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Clinical Study

Getting what you pay for: impact of copayments on physical therapy and opioid initiation, timing, and continuation for newly diagnosed low back pain

Michael C. Jin, BS, Michael Jensen, MD, PhD, Maria Isabel Barros Guinle, BA, Alexander Ren, BA, Zeyi Zhou, BS, Corinna C. Zygourakis, MD, Atman M. Desai, MD, Anand Veeravagu, MD, John K. Ratliff, MD*

Department of Neurosurgery, Stanford University School of Medicine, Stanford, CA, USA

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Abstract

BACKGROUND CONTEXT: Physical therapy (PT) is an important component of low back pain (LBP) management. Despite established guidelines, heterogeneity in medical management remains common.

PURPOSE: We sought to understand how copayments impact timing and utilization of PT in newly diagnosed LBP.

STUDY DESIGN/SETTING: The IBM Watson Health MarketScan claims database was used in a longitudinal setting.

PATIENT SAMPLE: Adult patients with LBP.

OUTCOME MEASURES: The primary outcomes-of-interest were timing and overall utilization of PT services. Additional outcomes-of-interest included timing of opioid prescribing.

METHODS: Actual and inferred copayments based on nonnonprimary care provider visit claims were used to evaluate the relationship between PT copayment and incidence of PT initiation. Multivariable regression models were used to evaluate factors influencing PT usage.

RESULTS: Overall, 2,467,389 patients were included. PT initiation, among those with at ≥1 PT service during the year after LBP diagnosis (30.6%), occurred at a median of 8 days postdiagnosis (IQR 1−55). Among those with at least one PT encounter, incidence of subsequent PT visits was significantly lower for those with high initial PT copayments. High initial PT copayments, while inversely correlated with PT utilization, were directly correlated with subsequent opioid use (0.77 prescriptions/patient [$0 PT copayment] versus 1.07 prescriptions/patient [$50−74 PT copayment]; 1.15 prescriptions/patient [$75+ PT copayment]). Among patients with known opioid and PT copayments, higher PT copayments were correlated with faster opioid use while higher opioid copayments were correlated with faster PT use (Spearman $p<.05$). For multivariable whole-cohort analyses, incidence of PT initiation among patients with inferred copayments in the 50−75th and 75−100th percentiles was significantly lower than those below the 50th percentile (HR=0.893 [95%CI 0.887−0.899] and HR=0.905 [95%CI 0.899−0.912], respectively).

CONCLUSIONS: Higher PT copayments correlated with reduced PT utilization; higher PT copayments and lower opioid copayments were independent contributors to delayed PT initiation and higher opioid use. In patients covered by plans charging high PT copayments, opioid use was

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*Corresponding author: Department of Neurosurgery, Stanford University School of Medicine, 300 Pasteur Drive, Edwards Building/R-292, Stanford, CA 94305, USA. Tel.: (650) 723-6469; fax: (650) 725-0390

E-mail address: jratliff@stanford.edu (J.K. Ratliff).

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significantly higher. Copays may impact long-term adherence to PT.

Keywords: Physical therapy; Insurance copay; Opioid use; Low back pain; Lumbar degenerative disc disease; Conservative treatment

Introduction

Low back pain (LBP) remains pervasive and is a major source of healthcare expenditures globally [1–3]. Point prevalence of LBP remains high, exceeding 20% among those over 65 years of age [4]. Physical therapy (PT) is one of several treatment options for patients suffering from LBP and is recommended for first-line pain management along with over-the-counter nonsteroidal antiinflammatory drugs and acetaminophen [5–8]. Financial barriers can pose significant logistical barriers to patients who are seeking PT services [9]. These barriers may prevent timely access to care or divert patients to lower efficiency care approaches, such as resorting to pharmaceutical treatment with prescription opioids [10]. In the last year alone, over 16,000 deaths were attributed to overdoses related to prescription opioids in the United States [11].

Rapid initiation of conservative care following diagnosis of LBP may effectively reduce long-term opioid use [12]. However, extrinsic barriers unrelated to disease symptomatology or severity, such as patient-side costs, may affect how PT is incorporated into patient care. PT out-of-pocket costs can be significant, with a prior study demonstrating that median out-of-pocket costs per care episode was nearly $150 with average total costs nearly $2,000 [13]. These costs may deter patients, who might benefit from PT, from pursuing further evaluation and treatment; however, the quantitative impact of PT copays on PT and opioid utilization among LBP has not been well-demonstrated. Characterizing barriers that may influence initial utilization and adherence to PT after LBP diagnosis may uncover opportunities to improve PT access, particularly for patients most likely to benefit from prompt PT.

This study aimed to estimate the influence of PT and opioid copayments on PT initiation and adherence. In a nationally sourced cohort of adult patients with newly diagnosed LBP compiled from a large administrative database, we analyzed the longitudinal care of LBP patients, including the frequency and timing of PT sessions and opioid prescriptions, and explored how clinical management is affected by copayments for therapeutic services.

Methods

Data source

All data used in this study was derived from the IBM Watson Health MarketScan Claims Database, which we have previously described [14,15] and encompasses the longitudinal healthcare claims of over 150 million patients covered by major commercial healthcare insurance providers. These include outpatient services and encounters, including clinic visits, prescription medications, and PT encounters. Charges and costs associated with encounter, such as copayments and total costs, are available for each documented service. All encounters, enrollees, and providers were deidentified prior to analysis and our study was approved by our Institutional Review Board (#40974).

Cohort construction

Adult patients (age ≥18) with new diagnoses of low back pain with or without lower extremity pain were included in our cohort. Exclusion criteria included red flag diagnoses indicative of a more severe underlying pathology (Supplementary Table 1). Those with prior diagnoses of chronic pain or evidence of any prior opioid use were excluded. The index LBP date was defined as the first instance of a qualifying diagnosis code (Supplementary Table 1). To comprehensively assess comorbidities, we required at least 1 year of continuous lookback prior to the index LBP date. Comorbidities were canvassed during the year prior to the index LBP date according to the Elixhauser comorbidity index [16]. Additionally, all patients were required to have at least 1 year of postLBP continuous follow-up. Patients treated surgically during the year after the index LBP date were excluded.

For subset analyses of patients with at least one PT claim, empiric copayment estimates were directly extracted from individual PT claims identified by the linked provider category. However, we suspect a subset of patients with high PT copayments may never seek an initial PT evaluation and would therefore be lost from the prior analysis. Therefore, we conducted whole-cohort analyses including patients without recorded PT visits by inferring generalized nonprimary care provider (PCP) copayment burden from alternative PCP healthcare claims and subsequently stratifying based on this copayment fraction. To infer nonPCP copayment fraction, all nonPCP consult, clinic visits, and evaluations (see Supplementary Table 1 for CPT code list; PCPs were defined as family medicine, internal medicine, pediatrics, and OB/GYN) for each patient were extracted and the fraction of total costs attributable to the copayment was computed as a proxy for PT copayment magnitude. Among the subset of patients with known exact PT copayments, correlation analyses were conducted between inferred and exact copayments to validate this approach.

Statistical analysis

All univariable quantitative and qualitative distribution comparisons were conducted using the nonparametric Mann-Whitney U-test and chi-square test of independence, respectively. Multivariable time-to-event analyses used the semiparametric Cox regression model to determine factors that impact initiation of first-time and subsequent PT services. Schoenfeld residuals were examined to confirm satisfaction of proportionality assumption. For multivariable regression models, covariates included demographics, plan type, and comorbidities. For grouped quantitative variables, such as inferred nonPCP copayment fraction and actual PT copayments, strata were defined *a priori*. The primary outcomes of interest were time to PT initiation and PT adherence following the first encounter. Secondary outcomes of interest included opioid prescribing frequency and timing. Statistical significance was established below a p-value of .05 and all statistical and graphical analyses were conducted using R and GraphPad Prism 8 (GraphPad Software).

Results

A total of 2,467,389 patients were included in our study (Fig. 1); among these, 2,021,657 (81.9%) had isolated LBP without additional lower extremity symptoms. Approximately 30% of patients had at least one PT encounter during the year after LBP onset (N=753,849, 30.6%), from which exact PT copayment data could be directly extracted. Median time to PT initiation, among those with at least one PT encounter, was 8 days (interquartile range [IQR] 1 to 55). Additional characteristics described in Table 1.

Among patients who had at least one PT encounter, actual PT copayments for the first PT encounter were used

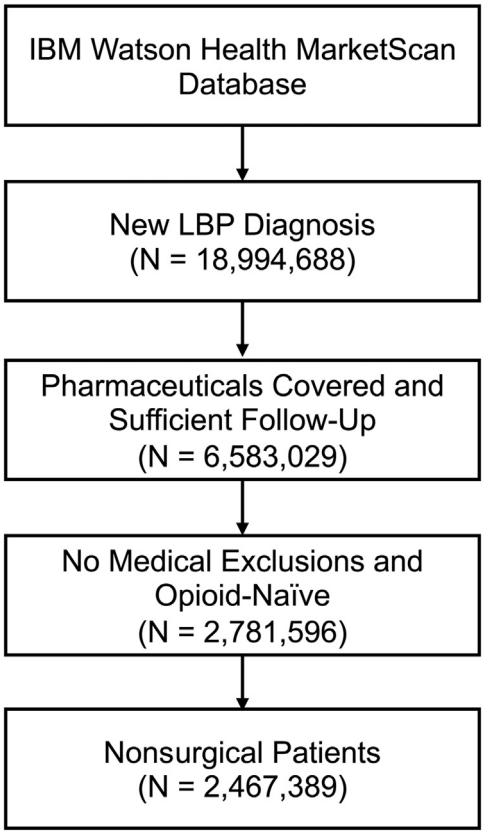

Fig. 1. CONSORT Diagram.

Table 1
Low back pain nonsurgical cohort characteristics

Characteristic	N=2,467,389	
	N	%
Age at diagnosis (mean (SD))	47.35	15.79
Year of diagnosis (mean (SD))	2011.16	2.19
Sex (%)		
Male	1,107,029	44.9
Female	1,360,360	55.1
Geographic region (%)		
Northeast	369,475	15
North Central	506,980	20.5
South	882,901	35.8
West	407,828	16.5
Unknown	300,205	12.2
Healthcare plan type (%)		
Comprehensive	518,23	2.1
EPO	26,865	1.1
HMO	327,779	13.3
POS	160,914	6.5
PPO	1,304,146	52.9
POS with capitation	13,413	0.5
CDHP	152,691	6.2
HDHP	79,043	3.2
Unknown	350,715	14.2
Comorbidities		
Congestive heart failure (%)	32,988	1.3
Cardiac arrhythmia (%)	102,078	4.1
Valvular disease (%)	60,421	2.4
Pulmonary circulation disorders (%)	9,476	0.4
Peripheral vascular disorders (%)	49,340	2
Hypertension uncomplicated (%)	580,363	23.5
Hypertension complicated (%)	37,717	1.5
Paralysis (%)	1,305	0.1
Other neurological disorders (%)	34,908	1.4
Chronic pulmonary disease (%)	183,714	7.4
Diabetes uncomplicated (%)	227,808	9.2
Diabetes complicated (%)	49,967	2
Hypothyroidism (%)	179,738	7.3
Renal failure (%)	28,304	1.1
Liver disease (%)	36,510	1.5
Peptic ulcer disease (%)	5,858	0.2
AIDS/HIV (%)	3,192	0.1
Rheumatoid arthritis/collagen (%)	42,213	1.7
Coagulopathy (%)	11,562	0.5
Obesity (%)	101,732	4.1
Weight loss (%)	17,226	0.7
Fluid and electrolyte disorders (%)	46,407	1.9
Blood loss anemia (%)	4,974	0.2
Deficiency anemia (%)	41,243	1.7
Alcohol abuse (%)	15,099	0.6
Drug abuse (%)	11,461	0.5
Psychoses (%)	9,646	0.4
Depression (%)	192,190	7.8
Number of comorbidities (mean (SD))	0.86	1.25

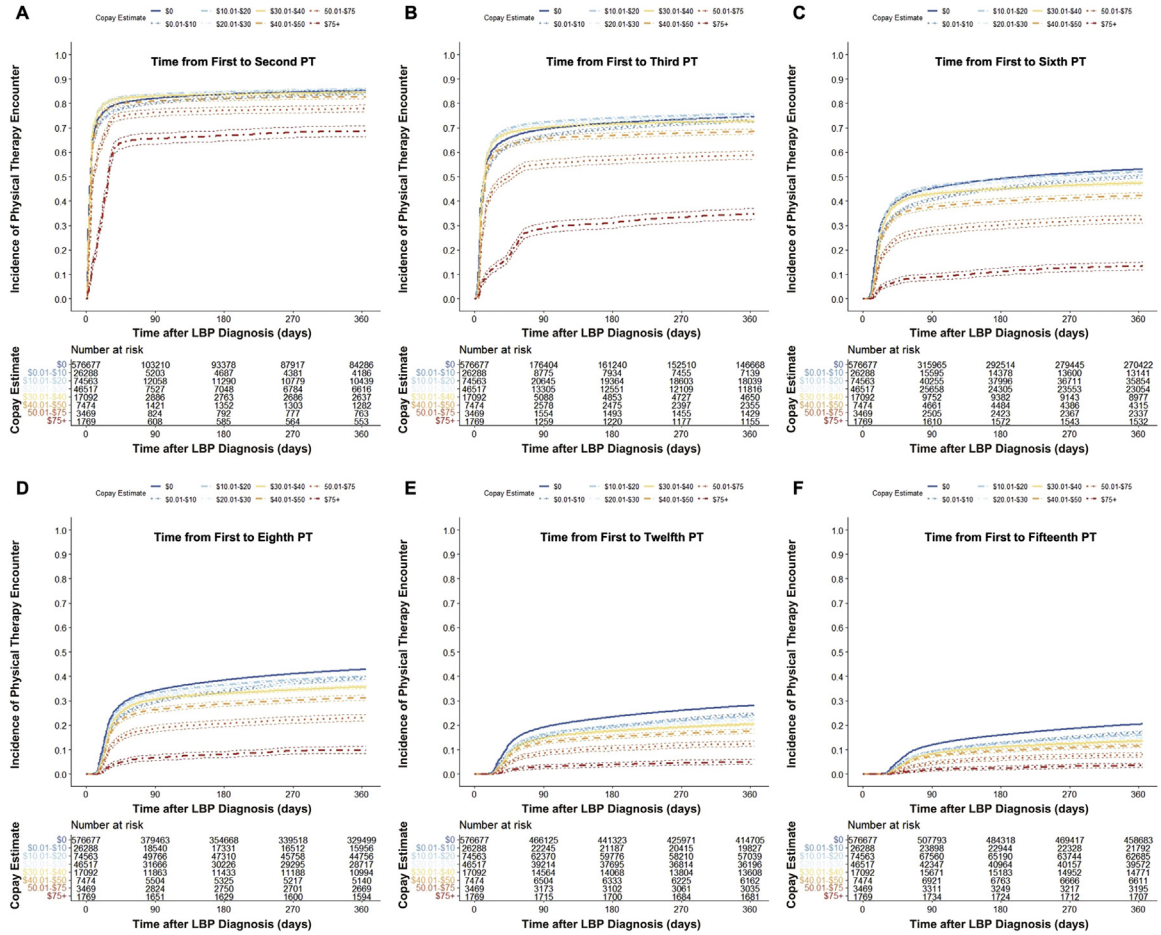

Fig. 2. Time to continued physical therapy services among physical therapy users. Empiric copayments associated with the first physical therapy encounter were closely associated with incidence of second (A), third (B), sixth (C), eighth (D), twelfth (E), and fifteenth (F) physical therapy encounters. Number at risk included below each figure.

for stratification. Six univariable comparisons were conducted (time from first to second [Fig. 2A], third [2B], sixth [2C], eighth [2D], twelfth [2E], and fifteenth [2F] PT encounters). Broadly, patients were significantly less likely to pursue a second PT visit if initial PT copayment exceeded $50 (HR=0.600, 95%CI 0.582−0.619); this was similar in patients with isolated LBP (HR=0.612, 95%CI 0.591−0.633). This was particularly evident when evaluating long-term PT utilization; compared with those with no PT copayment, those with $20−$29, $30−$39, $40−$49, $50−$74, and $75+ copayments were much less likely to reach twelfth (HRs 0.761, 0.693, 0.587, 0.403, and 0.154, respectively) and fifteenth PT sessions (HRs 0.705, 0.637, 0.536, 0.360, and 0.155, respectively). On multivariable analysis, association between PT copayment and PT usage remained significant (Fig. 3).

The effect of copayment on long-term PT use was pronounced, with the highest relative effect of copayments on PT usage most evident beyond the first three encounters (Fig. 3). When specifically evaluating likelihood of immediate (≤3 days delay) and early (≤30 days delay) PT among patients with known PT copayment data, patients with PT copayments of less than $10 were significantly more likely to pursue PT early after diagnosis compared with those with higher copayments (Fig. 4). Among these patients with at least one PT encounter, higher copayments correlated inversely with overall PT utilization and directly with opioid use (Spearman p<.001; Figs. 5A and B). While patients with no PT copayment averaged 0.77 opioid prescriptions during the year after LBP diagnosis, those with PT copayments exceeding $50 averaged over 1 prescription per patient (1.07 [$50−$74] and 1.15 [$75+]); compared with those with $0 PT copayments, this constituted 38.5% and 49.2% increases, respectively. Overall, patients receiving early PT were significantly less likely to receive opioids than those not receiving early PT or no PT at all (20.6% [≤3 days] and 25.5% [≤30 days] vs 32.7%, both p<.001). In the subset of patients with both PT and opioid copayments available, higher PT copayments were associated with faster opioid use (Fig. 6A), while lower opioid copayments were associated with delayed PT initiation (Fig. 6B).

Nearly 70% of LBP patients did not have any available PT claims from which empiric PT copayment burden can be directly extracted. We speculate high copayment costs

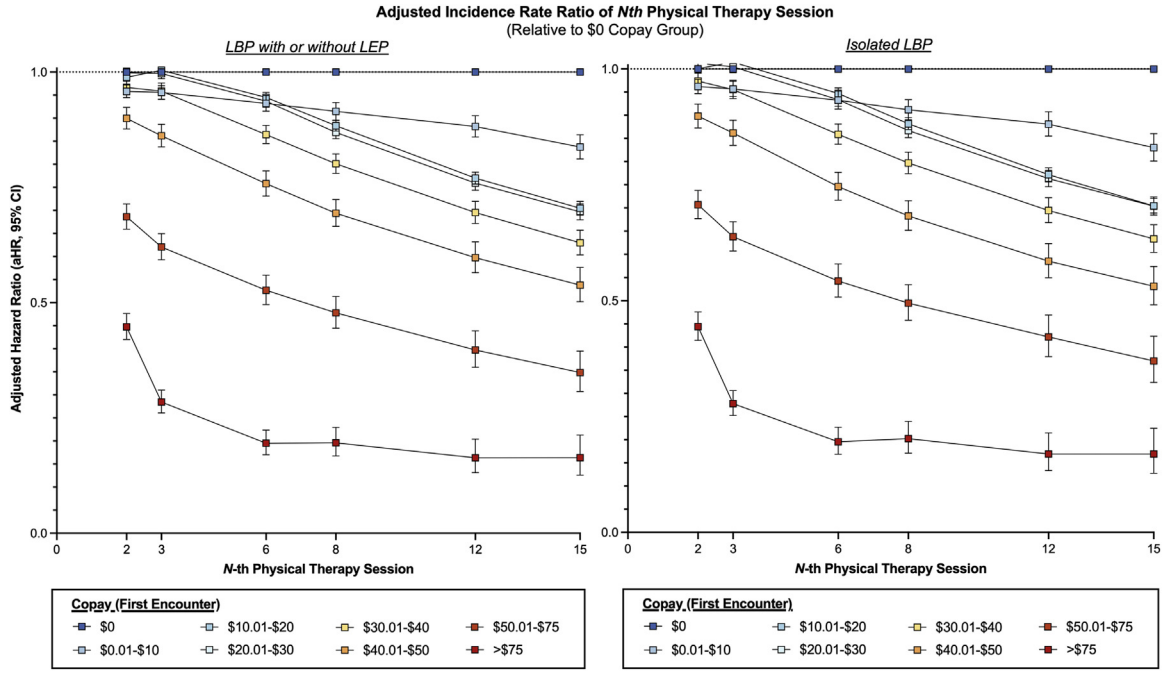

Fig. 3. Adjusted incidence rate ratios of subsequent physical therapy services among physical therapy users. Adjusting for demographics, geographic region, plan type, and comorbidities at initial diagnosis, empiric copayment amount associated with the first physical therapy encounter remained associated with incidence of subsequent physical therapy utilization. Overall, the effect of high copayments on reducing physical therapy utilization was magnified with increasing services used.

may have deterred many patients from even attempting PT, so we conducted secondary whole-cohort analyses of PT incidence by inferring relative healthcare plan copayment burden from other nonPCP services (as described further in the Methods). To validate this inferred nonPCP copayment fraction as an interpolated proxy for underlying PT copayment, we evaluated the subset of patients (N= 753,849, 30.6%) with both inferred nonPCP copayment fraction and empiric PT copayment data. Inferred nonPCP copayment fraction and empiric PT copayments demonstrated moderate direct correlation (Pearson r=0.31, p<.001), and patients in the moderate-high (50th–75th percentile) and high (>75th percentile) inferred copay groups had significantly higher average PT copays ($6.82 and $9.03, respectively) than those in the low inferred copay group ($1.72, all p<.001). Applying these strata to the full cohort, we evaluated incidence of first and second PT encounters. Compared with patients in the low inferred copay group, those with higher inferred copays pursued PT significantly less frequently (vs low inferred copay group, HR=0.887 [50th–75th percentile, 95%CI 0.882–0.892] and HR=0.873 [75th+ percentile, 95%CI 0.867–0.880], Figs. 7A and B). After adjusting for available demographic, geographic, and comorbidity covariates, inferred copay group remained significantly associated with incidence of first and second PT visits (Table 2).

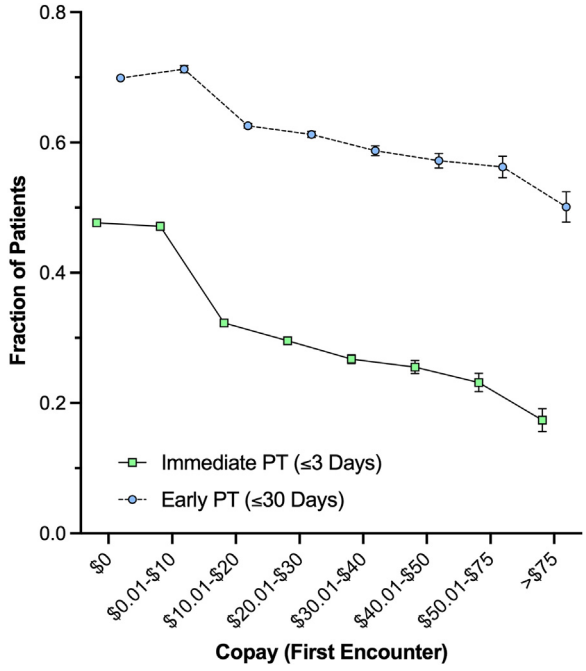

Fig. 4. Prevalence of immediate and early physical therapy initiation among physical therapy users. Among patients with at least one physical therapy encounter, increasing first-visit copayments were associated with decreasing rates of immediate (within 3 days of diagnosis) and early (within 30 days of diagnosis) physical therapy.

Discussion

Despite established guidelines and clinical literature suggesting prompt initiation of PT for LBP may improve pain control, heterogeneity in care remains pervasive [14]. In our study, we evaluated the impact of PT and opioid

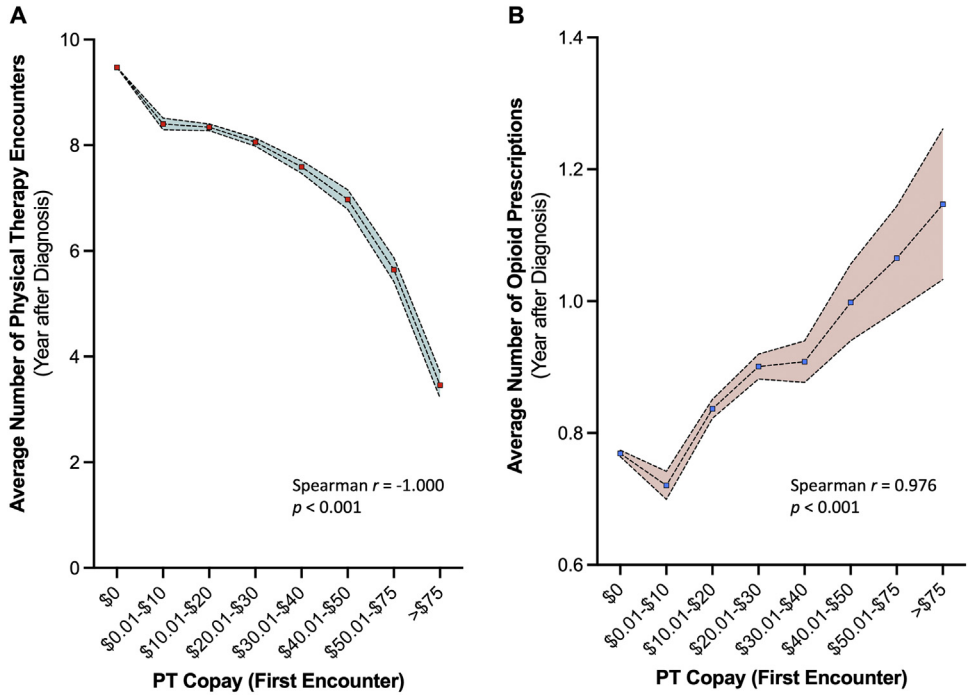

Fig. 5. Correlation of one year postdiagnosis physical therapy and opioid utilization with first-visit physical therapy copayments. Higher first-visit physical therapy copayments were associated with decreased cumulative physical therapy utilization (A) and increased cumulative opioid use (B).

copayments on treatment approach and timing. Lower PT copayments were associated with more frequent and rapid utilization of PT services while also influencing long-term PT use. PT copayments inversely correlated with PT utilization and positively correlated with opioid utilization. Higher PT copayments were associated with delayed PT initiation and earlier opioid prescription, while higher opioid copayments were associated with earlier PT initiation and delayed opioid prescription.

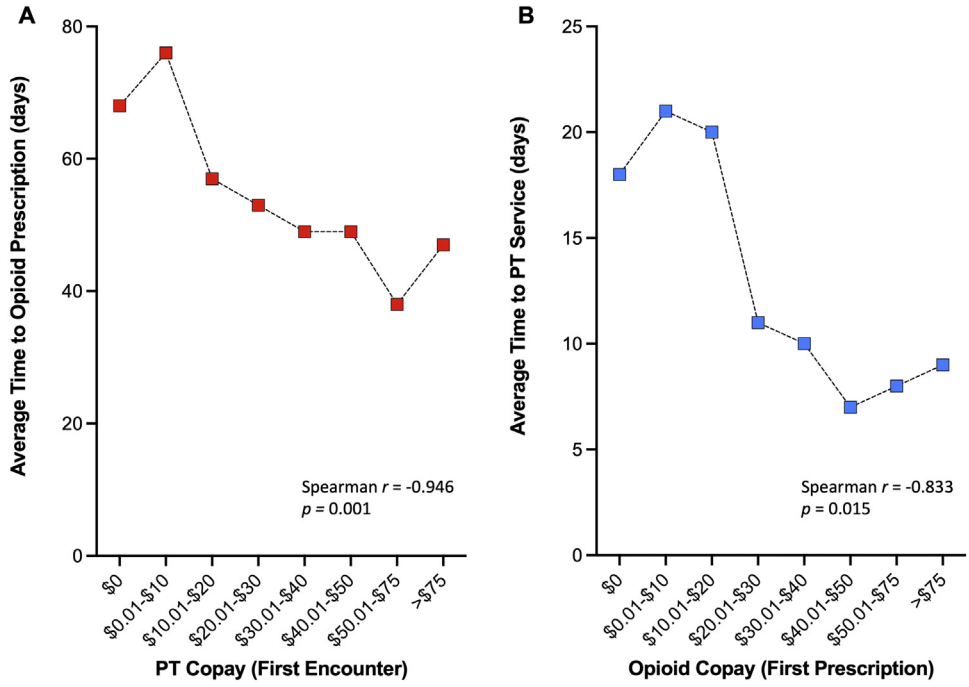

Fig 6. Timing of physical therapy and opioid initiation correlated against copayment amount. Increased physical therapy copayments were associated with earlier opioid prescription (A) while increased opioid copayments were correlated with faster physical therapy initiation (B).

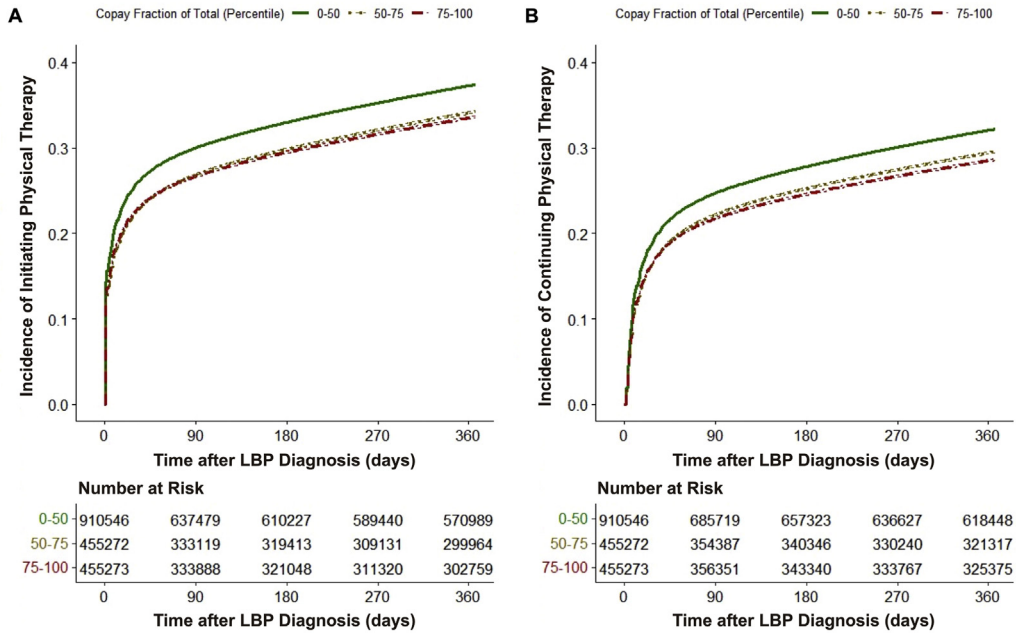

Fig. 7. Comparison of physical therapy initiation and continuation based on inferred nonprimary care provider copayment. Patients with a higher inferred nonPCP copayment initiate (A) and continue (B) physical therapy at lower rates than those with low inferred nonPCP copayments.

While current clinical guidelines recommend incorporation of PT with nonsteroidal antiinflammatory drugs and acetaminophen, optimal timing of PT initiation is not well-known [5–8]. Recent literature suggests early referral and initiation of PT may improve long-term prognosis and reduce healthcare spending. Utilizing MarketScan, Liu et al [17] demonstrated that patients with acute LBP receiving PT within 3 days of diagnosis eventually required less pain medication, advanced imaging studies, nonPCP visits, and emergency room admissions than those receiving later PT. A systematic review by Arnold et al [18] similarly indicated that initiation of PT within 30 days of LBP diagnosis resulted in reduced healthcare spending and opioid utilization. In our study, we hypothesized that high copayments for PT services may prevent or delay PT evaluation, potentially resulting in suboptimal outcomes for those patients that might benefit from intervention. In a prior study of patients with acute LBP insured by a single healthcare provider, Carey et al [19] demonstrated that higher copayments were associated with reduced likelihood of seeing a physical therapist as the first provider. However, the timing of PT initiation and how higher copayments affect pharmaceutical use were not explored. We demonstrate that, across over 2.4 million patients with qualifying LBP diagnoses, higher PT copayments are associated with decreased immediate and early PT initiation. Healthcare plans charging high copayments for PT and relatively lower copayments for opioid prescriptions may incentivize patients to explore pharmaceutical pain interventions first, without attempting guideline-supported conservative pain control.

The optimal duration of PT is not well-established for patients with LBP. However, among patients with chronic LBP, prior studies have suggested that up to 15 sessions may offer long-term benefit to pain and mobility [20]. Guidelines for LBP without red flag findings have suggested four to 6 weeks of conservative care as appropriate without need for imaging [21]. Despite this, barriers to PT adherence, such as high copayment charges, may limit longitudinal PT utilization. In a prior study of a single PT provider, Dolot et al demonstrated that higher out-of-pocket payments were associated with reduced PT visits. Our study similarly supports this association while additionally demonstrating the relationship between higher PT copayments and increased opioid utilization. The relative effect of copayment magnitude on PT utilization also increased with continued PT use. In patients receiving more than three PT visits, our study demonstrates that even nonzero copays less than $10 per visit may prolong time between PT services or prevent subsequent visits altogether. Even with moderate increases in copayment burden, patients may be less willing to remain on PT after initial evaluation and may choose to explore alternative, more costly, and invasive pain control approaches.

Though opioids are not recommended for newly diagnosed LBP, early opioid initiation remains common [22,23]. Systematic review of studies evaluating subacute and chronic LBP suggest little benefit to opioid use while increasing potential harm [24]. In our study, we demonstrate that not only were higher PT copayments associated with reduced PT utilization but were also associated with more frequent and earlier opioid prescription. Opioid copayments inversely affected timing of PT services, with higher copayments associated with earlier PT. Previously, we have demonstrated that, despite established guidelines

Table 2
Incidence of initiating and continuing physical therapy

Characteristic	First PT service		Second PT service	
	HR	95%CI	HR	95%CI
Inferred copay group				
1 (0–50th percentile) (ref)				
2 (50–75th percentile)	0.893	0.887–0.899	0.905	0.899–0.912
3 (75–100th percentile)	0.888	0.882–0.894	0.882	0.875–0.888
Age at diagnosis	1.003	1.003–1.003	1.006	1.005–1.006
Sex				
Male (ref)				
Female	0.974	0.969–0.979	0.996	0.990–1.001
Geographic region				
Northeast (ref)				
North Central	0.960	0.952–0.968	0.946	0.938–0.955
South	0.907	0.899–0.914	0.886	0.878–0.893
West	1.087	1.077–1.096	1.032	1.022–1.042
Unknown	0.844	0.821–0.868	0.833	0.809–0.858
Healthcare plan type				
Comprehensive (ref)				
EPO	1.217	1.181–1.254	1.174	1.136–1.212
HMO	0.919	0.901–0.938	0.867	0.849–0.886
POS	1.281	1.255–1.308	1.250	1.223–1.278
PPO	1.303	1.279–1.328	1.270	1.246–1.296
POS with capitation	1.289	1.240–1.340	1.234	1.183–1.287
CDHP	1.311	1.284–1.339	1.265	1.237–1.293
HDHP	1.386	1.355–1.417	1.365	1.333–1.398
Comorbidities				
Congestive heart failure	0.854	0.826–0.884	0.849	0.819–0.880
Cardiac arrhythmia	0.949	0.934–0.964	0.956	0.940–0.973
Valvular disease	0.993	0.973–1.013	1.000	0.979–1.021
Pulmonary circulation disorders	0.890	0.844–0.938	0.894	0.845–0.946
Peripheral vascular disorders	0.913	0.889–0.937	0.919	0.893–0.945
Hypertension uncomplicated	0.870	0.864–0.877	0.876	0.869–0.883
Hypertension complicated	0.943	0.918–0.969	0.953	0.92–0.981
Paralysis	1.059	0.948–1.184	1.061	0.940–1.197
Other neurological disorders	0.892	0.871–0.913	0.894	0.872–0.918
Chronic pulmonary disease	0.957	0.947–0.966	0.965	0.954–0.975
Diabetes uncomplicated	0.883	0.873–0.892	0.888	0.877–0.898
Diabetes complicated	1.003	0.979–1.026	0.999	0.974–1.024
Hypothyroidism	1.052	1.042–1.063	1.057	1.046–1.068
Renal failure	0.933	0.902–0.965	0.927	0.894–0.961
Liver disease	0.938	0.918–0.958	0.942	0.921–0.964
Peptic ulcer disease	0.862	0.813–0.914	0.865	0.813–0.921
AIDS/HIV	0.848	0.792–0.908	0.860	0.799–0.926
Rheumatoid arthritis/collagen	0.955	0.936–0.974	0.966	0.946–0.986
Coagulopathy	0.996	0.958–1.036	1.004	0.962–1.048
Obesity	0.893	0.881–0.905	0.880	0.867–0.893
Weight loss	0.892	0.862–0.924	0.893	0.860–0.927
Fluid and electrolyte disorders	0.924	0.904–0.944	0.913	0.892–0.934
Blood loss anemia	0.948	0.890–1.010	0.944	0.882–1.011
Deficiency anemia	0.964	0.943–0.985	0.973	0.951–0.996
Alcohol abuse	0.893	0.863–0.925	0.878	0.845–0.912
Drug abuse	0.830	0.797–0.865	0.805	0.769–0.842
Psychoses	0.932	0.889–0.977	0.935	0.888–0.985
Depression	1.094	1.084–1.104	1.096	1.085–1.107

recommending early conservative therapy, care heterogeneity remains pervasive. A driver of this heterogeneity may be nonmedical factors, such as patient out-of-pocket costs and in this study, the secondary effect of PT copayments on opioid prescribing patterns suggests that extrinsic motivators such as costs may influence choice of conservative treatments.

The limitations of our study include those inherent of retrospective studies, which includes the risk of residual confounding due to unseen and unrecorded covariates. All

data used for our study was derived from a nationally sourced healthcare claims database. As such, manual review of clinical reports and radiographic studies was not possible; data granularity is also limited by diagnostic and procedural coding. The MarketScan database, while nationally sourced and spanning multiple commercial insurance providers, does not include Medicaid and uninsured patients. Furthermore, worker's compensation plans were not available for analysis. Additionally, we demonstrate that inferred nonPCP copayment fraction is correlated with empiric PT copayment and serves as a valuable proxy for estimating incidence of PT initiation when including patients without available PT claims; nonetheless it is a relatively rough approximation and is not an exact reflection of underlying PT copayment magnitude. Further studies stratifying by actual PT copayments in whole-cohort analyses would facilitate direct interpretation of how copayment magnitude may influence patient willingness to pursue an initial PT evaluation; however, to our knowledge, there are no clinical datasets curated with this information.

Conclusion

In patients with LBP, higher PT copayments were associated with delayed PT initiation, poorer PT follow-up, and increased opioid use. This study suggests that PT and opioid copayments may be extrinsic motivators of immediate and long-term clinical management. Among patients who may benefit from prompt PT, high PT copayments, and relatively lower opioid copayments may drive patients away from guideline-supported care and towards earlier opioid use.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Michael C. Jin: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. **Michael Jensen:** Conceptualization, Formal analysis, Investigation, Methodology, Validation, Writing – review & editing. **Maria Isabel Barros Guinle:** Investigation, Writing – review & editing. **Alexander Ren:** Investigation, Writing – review & editing. **Zeyi Zhou:** Investigation, Writing – review & editing. **Corinna C. Zygourakis:** Investigation, Writing – review & editing. **Atman M. Desai:** Investigation, Writing – review & editing. **Anand Veeravagu:** Investigation, Writing – review & editing.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.spinee.2024.01.008.

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