

The Relationship of PROMIS Physical Function Scores, Healthcare Resource Utilization, and Charges in Patients Treated for Chronic Mechanical Low Back Pain

Hejazi A¹, Ye X¹, Youssef J², Moebus C², Goss B², Brodke D³, McCormick Z⁴, Schaecher K⁵, Brixner D¹, Willis C¹

(1) Department of Pharmacotherapy, College of Pharmacy, University of Utah, Salt Lake City, UT, USA
(2) Mainstay Medical, San Diego, CA, USA
(3) Department of Orthopaedics, School of Medicine, University of Utah, Salt Lake City, UT, USA
(4) Department of Physical Medicine and Rehabilitation, School of Medicine, University of Utah, Salt Lake City, UT, USA
(5) University of Utah Health Plans, Salt Lake City, UT, USA



BACKGROUND

- In the United States, direct yearly spending on chronic lower back pain (CLBP) in 2016 was estimated at \$134.5 billion¹
- The Patient-Reported Outcomes Measurement Information System Physical Function (PROMIS-PF) is a National institutes of Health-funded tool with demonstrated reliability in measuring functionality among patients with mechanical CLBP ²⁻⁵

OBJECTIVES

- Assess the correlation between healthcare resource utilization (HRU) and PROMIS-PF scores among patients with mechanical chronic lower back pain (CLBP)
- Develop a model to estimate adjusted healthcare charges by PROMIS-PF scores for patients with CLBP

METHODS

- Retrospective cohort study within the University of Utah Health system (UHealth)
- Included patients were adults diagnosed with CLBP between 2015 through 2020 who were non-surgical candidates, identified using relevant ICD-9/10 codes
- Patients were grouped by baseline PROMIS-PF scores into Category 0 (lowest physical function) to Category 3 (highest physical function); patients were further stratified into Low-PF (Category 0-1) or High-PF (Category 2-3) cohorts
- Demographics, comorbidities, and actual healthcare charges were compared between Category 0-3 patients using descriptive statistics
- Incidence rate ratios (IRR) were used to compare HRU between Low and High-PF cohorts using Poisson regression model
- Mixed-effects regression was used to model healthcare charges while controlling for PROMIS scores, comorbidities, and other patient characteristics among Low and High-PF cohorts

RESULTS

Physical Function Cohorts (Table 1)

- Total of 3,586 patients included: Category 0 (n=451, 13%), Category 1 (n=447, 12%), Category 2 (n=1391, 39%), and Category 3 (n=1297, 36%)
- Low-PF (n=898, 25%) and High-PF (n=2688, 75%)

Baseline Demographics and Comorbidities (Table 2)

- Mean age was 49.9 (SD:17.3) years, 69.3% were female, and 85.8% were white

Procedure and Medication Utilization (Figure 1)

- There was higher utilization of biofeedback (9.0% vs 6.5%, p=0.011), botulinum toxin injections (4.3% vs 2.2%, p<0.001), EMG (1.2% vs 0.3%, p<0.001), ketamine infusions (5.0% vs 2.1%, p<0.001), sympathetic nerve blocks (4.5% vs 2.7%, p=0.008) and psychotherapy (10.7% vs 6.4%, p<0.001) among Low-PF patients compared to High-PF
- Medication utilization was higher in the Low-PF cohort compared to High-PF for opioids (54% vs 37%, p<0.001), antidepressants (48% vs. 38%, p<0.001), NSAIDs (47% vs. 39%, p<0.001), and anticonvulsants (42% vs. 24%, p<0.001)

Healthcare Visits (Figure 2)

- The Low-PF cohort (n=898) showed higher rates of inpatient (IRR: 2.3, p<0.001), outpatient (IRR: 1.2, p<0.001), intensive care unit (IRR: 7.6, p=0.002), and emergency department (IRR: 1.9, p<0.001) visits compared to High-PF (n=2,688)

Actual Healthcare Charges (Figure 3)

- Actual median healthcare charges for Year-1 were highest for Category 0 patients (\$14,650 [IQR: 5,506-37,936]) and lowest for Category 3 (\$5,450 [IQR: 2,455-13,694])

Mixed-Effects Model (Table 3)

- The mixed-effects regression model for a base-case scenario (no comorbidities, White, Female, BMI<25) estimated cumulative charges at Year-2 being >2-fold higher for Low-PF patients compared to High-PF (\$15,126 [95% CI: \$12,953-17,746] vs \$7,345 [95% CI: \$6,771-7,976])
- In the Low-PF cohort, Anxiety (\$661, p<0.05), Depression (\$501, p<0.05), and Hypertension (\$554, p<0.05) were associated with increased predicted healthcare charges per quarter in the 2 years following mechanical CLBP diagnosis

CONCLUSIONS

This study found **significantly higher HRU** for Low- vs. High-PF patients with CLBP led to an almost **3-fold increase in actual healthcare charges**. This data can be used to estimate the economic impact and inform reimbursement and benefit design of new therapies based on changes in disability or physical function scores.

Table 3. Mixed-Effects Model

	Low-PF (N=898)		High-PF (N=2,688)	
	Median age: 56.0		Median age: 47.2	
	Charge Estimate ¹	95% CI	Charge Estimate ¹	95% CI
Base-case scenario				
Quarter: 1	3072*	[2292-4116]	1266*	[1106-1450]
Quarter: 2	1854*	[861-3138]	874*	[655-1123]
Quarter: 3	1619*	[656-2869]	839*	[623-1084]
Quarter: 4	1800*	[816-3076]	807*	[593-1049]
Quarter: 5	1630*	[664-2885]	879*	[659-1127]
Quarter: 6	1693*	[715-2960]	901*	[679-1151]
Quarter: 7	1728*	[745-3002]	874*	[654-1123]
Quarter: 8	1730*	[744-3008]	905*	[682-1157]
→ Year-2 cumulative	15126*	[12953-17746]	7345*	[6771-7976]
Age				
<i>Cohort median (reference)</i>				
Charge per 1-year increase from median	-15*	[-28--1]	4*	[1-7]
Sex				
<i>Female (reference)</i>				
Male	-195	[-586-257]	-111*	[-195--21]
Race:				
<i>White (reference)</i>				
Black	910	[-605-3356]	66	[-287-548]
Asian	-892	[-1640-248]	-77	[-296-191]
Other	255	[-552-1321]	-6	[-177-191]
Unknown	-516	[-1945-2725]	-232	[-542-211]
Ethnicity				
<i>Non-Hispanic (reference)</i>				
Hispanic/Latino	6	[-777-1056]	-135	[-289-43]
Unknown	-85	[-1170-1618]	93	[-219-497]
Comorbidities				
<i>None (reference)</i>				
Anxiety	661*	[139-1267]	169*	[54-295]
Depression	501*	[7-1073]	255*	[136-384]
Bipolar	488	[-429-1724]	193	[-69-512]
Schizophrenia	-185	[-2329-8142]	1090	[40-2983]
Hypertension	554*	[23-1176]	104	[-15-233]
Obesity	270	[-265-907]	187*	[45-346]
Hypothyroidism	495	[-103-1214]	62	[-71-210]
Coagulopathy	660	[-526-2397]	166	[-269-792]

1, Difference in charges (\$USD) from respective reference value
* p<0.05
CI, confidence interval; High-PF, high-physical function; Low-PF, low-physical function
Model is adjusted for demographic and comorbidities and shows quarterly charge predictions for Q1-Q8 in the first 8 rows for base-case patient (age=cohort median, BMI<25, Female, White, Non-Hispanic, and no comorbidities). Q1 served as the reference, with the following quarters shown as the respective difference from Q1. To factor in patient characteristics into prediction, add charge estimate for given variable to each quarterly charge.

REFERENCES

1. Dieleman JL, Cao J, Chapin A, et al. US Health Care Spending by Payer and Health Condition, 1996-2016. JAMA. 2020;323(9):863-884. doi:10.1001/jama.2020.0734
2. Brodke DJ, Saltzman CL, Brodke DS. PROMIS for Orthopaedic Outcomes Measurement. J Am Acad Orthop Surg. 2016;24(11):744-749. doi:10.5435/JAAOS-D-15-00404
3. Brodke DS, Goz V, Voss MW, Lawrence BD, Spiker WR, Hung M. PROMIS PF CAT Outperforms the ODI and SF-36 Physical Function Domain in Spine Patients. Spine (Phila Pa 1976). 2017;42(12):921-929. doi:10.1097/BRS.0000000000001965
4. Rijk L, Kortlever JTP, Tipton GW Jr, Ring D, Queralt MV: Austin Spine Study Group. Is It Time to Replace the Oswestry Index With PROMIS Physical Function Computer Adaptive Test? Arch Phys Med Rehabil. 2020;101(9):1549-1555. doi:10.1016/j.apmr.2020.03.021
5. Zeldes A, Abed V, Bench C, Rahman T, Malkini MC. Patient-Reported Outcomes Measurement Information System physical function instruments compare favorably to legacy patient-reported outcome measures in spine patients: a systematic review of the literature. Spine J. 2022;22(4):646-659. doi:10.1016/j.spinee.2021.10.009

Table 1. Physical Function Cohorts

Physical functionality	PROMIS-PF category	n (%)	PF cohort	n (%)
Minimal	0	451 (13%)	Low-PF	898 (25%)
Low	1	447 (12%)		
Medium	2	1,391 (39%)	High-PF	2,688 (75%)
High	3	1,297 (36%)		

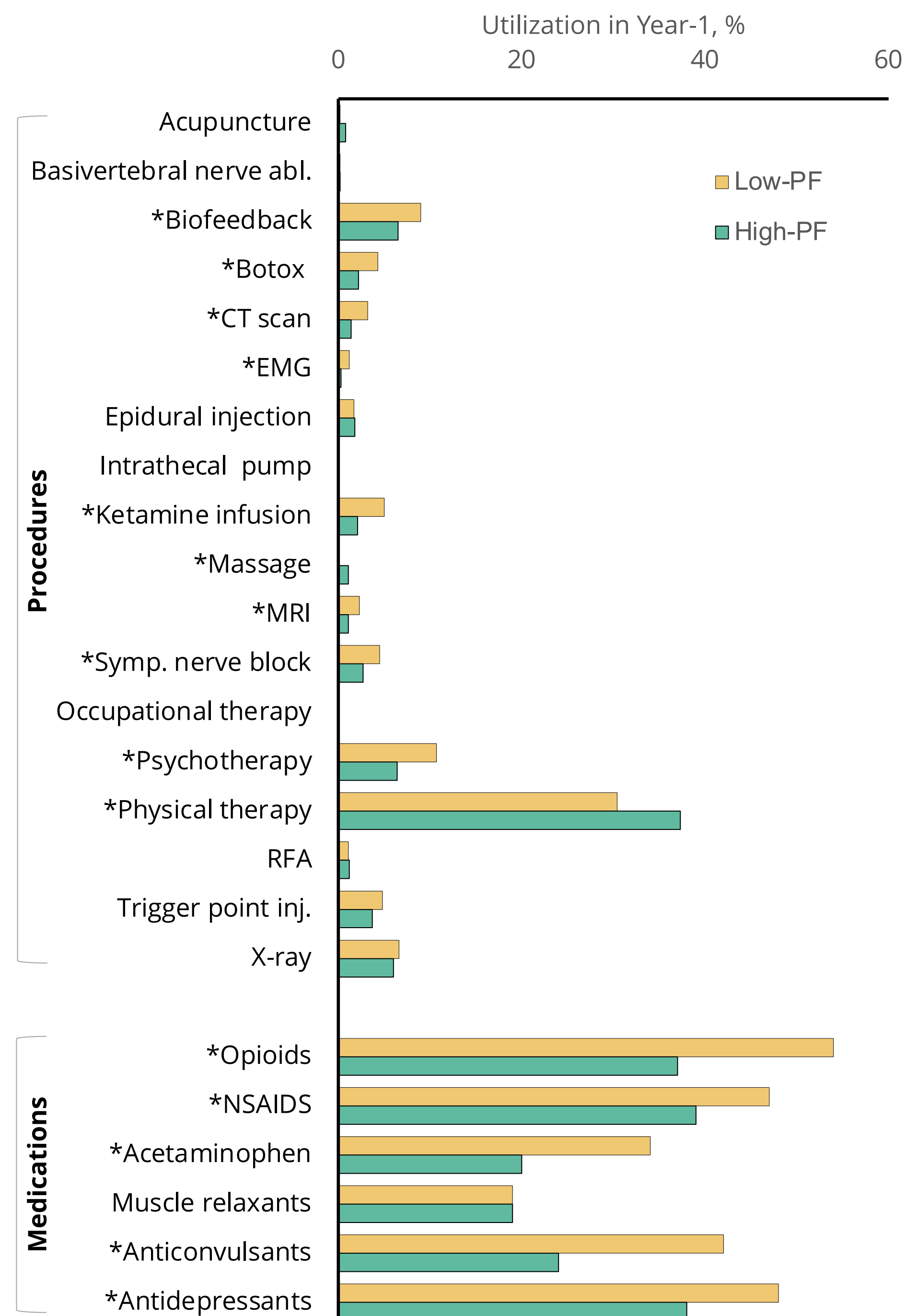
Low-PF cohort (PROMIS-PF score <38.5) translates to ODI scores >37.6
High-PF cohort (PROMIS-PF score ≥38.5) roughly translates to ODI scores ≤37.6

Table 2. Baseline Demographics and Comorbidities

Variables	Category 0 (N=451)	Category 1 (N=447)	Category 2 (N=1,391)	Category 3 (N=1,297)	Overall (N=3,586)
Age, mean (SD)	55 (18)	54.2 (17)	49.8 (17)	46.7 (16)	49.9 (17)
BMI categories, n (%)					
<25	141 (31)	112 (25)	461 (33)	507 (39)	1221 (34)
25 - <30	118 (26)	118 (26)	388 (28)	406 (31)	1030 (29)
>=30	191 (42)	217 (49)	530 (38)	382 (30)	1320 (37)
Missing	1 (0)	0 (0)	12 (1)	2 (0)	15 (0)
Sex, n (%)					
Female	325 (72)	310 (69)	993 (71)	858 (66)	2486 (69)
Male	126 (28)	137 (31)	398 (29)	439 (34)	1100 (31)
Race, n (%)					
White	394 (87)	381 (85)	1215 (87)	1087 (84)	3077 (86)
Black	7 (2)	10 (2)	15 (1)	18 (1)	50 (1)
Asian	13 (3)	9 (2)	32 (2)	43 (3)	97 (3)
Other	34 (8)	44 (10)	110 (8)	139 (11)	327 (9)
Unknown	3 (1)	3 (1)	19 (1)	10 (1)	35 (1)
Ethnicity, n (%)					
Non-Hispanic	412 (91)	398 (89)	1251 (90)	1137 (88)	3198 (89)
Hispanic/Latino	29 (6)	39 (9)	109 (8)	136 (11)	313 (9)
Unknown	10 (2)	10 (2)	31 (2)	24 (2)	75 (2)
Comorbidities, n (%)					
Anxiety	174 (39)	155 (35)	436 (31)	317 (24)	1082 (30)
Depression	231 (51)	230 (52)	524 (38)	350 (27)	1335 (37)
Hypertension	220 (49)	189 (42)	458 (33)	317 (24)	1184 (33)
Obesity	111 (25)	120 (27)	256 (18)	179 (14)	666 (19)
Hypothyroidism	81 (18)	59 (13)	196 (14)	116 (9)	452 (13)
COPD	144 (32)	127 (28)	326 (23)	217 (17)	814 (23)

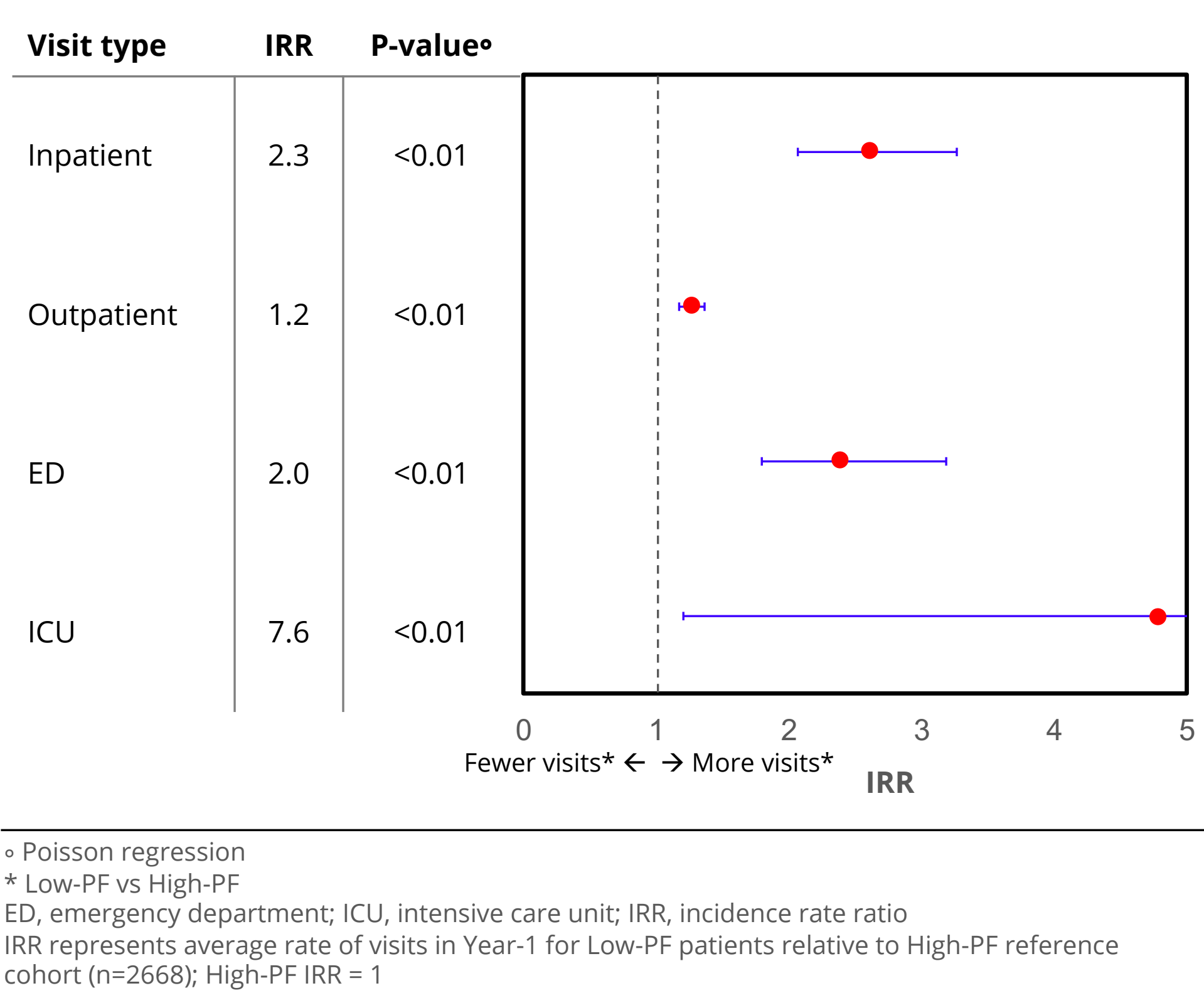
BMI, body mass index; COPD, chronic obstructive pulmonary disease; SD, standard deviation

Figure 1. Procedure and Medication Utilization



*p<0.05, Chi-square or Fisher's exact
CT, computed tomography; EMG, electromyography; High-PF, high-physical function; Low-PF, low-physical function; MRI, magnetic resonance imaging; NSAIDs, non-steroidal anti-inflammatory drugs; RFA, radiofrequency ablation
Percentages represent number of patients receiving at least one procedure/medication in the first year following CLBP diagnosis date

Figure 2. Healthcare Visits



* Poisson regression
* Low-PF vs High-PF
ED, emergency department; ICU, intensive care unit; IRR, incidence rate ratio
IRR represents average rate of visits in Year-1 for Low-PF patients relative to High-PF reference cohort (n=2668); High-PF IRR = 1

Figure 3. Actual Healthcare Charges

