lowest utilization rate, they were the third most costly, mainly driven by the high average prices of surgeries and procedures.

STATE-LEVEL VARIATION IN WASTEFUL SPENDING We observed greater variation in wasteful

EXHIBIT 2

State-level variation in utilization rates for low-value services per 100,000 eligible enrollees across 23 low-value care measures, 2009–19



SOURCE Authors' analysis of data from deidentified administrative claims data from OptumLabs Data Warehouse for all 50 states and Washington, D.C.

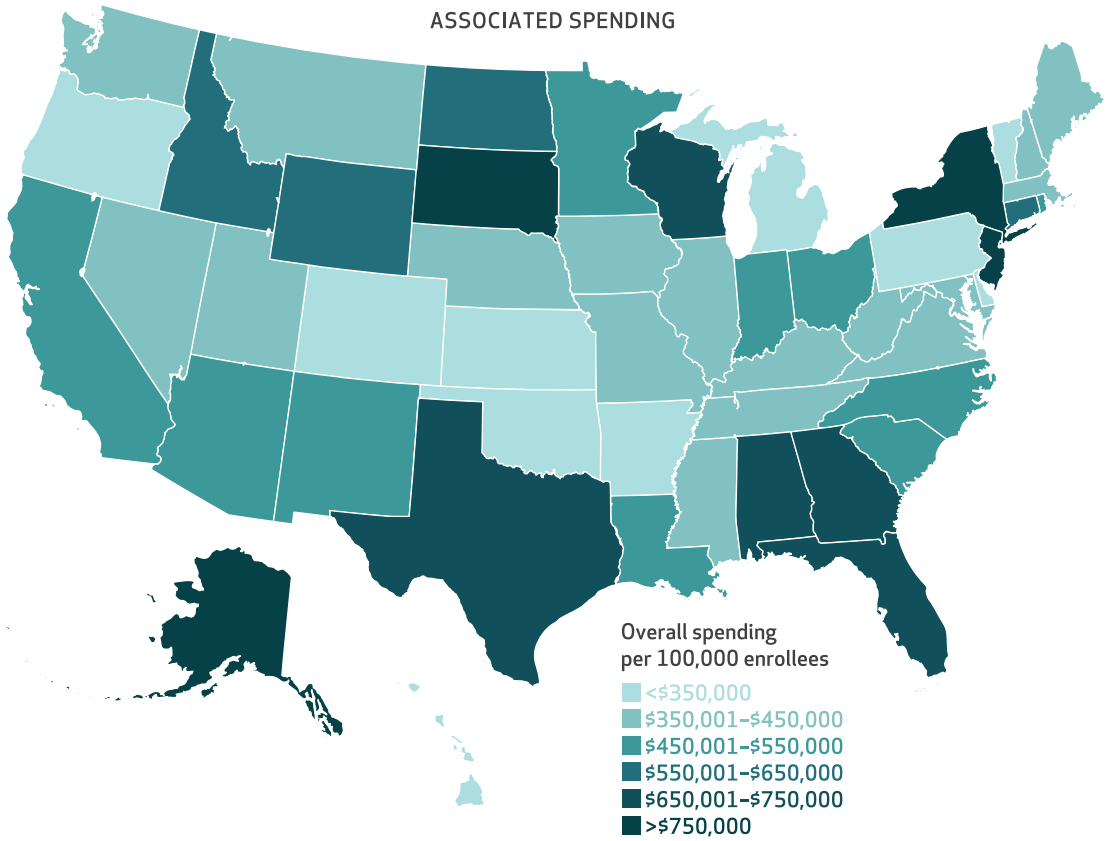
spending than in utilization: The extreme decile ratio for mean overall wasteful spending was consistently higher than that for utilization across all six service categories. For example, top-decile states (Georgia, New York, New Jersey, Florida, and South Dakota) spent nearly three times more per 100,000 eligible enrollees than states in the bottom decile (Vermont, Delaware, Kansas, Michigan, Hawaii, and Oklahoma) (exhibit 3, appendix exhibits S2 and S6,[17] and the web-based tool[24]). This is, in part, because of the greater variation in prices of low-value services. For example, the average price for all twenty-three low-value services was 2.9 times higher in the most expensive states (Wyoming, Texas, Alaska, South Dakota, and Wisconsin) versus the least expensive (Hawaii, Vermont, Arkansas, Delaware, Oklahoma, and Utah) (appendix exhibits S4 and S5[17] and the web-based tool[24]). The greatest variation in average prices in service categories included low-value cardiovascular testing and procedures (extreme decile ratio: 4.1) and low-value preoperative testing (extreme decile ratio: 3.9).

Accordingly, the latter two service categories exhibited the greatest state-level variation in wasteful spending. For preoperative testing, the top-decile states (Texas, Wisconsin, Louisiana, New Jersey, and New York) spent 7.8 times more than states in the bottom decile (Alaska, Montana, Maine, Utah, North Dakota, and Idaho). The extreme decile ratio of low-value cardiovascular testing and procedures was 6.9. Similar to utilization rates, the smallest amount of variation in wasteful spending was in low-value imaging, where top-decile states (New Jersey, Rhode Island, Texas, Wyoming, and Alaska) spent 2.8 times more than states in the bottom decile (Hawaii, Michigan, Pennsylvania, Vermont, Missouri, and Virginia). Appendix exhibits S4–S7[17] and the web-based tool[24] provide state-level variation in average prices and overall wasteful spending.

PRICES Our analysis of substituting the state-specific average procedure prices with the national average procedure price found that high

EXHIBIT 3

State-level variation in overall spending associated with the use of low-value services per 100,000 eligible enrollees across 23 low-value care measures, 2009–19



SOURCE Authors' analysis of data from deidentified administrative claims data from OptumLabs Data Warehouse for all 50 states and Washington, D.C.

prices were the primary contributor to overall spending associated with the twenty-three low-value services for nine of the top ten states with the highest wasteful spending (exhibit 4, appendix exhibits S8 and S9,[17] and the web-based tool[24]). The top ten states (South Dakota, Florida, New Jersey, New York, Georgia, Texas, Wisconsin, Alabama, Connecticut, and North Carolina) spent an average of $735,000 per 100,000 eligible enrollees (data not shown) on these twenty-three services. If their average price were equal to the national average, overall spending would have dropped by 19.8 percent (from $735,000 to $590,000 per 100,000 enrollees).

Variation in the average prices of low-value services drove most of this variation in overall spending. For instance, although Alaska was in the bottom 10 percent of states for overall use of low-value imaging services, it was in the top 10 percent of low-value care spenders because of its high average price of $314 compared with the national average of $256. In contrast, although Hawaii ranked in the top 10 percent of states for use of low-value services at the aggregate level, it remained in the bottom 10 percent of spenders because of its relatively low average prices (appendix exhibits S2 and S6).[17]

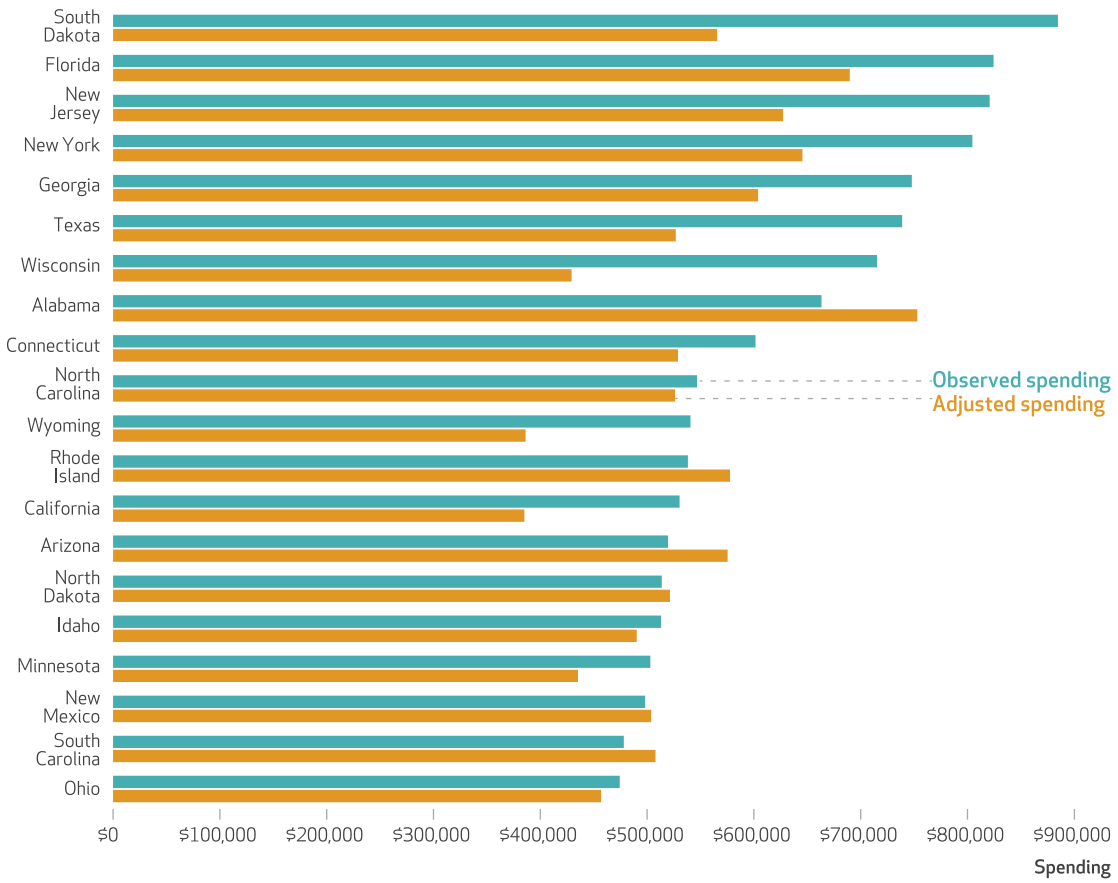
Discussion

The systematic delivery of low-value care in the US has contributed to inferior patient outcomes, worsened health care disparities, and spending inefficiencies.[1,6,25,26] Despite nearly a decade of programs focused on identifying low-value services, our analyses showed that use of and spending on low-value care remain prevalent among commercially insured and Medicare Advantage enrollees. On average, 2 in 100 enrollees eligible for at least one of the twenty-three low-value services received avoidable and possibly unnecessary services. This amounted to $3.7 billion in wasteful spending from 2009 to 2019.

The prevalence of low-value care differed by service type. Among the six major service cate-

EXHIBIT 4

Changes in wasteful spending if national average prices had been paid for 23 low-value treatments in the top 20 US states, observed and adjusted, 2009–19



SOURCE Authors' analysis of data from deidentified administrative claims data from OptumLabs Data Warehouse for all 50 states and Washington, D.C. **NOTES** Values reflect overall spending associated with 23 low-value care measures per 100,000 eligible enrollees from 2009 to 2019, measured in nominal dollars. Observed spending is state-specific price × state-specific utilization. Adjusted spending is national average price × state-specific utilization.

gories, low-value cancer screenings had the highest utilization rate and contributed the most to overall spending at the aggregate level. Unlike other low-value services, strong patient or physician preferences may play an important role in continuing cancer screening beyond the recommended ages.[27,28] Physicians' fear of litigation for missed or delayed cancer diagnosis might be another factor.[29,30]

In addition, we found substantial state-level variation in utilization, prices, and overall spending, suggesting considerable health care system inefficiency within the US. State-level variation in overall spending exceeded variation in utilization, where states in the top 10 percent of spending per 100,000 eligible enrollees across the twenty-three low-value services spent nearly three times as much as states at the bottom 10 percent, whereas states in the top 10 percent of utilization had rates only about twice those of states in the bottom 10 percent. If the average price for these twenty-three services among the top ten states in overall spending were equal to the national average, their spending would have fallen by 20 percent. This suggests that variation in spending is driven primarily by high average prices rather than high utilization. High prices may explain why some states, such as Alaska, are top spenders compared with other states, despite being in the bottom 10 percent for overall low-value care use.

Addressing variation in prices of low-value services would be important to reduce unnecessary spending. Researchers have suggested using all-payer claims databases and consumer-facing price comparison tools to help reduce price variation and make value-based decisions.[31,32] Increased price transparency and raising patients' awareness of those tools could influence patients to opt for high-value services while avoiding low-

value ones, thereby reducing overall use of and spending on low-value care.[32] However, implementation of these tools has been slow, with eighteen states operationalizing all-payer claims databases and only nine states maintaining consumer-facing price comparison websites to provide cost and quality data as of 2021.[33] Notably, none of these websites are focused explicitly on low-value services. The challenges of developing and maintaining these tools vary by state; states place their emphasis on different priority issues such as provider identification, rate review enhancement, data collection standardization, or patient awareness and engagement.[31,32]

Differences in state characteristics, such as better health care provision and access to specialty care, might also contribute to variation in the prevalence of low-value care.[34] We found that three states in the top 10 percent in low-value care use (Hawaii, New Jersey, and New York) are also ranked as the best states for health care in terms of access, quality, and public health.[35,36] Between-state differences in access to specialty care could explain greater variation in some low-value services,[34] such as preoperative cardiac testing for cataract surgery. In addition, rural populations with less access to care could result in less utilization overall. Our analysis found that rural states with fewer residents (Alaska, Maine, Montana, and Vermont) were consistently in the lower deciles of utilization for most of the twenty-three low-value care measures.

Our findings underscore the importance of routine measurement and reporting of the use of and spending associated with low-value services at the state level. Such information could inform the design of state-specific policies aiming to reduce waste. For example, New York, which was in the top decile for low-value cancer screening use and spending, could focus on implementing educational initiatives (such as shared decision making) that target providers and patients, particularly when patients' preferences may conflict with clinical evidence and guidelines.[37–39] Providers, who are regularly informed on current, evidence-based practices, are better equipped to communicate high-value care options to their patients. In the long term, instituting shared decision-making initiatives that seek to align provider expertise with patient preference may lead to safer and more cost-effective health outcomes.[40]

Other strategies to reduce overall low-value care could include redesigning financial incentives, such as enhancing pay-for-performance models to reward decreases in, or penalize the provision of, low-value services.[41] Importantly, Section 4105 of the Affordable Care Act states that services that receive a US Preventive Services Taskforce "D" grade (no net clinical benefits) can be removed from reimbursement. For example, in 2013 the US Preventive Services Taskforce released a new recommendation for BRCA testing, where routine genetic counseling and testing of women without a family history of cancer received a D grade.[42] Medicare subsequently revised its local coverage decision in 2016 for BRCA testing to exclude populations that are unlikely to benefit.[43] However, although the 2013 recommendation was cited as a justification for this revision, Section 4105 was not referenced. Recent estimates suggest that more than thirty million D-rated services are received annually by Medicare beneficiaries, at a cost approaching $500 million.[44] Also, health plans can selectively increase the cost-sharing level to affect patients' behavior on the use of low-value services.[45,46]

Addressing variation in prices of low-value services would be important to reduce unnecessary spending.

Conclusion

Despite increased attention, the use of low-value care and associated spending among commercially insured and Medicare Advantage enrollees remained prevalent as of 2019, with much variation by service type and enrollees' state of residence. State actions to improve the routine measurement and reporting of use of and spending on low-value services would be an important step forward in identifying sources of variation and designing state-specific policies that would improve patient-centered outcomes, enhance equity, and increase spending efficiency. ■

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