Real-World Healthcare Resource Utilization and Economic Burden Associated with Progressive Pulmonary Fibrosis in Commercially Insured and Medicare Advantage Populations in the United States

EE365

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BACKGROUND

- Fibrosing interstitial lung disease (ILD) that progresses is known as progressive pulmonary fibrosis (PPF). Previous studies have estimated economic burden associated with PPF. However, evidence is limited on burden by insurance type.

OBJECTIVES

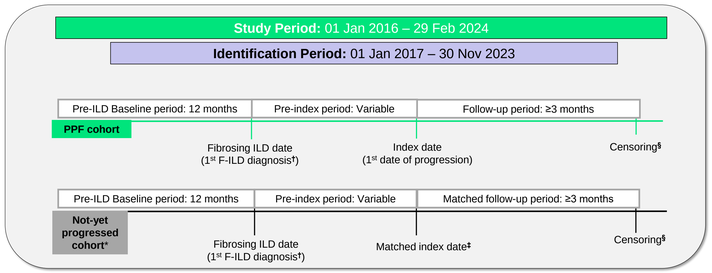
- This study aimed to estimate healthcare resource utilization (HCRU) and costs among patients with PPF by payer type (commercial and Medicare Advantage Prescription Drug [MAPD] plans).

METHODS

Study Design

- This was a retrospective cohort study using claims data from the Optum® Research Database from January 2016 to February 2024. Patients aged ≥18 years with ≥2 fibrosing ILD diagnoses on different dates within 365 days from January 2017 to November 2023 were included.
- Patients with evidence of progression (PPF cohort) were identified using previously published claims-based progression proxy measures and were 1:1 propensity score matched to patients with fibrosing ILD who had not-yet-progressed based on covariates measured before fibrosing ILD diagnosis (pre-ILD baseline period).[1]
  - For the PPF cohort, the index date was defined as the first date with evidence of progression.
  - For the not-yet-progressed cohort, an index date was assigned based on the matched PPF patient's index date such that the pre-index period was of the same length of time for matched patients.
- Continuous enrollment of ≥12 months before the fibrosing ILD diagnosis date and ≥3 months after the index date was required for both cohorts.
  - Patients were followed until the earliest of health plan disenrollment, death, or end of study period (follow-up period).

Figure 1. Study schematic



Abbreviation: ILD, interstitial lung disease; PPF, progressive pulmonary fibrosis
Notes: *The not-yet-progressed cohort was matched to the PPF cohort based on the propensity score (calculated using the covariates during the pre-ILD baseline).
†Patients were required to have a 2nd fibrosing interstitial lung disease (F-ILD) diagnosis within the 365 days after the fibrosing ILD date and before the end of Feb 2024.
‡Matched index date was based on the length between F-ILD date and the index date (i.e., pre-index period) of the PPF cohort.
§Censoring events included death, disenrollment, and end of the study period for both cohorts. For the not-yet-progressed cohort, evidence of progression was also a censoring event.

Study Outcomes

- Post-match all-cause HCRU and costs (plan-paid + patient-paid amounts), reported as observation time weighted per-person-per-month (wPPPM); and all-cause hospitalization (counts and time-to-first).

Analyses

- HCRU and costs were compared between PPF vs. not-yet-progressed cohorts within insurance type (i.e., commercial and MAPD).
- For descriptive analyses, appropriate tests comparing the cohorts were used based on the distribution of the measure (i.e., standardized mean differences comparing cohorts, Z-test using robust standard errors in an ordinary least squares regression for continuous measures, and Rao-Scott chi-square test for categorical measures).
- Multivariate analyses were conducted to compare the risk of all-cause hospitalizations and total healthcare costs, adjusting for residual confounding effect between the cohorts following matching.
  - Generalized linear model with gamma distribution was used to compare all-cause healthcare costs.
  - Cox proportional hazards regression model was used to compare the risk of all-cause hospitalizations.

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RESULTS

Table 1. Baseline demographic and clinical characteristics

	Commercial			MAPD		
	PPF (N=9,488)	Not-yet-progressed (N=9,488)	SMD (%)	PPF (N=50,683)	Not-yet-progressed (N=50,683)	SMD (%)
Age, mean	57.7	59.4	-12.3	75.1	75.8	-8.3
Age group, n (%)						
18-39	846 (8.9)	703 (7.4)	5.5	95 (0.2)	72 (0.1)	1.1
40-49	1,308 (13.8)	1,241 (13.1)	2.1	375 (0.7)	369 (0.7)	0.1
50-59	2,884 (30.4)	2,791 (29.4)	2.1	1,953 (3.9)	1,643 (3.2)	3.3
60-69	3,062 (32.3)	2,946 (31.1)	2.6	9,915 (19.6)	8,906 (17.6)	5.1
70-79	776 (8.2)	880 (9.3)	-3.9	21,933 (43.3)	21,346 (42.1)	2.3
80+	612 (6.5)	927 (9.8)	-12.2	16,412 (32.4)	18,347 (36.2)	-8.1
Gender, n (%)						
Male	4,832 (50.9)	4,901 (51.7)	-1.5	23,857 (47.1)	24,817 (49.0)	-3.8
Race*, n (%)						
African-American/Black	918 (9.7)	883 (9.3)	1.3	6,485 (12.8)	6,026 (11.9)	2.8
Asian	242 (2.6)	249 (2.6)	-0.5	970 (1.9)	1,143 (2.3)	-2.4
Hispanic	935 (9.9)	942 (9.9)	-0.3	5,695 (11.2)	8,398 (16.6)	-15.5
White	7,015 (73.9)	7,058 (74.4)	-1.0	34,985 (69.0)	32,772 (64.7)	9.3
Unknown	211 (2.2)	186 (2.0)	1.8	2,544 (5.0)	2,342 (4.6)	0.3
No SES data	165 (1.7)	170 (1.8)	-0.4	2,544 (5.0)	2,342 (4.6)	2.1
Baseline Quan-Charlson comorbidity score, mean (SD)	2.1 (2.4)	2.2 (2.4)	-4.5	2.9 (2.4)	2.8 (2.4)	3.8

Abbreviation: MAPD, Medicare Advantage prescription drug; PPF, progressive pulmonary fibrosis; SMD, standardized mean difference; SES, socioeconomic status
Notes: Demographic characteristics assessed as of the fibrosing interstitial lung disease (ILD) diagnosis date or as of the health plan record nearest the fibrosing ILD diagnosis date. Quan-Charlson comorbidity score assessed during the 12-month ILD baseline period.
SMD of less than 10% were considered adequate balance between the cohorts.
*Patients with multiple race categories were omitted from the table due to small N sizes.

Sample Selection

- 60,171 patients of PPF cohort were matched with 60,171 not-yet-progressed patients (commercial: 9,488 pairs; MAPD: 50,683 pairs).

Patient Demographic and Clinical Characteristics

- Baseline patient characteristics were well-balanced between PPF and not-yet-progressed cohorts within both insurance types.
- The mean age was 57.7 years for the commercial PPF cohort and 75.1 years for the MAPD PPF cohort (**Table 1**).
- The mean (SD) Quan-Charlson comorbidity score in the baseline was 2.1 (2.4) for the commercial PPF cohort and 2.9 (2.4) for the MAPD PPF cohort (**Table 1**).

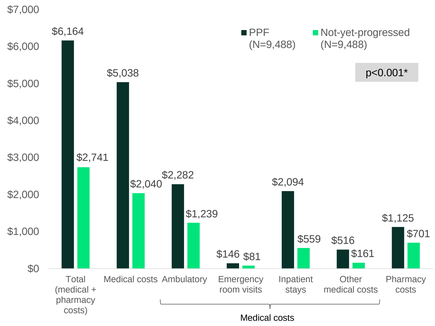
Healthcare Costs during Follow-up

- Patients with PPF had higher mean (SD) total all-cause wPPPM costs vs. not-yet-progressed patients across all cost categories (**Figures 2 and 3**).
- Total costs for patients with PPF were primarily driven by medical costs, with hospitalization constituting 42% and 50% of medical costs for commercial and MAPD patients, respectively.
- The mean total healthcare costs were numerically higher among commercial patients than MAPD patients.

Healthcare Resource Utilization during Follow-up

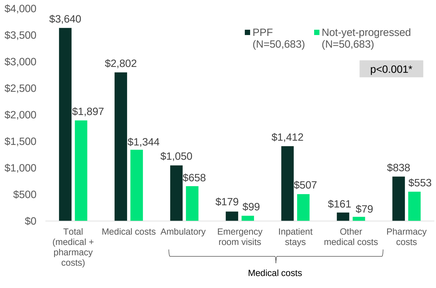
- Patients with PPF had higher HCRU across all categories vs. not-yet-progressed patients during follow-up in both insurance types (**Table 2**).
- The mean (SD) wPPPM number of hospitalizations was >2 times higher among patients with PPF vs. those who had not-yet-progressed patients.

Figure 2. All-cause healthcare costs during follow-up period among commercial insurance enrolled patients, wPPPM (US $)



Abbreviation: wPPPM, weighted per-person-per-month; PPF, progressive pulmonary fibrosis
Notes: Costs were adjusted using the annual medical care component of the Consumer Price Index (CPI) to reflect inflation to year 2023. Medical costs include ambulatory, emergency, hospitalization, and other costs.
*All cohort differences were significant at p<0.001.

Figure 3. All-cause healthcare costs during follow-up period among MAPD beneficiaries, wPPPM (US $)



Abbreviation: MAPD, Medicare Advantage prescription drug; wPPPM, weighted per-person-per-month; PPF, progressive pulmonary fibrosis
Notes: Costs were adjusted using the annual medical care component of the Consumer Price Index (CPI) to reflect inflation to year 2023. Medical costs include ambulatory, emergency, hospitalization, and other costs.
*All cohort differences were significant at p<0.001.

Multivariable-adjusted Healthcare Costs and Hospitalizations

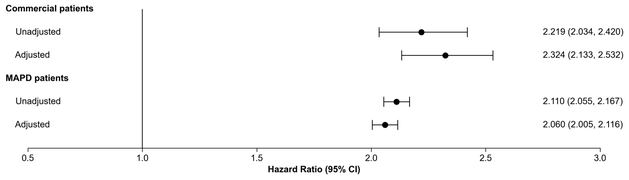
- The risk of all-cause hospitalizations was >2 times higher among patients with PPF vs. those who had not-yet-progressed in both insurance types (**Figure 4**).
- All-cause total healthcare costs were 1.9 to 2.1 times higher among patients with PPF vs. those who had not-yet-progressed across both insurance types (**Figure 5**).

Table 2. All-cause wPPPM HCRU counts, mean (SD)

	Commercial			MAPD		
	PPF (N=9,488)	Not-yet-progressed (N=9,488)	p-value	PPF (N=50,683)	Not-yet-progressed (N=50,683)	p-value
Ambulatory visits	2.77 (2.41)	1.97 (1.96)	<0.001	3.84 (3.25)	2.86 (2.94)	<0.001
Office visits	1.53 (1.35)	1.21 (1.17)	<0.001	1.64 (1.30)	1.45 (1.24)	<0.001
Outpatient visits	1.25 (1.78)	0.76 (1.31)	<0.001	2.20 (2.92)	1.42 (2.62)	<0.001
Emergency room visits	0.11 (0.21)	0.06 (0.23)	<0.001	0.22 (0.45)	0.12 (0.37)	<0.001
Inpatient stays	0.05 (0.10)	0.02 (0.07)	<0.001	0.07 (0.11)	0.03 (0.07)	<0.001
Length of stay, days	0.51 (1.64)	0.19 (1.70)	<0.001	0.85 (1.81)	0.35 (1.22)	<0.001
Pharmacy fills	3.81 (3.10)	3.02 (2.72)	<0.001	4.50 (3.32)	3.66 (3.15)	<0.001

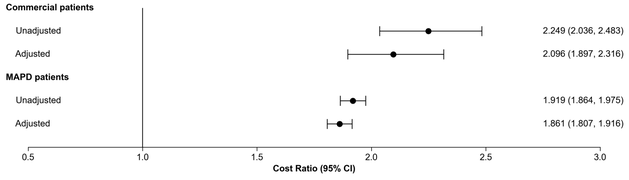
Abbreviation: wPPPM, weighted per-person-per-month; HCRU, healthcare resource utilization; MAPD, Medicare Advantage prescription drug; PPF, progressive pulmonary fibrosis

Figure 4. Risk of all-cause hospitalizations, PPF cohort vs. not-yet-progressed cohort



Abbreviation: PPF, progressive pulmonary fibrosis; MAPD, Medicare Advantage prescription drug
Notes: Excludes first inpatient stay for patients who progressed due to respiratory hospitalization.

Figure 5. Cost ratios of follow-up all-cause wPPPM total healthcare costs, PPF cohort vs. not-yet-progressed cohort



Abbreviation: wPPPM, weighted per-person-per-month; PPF, progressive pulmonary fibrosis; MAPD, Medicare Advantage prescription drug
Notes: The reference group for each insurance type model was the not-yet-progressed matched group. For adjusted models, the covariates included those with a residual imbalance between the PPF and not-yet-progressed patients following propensity score matching: commercial (age groups) and MAPD (race, fibrosing ILD diagnosis year, and count of unique medications filled).

LIMITATIONS

- Claims-based proxy measures used to classify patients by disease progression lack clinical validation, thus misclassification is possible.

CONCLUSION

- Patients with PPF had substantially higher HCRU and cost burden relative to not-yet-progressed patients in both payer types.
- Commercially-insured patients incurred nominally higher total healthcare costs compared to those with Medicare Advantage prescription drug plans, despite lower HCRU counts.

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REFERENCES

1. Singer D et al. *Ann Am Thorac Soc.* 2022 Jul;19(7):1112-1121. doi: 10.1513/AnnalsATS.202102-222OC.

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