

## Observational Study



# Healthcare Utilization and Costs Associated with New-Onset Pain in a Medicare Population

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**Background:** Chronic pain is a common and growing problem in the United States with variable strategies for its treatment. Surgical interventions are necessary in some cases but not required for all patients with new-onset pain. For some patients, interventional pain management (IPM) techniques can treat chronic pain without the cost or risk associated with surgical intervention.

**Objective:** The objective of this study was to compare healthcare utilization and costs for new-onset chronic pain treated by IPM specialists to those treated by providers with surgical specialties (i.e., orthopedists and neurosurgeons).

**Study Design:** This was a retrospective observational study of qualifying patients over 36-months (2016-2019).

**Setting:** This study was conducted using 100% Medicare FFS Parts A, B, and Prescription Drug Event (PDE) Part D data, including enrollment and claims.

**Methods:** Patients with a diagnosis of pain were identified in the claims data. Twelve months of pre-period claims were examined to ensure the incident diagnosis of pain, and 2 additional pain diagnoses were required after initial diagnosis. Patients were assigned either to the IPM cohort or a Surgical cohort based on the specialty of the provider involved in their first pain-related visit after initial diagnosis. Key outcomes, such as the utilization of healthcare services and cost of care, were evaluated for both cohorts over the 24-months following the index diagnosis of pain.

**Results:** 106,658 beneficiaries were included in the study with roughly 36% in the IPM cohort. Patients in the IPM cohort were less healthy and had lower incomes in the baseline period compared to the Surgical cohort. Fewer members of the IPM cohort had an inpatient stay in the 24-months post index pain diagnosis (40% compared to 43% in the surgery cohort) and the IPM cohort had fewer patients with a post-acute care stay (29% compared to 31% in the inpatient stay cohort). The IPM cohort had lower risk-adjusted total costs of care than the Surgical cohort, driven by lower inpatient, outpatient, and post-acute care costs.

**Limitations:** Retrospective claims data may not include some factors important to patients with a pain diagnosis (such as over-the-counter medications, holistic treatments, or pain scores).

**Conclusion(s):** By shifting patients from higher-cost and more invasive surgical procedures, IPM's multidisciplinary approach to pain treatment can reduce surgical utilization and costs for certain chronic pain patients. This shift away from more expensive surgical treatments fits well with Medicare's move toward value-based care, driven by a focus on patient outcomes including health care utilization and costs.

**Key words:** Pain management specialist; interventionalist; healthcare costs; utilization; chronic pain; observational analysis; claims analysis; interventional pain management; Medicare fee-for-service

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**C**hronic pain remains a longstanding public health challenge facing the United States (US). Spending on chronic pain and the secondary effect of lost wages eclipsed the combined spending on both cancer and heart disease combined. The Department of Health and Human Services (HHS) currently estimates that over 50 million US adults experience daily chronic pain, 41 million think about their pain constantly or frequently, and nearly 20 million report that pain interferes with their daily life or work activities (1-3). It is estimated that 16 million people, or 8% of the US adult population, experience chronic or persistent low back pain (4).

Spinal surgery, despite unclear long-term outcomes for the treatment of axial pain in the absence of dynamic instability, has been a longstanding treatment option for chronic refractory back pain. Surgical procedures can be costly and, even when successful, may not properly target all the complexities influencing a patient's experience with chronic pain (1). Further, a 2018 Choices Matter Survey of adults having undergone orthopedic surgery revealed that 12% of people who had surgery in the previous year self-reported becoming addicted to or dependent on opioids following surgery. In 2021, the CDC reported over 75,000 deaths due to opioid overdose, with even more from synthetic opioid products (such as fentanyl) (5). Moreover, the US cost of opioid use disorder in 2018 was nearly \$786 billion (6).

Interventional pain management (IPM) is a recently recognized medical specialty within the Medicare system. IPM specialists are trained to diagnose complex pain problems, often using advanced imaging, neurodiagnostic testing, and image-guided diagnostic blocks to definitively pinpoint the pain source and to then treat that pain with a comprehensive array of minimally invasive techniques designed to better control pain while avoiding the irreversible distortion of normal spinal architecture that comes with traditional spine surgery and long-term higher dose opiate utilization to mask pain. These procedures may include a host of treatments and emerging technology, including selective nerve root blocks, epidurals, vertebral augmentation with the injection of cement into fracture sites, minimally invasive lumbar decompression, neuroablation of pain generating nerves, percutaneous decompression of nerve root impingement, and neuromodulation strategies all used in conjunction with comprehensive rehabilitation and medical strategies. This comprehensive approach may include the incorporation of psychological, integrative, neuromodulating,

rehabilitative, and biological approaches used in combination to better manage chronic pain (7).

The IPM strategy of managing pain with more cost-effective, minimally invasive therapies while lessening the opioid burden aligns with CMS' movement towards value-based care, which encourages care coordination and high-quality care while reducing overall cost. IPM has been a growing specialty within Medicare since its inception, specifically driven by the growing demand for IPM services in an aging population. Manchikanti et al (8) found an increase of 228% in IPM procedures in Medicare FFS between 2000 to 2018. Despite high growth, initial evaluation of patients with new-onset low back pain continues to be more commonly performed by a spine surgeon than an IPM physician. Only 20% of patients with chronic LBP are evaluated by an IPM physician trained to offer a comprehensive array of diagnostic and non-surgical treatment options to address painful spinal conditions.

Even though demand remains robust in an aging population looking to avoid over-utilization of opioids, there has been a relative paucity of comparative research regarding the impact of IPM versus surgical services when it comes to the total cost of care. The objective of this study was to compare healthcare resource utilization and costs for patients in a Medicare population with a common diagnosis of chronic pain who were treated by IPM specialists compared to patients with similar diagnoses treated by surgical sub-specialty providers (i.e., orthopedists and neurosurgeons).

## METHODS

### Study Design

This retrospective, observational study was conducted using 36 months of 100% Medicare FFS Parts A, B, and Prescription Drug Event (PDE) Part D data, including enrollment and claims, from 2016-2019. Data were analyzed using SAS software (SAS Institute Inc., Cary, NC).

Study inclusion criteria were based on the first qualifying diagnosis (index pain diagnosis) in the calendar year 2017. Qualifying diagnoses, representing pain diagnoses commonly treated by interventional pain management and surgical specialists, were identified by the International Classification of Diseases 10 Clinical Modification (ICD-10-CM) code as: radiculopathy (M54.1); other spondylosis (M47.8); chronic pain syndrome (G89.4); low back pain (M54.5); post laminectomy syndrome, not elsewhere classified (M96.1); and

long term (current) use of opiate analgesic (Z79.891). At least 2 additional qualifying diagnoses of pain within 180 days of the index diagnosis were also required. Subsequent diagnoses were not required to be of the same code as the index.

Beneficiaries were required to be continuously enrolled in Medicare (Parts A, B, and D) for the 12 months prior to and the 24 months following the index pain diagnosis. To ensure the index pain diagnosis was the incident diagnosis, beneficiaries with a qualifying pain diagnosis in the 12 months prior to the index pain diagnosis were excluded from the analysis, as were beneficiaries with end-stage renal disease (ESRD) as the original reason for Medicare entitlement (OREC). Also excluded were individuals with a diagnosis associated with surgery for pain-related causes, such as spondylosis with myelopathy, in the 24-months post index pain diagnosis.

Two cohorts were created based on whether a patient received care for a qualifying pain diagnosis from an interventional pain management specialist, an orthopedic surgeon, or a neurosurgical surgeon. To capture utilization early in the patient's care journey (but not at incident diagnosis), cohort assignment was based on the first claim post-index pain diagnosis that also had a qualifying pain diagnosis (the second encounter for a pain diagnosis). Cohort assignment was based on the specialty of the provider on the first post-index diagnosis: either the IPM cohort (CMS Provider Specialty 09) or the Surgical cohort (CMS Provider Specialty 20 for orthopedic surgery or 14 for neurosurgery). Key outcomes were examined by cohort over the 24 months of follow-up post index pain diagnosis (Fig. 1). To account for between patient differences in observation length, utilization and costs were calculated on a per-patient-per-month (PMPM) basis.

**Key Outcomes**

Baseline patient characteristics were measured over the 12 months prior to the index pain diagnosis and identified through the Medicare enrollment file. Characteristics included age (defined as less than 65,

65-74, 75-79, and greater than or equal to 80 years old), gender, race and ethnicity, geographic region, dual eligibility for Medicaid, receipt of the Medicare Part D low-income subsidy (LIS), and OREC.

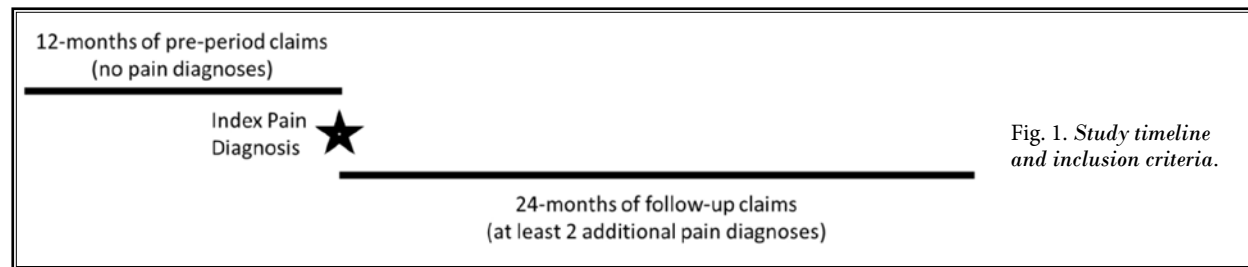
Two measures of health status were generated from the claims data, the Charlson Comorbidity Index (CCI) and the Hierarchical Condition Category (HCC) risk score (9,10). The components of the CCI were used to identify comorbidities such as chronic obstructive pulmonary disease (COPD), diabetes (with and without complications), and peripheral vascular disease within the sample population. The components were weighted and summed to create a CCI score (9). The HCC risk score was calculated using CMS software V2216. Both the CCI and the HCC scores were calculated using the 12 months of claims prior to the index pain diagnosis. Utilization and cost variables were risk-adjusted by HCC score to account for varying case mix between the IPM and surgical cohorts. Risk adjustment was conducted by dividing utilization and costs by the HCC score so that HCC scores above 1 (scores for beneficiaries expected to incur higher costs) would proportionally decrease the mean to account for patient complexities.

Costs were defined by the sum of the amount paid by Medicare, third parties, and beneficiaries and were segmented by category (i.e., inpatient, emergency department, outpatient, professional services, post-acute care, durable medical equipment, and pharmacy). Pharmacy costs were assigned as either opioids or non-opioids. Cost variables were created in both the baseline period (12 months pre-index pain diagnosis) and in the follow-up period (24 months post-index pain diagnosis).

**RESULTS**

**Baseline Demographics**

The IPM cohort was smaller than the surgical cohort, with 37,966 IPM beneficiaries compared to 68,692 beneficiaries in the surgical cohort. The IPM cohort had a higher percentage of beneficiaries who were younger/disabled, lower income, and had higher acu-



ity compared to the surgical cohort. A higher percent of beneficiaries in the IPM cohort were Medicare FFS beneficiaries under age 65 (19% vs 9%); as ESRD beneficiaries were excluded from this sample, Medicare enrollment under age 65 is suggestive of disability. This was confirmed by the OREC variables, which indicated that 31% of the IPM population was eligible for Medicare because they were disabled, compared to 19% of the surgical cohort.

A higher percentage of the IPM cohort were dually eligible for Medicaid (22% compared to 14%) and were eligible for a LIS (26% compared to 17%). Differences in race, gender, and geographic region by cohort were minimal (Table 1).

The IPM cohort had a 14% higher average HCC risk score (1.41 compared to 1.24). The IPM cohort also had more comorbidities on average compared to the surgical cohort (2.42 compared to 2.20 according to the CCI). Rates of COPD, as well as congestive heart disease, renal disease, peripheral vascular disease, and diabetes, were higher in the patient population attributed to IPM physicians in comparison to surgeons.

### Healthcare Services Utilization

The percentage of both cohorts with at least 1 hospitalization was similar in the pre- and post-period, with 18% of the IPM cohort having had a hospitalization in the pre-period and 40% in the post and 17% of

Table 1. Baseline patient characteristics (12-month pre-index).

		IPM		Surgical	
Total		37,966		68,692	
	Mean (SD)	71.08 (11.55)		73.33 (9.32)	
Age (n, %) at index date	< 65	7,386	19%	6,382	9%
	65-74 years	15,414	41%	31,755	46%
	75-79 years	7,023	18%	14,910	22%
	≥ 80 years	8,143	21%	15,645	23%
Gender (n, %)	Female	23,693	62%	42,655	62%
	Male	14,273	38%	26,037	38%
Race (n, %)	White	33,194	87%	61,267	89%
	Black	2,843	7%	3,701	5%
	Hispanic or Latino	601	2%	824	1%
	Asian	419	1%	914	1%
	Native American	143	0%	181	0%
	Unknown	766	2%	1,805	3%
Geographic Census Region (n, %)	Northeast	6,015	16%	11,159	16%
	Midwest	7,970	21%	14,242	21%
	South	17,734	47%	32,349	47%
	West	6,222	16%	10,864	16%
	Unknown	25	0%	78	0%
Dual eligible beneficiaries	Non-Dual	29,541	78%	58,885	86%
	Dual	8,425	22%	9,807	14%
Low-Income Subsidy	No	27,923	74%	57,155	83%
	Full or Partial	10,043	26%	11,537	17%
Reason for Entitlement	Age-related (without ESRD)	26,039	69%	55,781	81%
	Disabled	11,927	31%	12,911	19%
HCC score	Mean (SD)	1.41 (1.16)		1.24 (1.02)	
Charlson Comorbidity Index (CCI) score	Mean (SD)	2.42 (2.51)		2.18 (2.35)	
	0	9,547	25%	19,249	28%
	1-2	13,928	37%	25,943	38%
	3+	14,491	38%	23,500	34%

the surgical cohort having had a hospitalization in the pre-period and 43% in the post-period (Table 2). The number of risk-adjusted inpatient hospitalizations per 1,000 beneficiaries was statistically significantly higher in the surgical cohort as well, with 32 inpatient visits per 1,000 beneficiaries compared to 27 inpatient visits per 1,000 beneficiaries in the IPM cohort ( $P < 0.0001$ ).

The percentages of the cohorts with at least 1 post-acute care stay (including SNF, HHA, Hospice, IRF, LTAC) was higher in the surgical cohort, with 31% of the cohort having had a post-acute care stay in the post-period and 29% of the IPM cohort having had a post-acute care stay in the post-period (Table 2). The number of risk-adjusted post-acute care stays per 1,000 beneficiaries was statistically significantly higher in the surgical cohort as well, with 28 inpatient visits per 1,000 beneficiaries compared to 25 inpatient visits per 1,000 beneficiaries in the IPM cohort ( $P < 0.0001$ ).

Risk-adjusted emergency department visits were statistically significantly higher (4%) in the IPM group in the post-index period (72 per 1,000 beneficiaries compared to 69 per 1,000 beneficiaries in the surgical cohort;  $P = 0.0009$ ). Thirty-three percent of the IPM cohort had an emergency department visit in the baseline period, and emergency department visits increased 24 percentage points to 58% in the follow-up period; 30% of the surgical cohort had an emergency department visit in the pre-period and visits increased by 25 percentage points to 55% in the post-period. Outpatient visits (including outpatient procedures and observation stays) and physician office visits were high for both groups in the pre-index period and grew at similar proportions in the post-period (Table 2).

**Total Cost of Care**

Total annualized PMPM costs for the IPM cohort were 7% higher than for the surgical cohort (\$24,415 vs

\$22,892;  $P < 0.0001$ ), however after risk-adjusting, costs in the IPM cohort were 8% lower (\$21,550 vs \$23,481;  $P < 0.0001$ ). Risk adjustment of costs is a standard practice to create more accurate comparisons between physicians and practices with a different case mix of patients (11). In the IPM cohort, total risk-adjusted medical costs doubled in the 24 months following the index pain diagnosis; however, the increase was even larger in the surgical cohort, where costs were 2.17 times higher in the follow-up (IPM pre-index pain diagnosis medical costs were \$8,274 and post index pain diagnosis were \$16,655; in the surgical cohort medical costs were \$8,863 pre-index pain diagnosis and \$19,223 post).

Risk-adjusted annual inpatient hospital spending was 28% lower (\$4,476 vs \$6,231;  $P < 0.0001$ ) for Medicare beneficiaries attributed to IPM physicians compared to the surgical cohort. Post-acute care spending was 15% lower for the IPM cohort (\$1,762 vs \$2,075;  $P < 0.0001$ ), and outpatient care costs were 12% lower for the IPM cohort (\$3,450 vs \$3,921;  $P < 0.0001$ ) compared to the surgical cohort (Fig. 2). Those 3 settings (inpatient, outpatient, and post-acute care) accounted for 49% of total costs overall.

Risk-adjusted pharmaceutical costs were higher in the IPM cohort than the surgical cohort (15% higher in the post-period), but total pharmaceutical costs increased in the surgical cohort more between the pre- and post-period (\$3,541 to \$4,259;  $P < 0.0001$ ) for a 20% increase in the surgical cohort compared to (\$4,205 to \$4,895;  $P < 0.0001$ ) a 16% increase in the IPM cohort. Specifically, opioid-related costs increased in the surgical cohort more between the pre- and post-period compared to the IPM cohort; however, neither increase was statistically significant (\$91 to \$104 for a 14% increase in the surgical cohort;  $P = 0.1399$  compared to \$324 to \$335 for a 3% increase in the IPM cohort;  $P = 0.5191$ ) (Fig. 3).

Table 2. *Healthcare service utilization.*

	Baseline (12-month pre-index) Patients with at least 1 (% total)		Follow-up (24-month post-index) Patients with at least 1 (% total)		Percentage Point Change	
	IPM	Surgical	IPM	Surgical	IPM	Surgical
Inpatient Hospitalization	6,795 (18%)	11,680 (17%)	15,269 (40%)	29,681 (43%)	22%	26%
Emergency Department	12,693 (33%)	20,822 (30%)	21,875 (58%)	37,652 (55%)	24%	25%
Outpatient visits*	31,147 (82%)	56,673 (83%)	36,513 (96%)	66,817 (97%)	14%	15%
Physician office visit	37,097 (98%)	67,396 (98%)	37,808 (100%)	68,487 (100%)	2%	2%
Post-acute care stay**	4,438 (12%)	7,638 (11%)	10,839 (29%)	21,408 (31%)	17%	20%

\*Outpatient visits include outpatient procedures and observational stays

\*\*Post-acute care includes skilled nursing facilities, home health, hospice, inpatient rehabilitation facilities, and long-term acute care

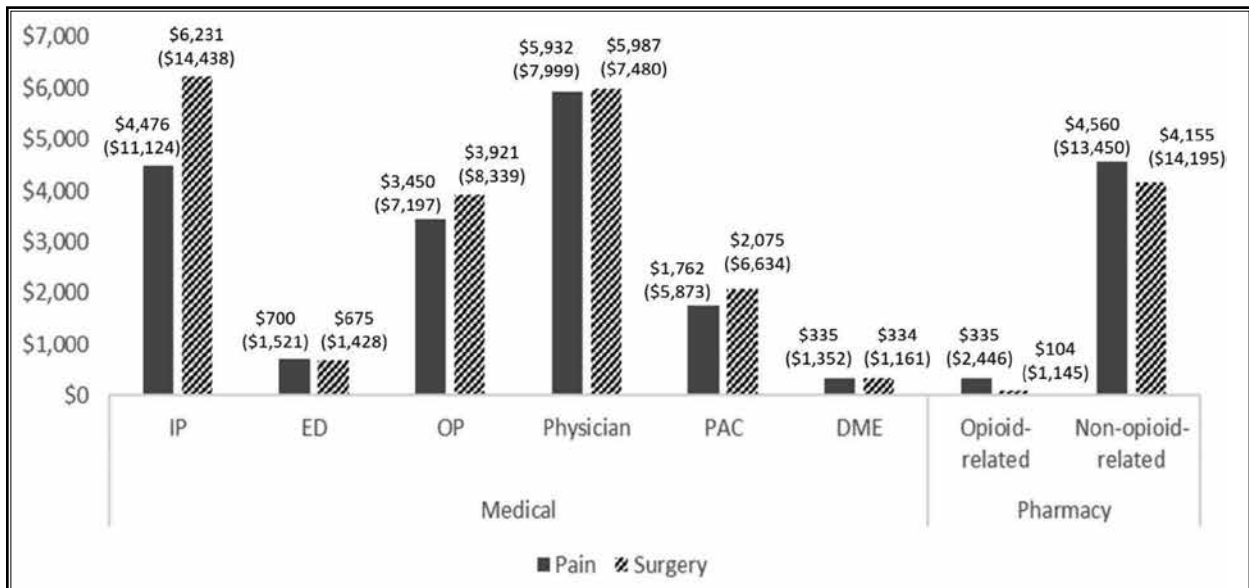


Fig. 2. Mean risk-adjusted costs by type of claim in the 24-month follow-up period, with standard deviations in parentheses. IP, inpatient; ED, emergency department; OP, outpatient facility; PAC, post-acute care; DME, durable medical equipment

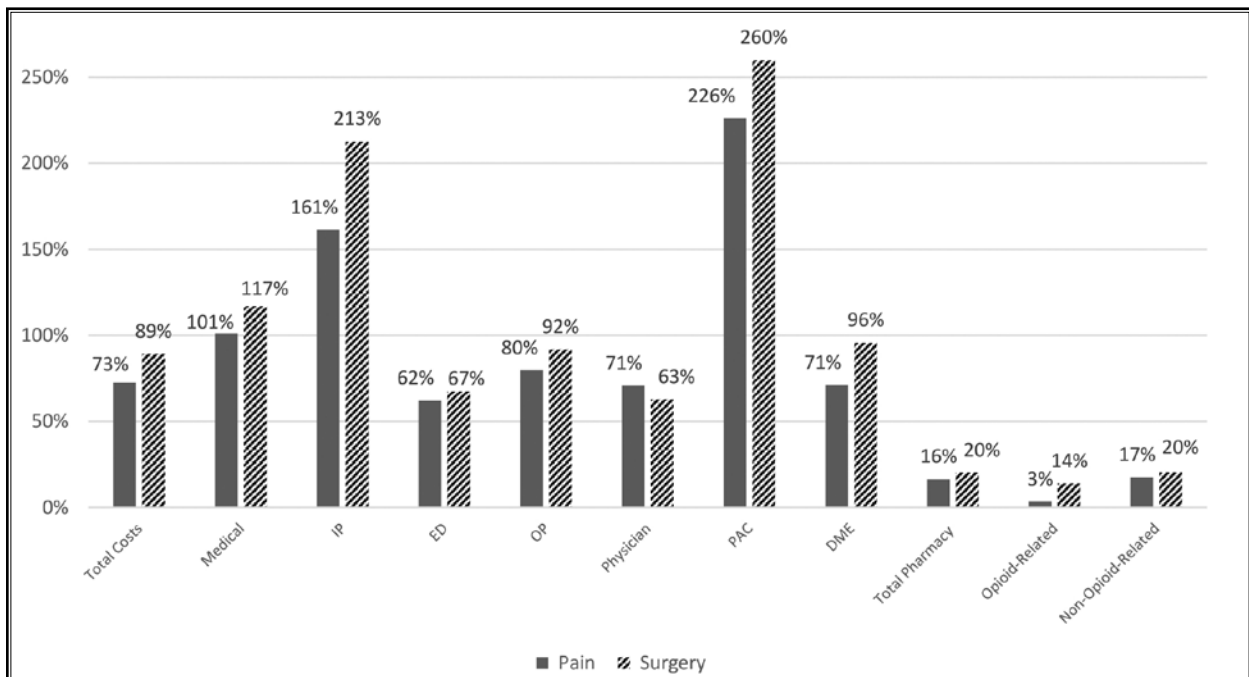


Fig. 3. Percent change in risk-adjusted costs between the 12-months pre-index pain diagnosis and the 24-month post index, by cohort and cost category. IP, inpatient; ED, emergency department; OP, outpatient facility; PAC, post-acute care; DME, durable medical equipment

**Limitations**

This observational, retrospective analysis used complete Medicare FFS claims as the basis for the

analysis. Despite the robustness of the data, there are some limitations. Pain is a complicated diagnosis, and an observational study cannot incorporate factors not



visible in claims (such as over-the-counter medications or holistic treatments) or clinical decision making in assigning diagnoses. While this study included the utilization of healthcare services and cost of care, it did not attempt to evaluate clinical outcomes in terms of the level of relief or improvement in function.

Additionally, this study focused on Medicare FFS beneficiaries, who were predominantly 65 years and older, or had some qualifying disabilities. Nondisabled, younger populations may have a different profile for healthcare utilization and associated costs. We also were not able to include Medicare Advantage members in this study. This study used pre-COVID-19 pandemic claims (2016-2019); however, utilization patterns in 2020 and beyond may differ due to the pandemic and a return to an endemic normal state.

In addition, we cannot determine long-term cost savings in this type of study. Given the high upfront costs of surgery, it is possible that the benefit noted in terms of costs would be mitigated if a longer follow-up was chosen. However, given the risks of complications following surgery versus interventional pain procedures, it is also possible that the cost savings gap would widen. Further studies will need to evaluate the effects on long-term costs.

## CONCLUSION

IPM services appear to help certain chronic pain patients manage their pain without higher-cost and more invasive surgical procedures. This shift away from more expensive surgical treatments fits well with Medicare's move toward value-based care, driven by a focus on patient outcomes and reducing costs.

Patients treated by IPM physicians tended to be a young, sicker overall population at baseline than those

treated in conventional surgical practice. This analysis looked at Medicare beneficiaries with incident chronic pain and assigned them a cohort based on the type of provider they visited early on. Compared to beneficiaries diagnosed with pain in the surgical cohort, those in the IPM cohort were more likely to be disabled, had more comorbidities, and were low-income, characteristics associated with higher clinical and psychosocial complexity.

Utilization increased more in the follow-up period for patients in the surgical cohort than in the IPM cohort. This may be due to the nature of the specialties, with invasive surgical procedures requiring more invasive monitoring and potentially having a higher complication rate than minimally invasive procedures. All procedures come with a certain level of risk, especially for patients with multiple comorbidities, but surgeries are more costly to the patient and the healthcare system. The lower costs from surgical avoidance are reflected in the higher increase in risk-adjusted medical costs in the follow-up period for the surgical cohort, led by larger inpatient spending. Costs were risk-adjusted to account for the IPM cohort being less healthy than the surgical cohort at the incident disease.

IPM physicians tend to offer lower-risk, less invasive procedures than benchmark open surgical procedures. Patients with chronic pain often have other comorbidities and complexities that prohibit the ability to relieve pain with a single procedure or surgical intervention. Chronic painful conditions may also benefit from a more holistic patient approach to care for the pain and underlying conditions. IPM may be a viable option to provide alternatives to surgical interventions for chronic pain patients seeking improved clinical outcomes while lowering both the cost of care and longer-term reliance on medications.

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