Healthcare resource utilization, costs, and outcomes among patients with extensive-stage small cell lung cancer in the United States: A retrospective, real-world analysis of administrative claims data

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OBJECTIVES

- To assess healthcare resource utilization (HCRU), costs, treatment patterns, and outcomes among a real-world population of patients with extensive-stage small cell lung cancer (ES-SCLC) in the US, using administrative claims data

CONCLUSIONS

- This real-world, retrospective study highlighted the substantial financial burden throughout the treatment journey for patients with ES-SCLC
- Survival was poor, particularly for patients initiating third-line (3L) therapy, among whom median real-world overall survival (OS) was only 4.0 months
- The treatment patterns analysis demonstrated that there is no clear standard of care beyond first-line (1L)
- The results of this study demonstrate the urgent need for more effective treatments for patients with ES-SCLC, particularly for those with relapsed disease after 1L

INTRODUCTION

- Standard-of-care 1L therapy for ES-SCLC includes PBC with or without a PD-L1 inhibitor; patients initially respond well to treatment, but most relapse within 6 months and are often resistant to subsequent PBC[1,2]
- Treatment options for ES-SCLC in 2L are limited and traditionally include the chemotherapeutic agents topotecan and lurbinectedin[2,3]
- The majority of patients with SCLC are aged ≥65 years at diagnosis and many have multiple comorbidities[4,5]; as such, these patients are particularly susceptible to complications associated with chemotherapy, which bears a significant economic burden[6–8]
- Despite recent improvements in treatment options for patients with ES-SCLC, there remains an urgent need for more effective therapies with tolerable safety profiles; understanding the economic burden of the disease and real-world treatment patterns may help guide the development of novel therapies for patients with ES-SCLC
- We performed an observational, retrospective, real-world study using administrative claims data to analyze HCRU, costs, treatment patterns, and outcomes among patients with ES-SCLC in the US

METHODS

- This study leveraged data from two nationally representative administrative claims databases: 100% Medicare Fee-For-Service and the Inovalon MORE² Registry®
- Patients were included if, during the study period (January 1, 2018 through December 31, 2022 [Medicare] or July 31, 2023 [MORE²]), they met the following criteria, which were used as proxies to identify patients with putative ES-SCLC since there is no ICD-10-CM code specifically for ES-SCLC:
  - ≥1 inpatient claim with a primary diagnosis of lung cancer (ICD-10-CM C34.xx) or ≥2 non-diagnostic outpatient claims (30–365 days apart) with a lung cancer diagnosis at any time; the earliest evidence of lung cancer was set as the diagnostic index date
  - ≥1 inpatient claim with a primary diagnosis of a secondary cancer (ICD-10-CM C77.xx, C78.xx, or C79.xx) or ≥2 non-diagnostic outpatient claims with a secondary cancer diagnosis at any time (to indicate metastatic disease); the earliest evidence of metastatic disease was set as the metastatic index date
  - Treatment indicative of ES-SCLC (any 1L, 2L, or 3L regimen containing carboplatin or cisplatin in combination with etoposide or irinotecan, or lurbinectedin); the start of a LOT indicative of treatment for ES-SCLC was set as the treatment index date for each LOT
  - To further minimize the inclusion of patients with NSCLC, patients with EGFR TKI use in 1L, 2L, or 3L were excluded
- Patients must have been continuously enrolled with both medical and pharmacy benefits for ≥6 months prior to the index treatment date and ≥30 days after the index treatment date
- Patients were considered to have started a new LOT if they had ≥1 claim for a new ES-SCLC–indicative therapy which was not a component of the current LOT >28 days after initiating current LOT
  - In the case of a gap of ≥60 days prior to a subsequent claim for a LOT with the same components, patients were considered to have started a new LOT
- All eligible patients were included in the LOT1 cohort; patients who received ≥1, ≥2, and ≥3 subsequent LOTs after 1L were also included in the LOT2, LOT3, and LOT4 cohorts, respectively
- The primary objective was to assess HCRU and costs (summarized descriptively) during each LOT (1L–4L) among all patients with ES-SCLC
  - ES-SCLC–related HCRU and costs were identified based on inpatient admissions with a diagnosis code for lung cancer in the primary position on the claim, outpatient medical claims with a diagnosis for lung cancer in any position, and outpatient pharmacy claims for all treatments indicated for ES-SCLC
- Secondary objectives were to assess treatment patterns across LOT1–4 in all patients and survival from initiation of each LOT (using Kaplan–Meier methodology) among Medicare beneficiaries

RESULTS

- A total of 2532 patients with ES-SCLC who received ≥1 LOT were identified, among whom 1049 (41.4%), 308 (12.2%), and 78 (3.1%) also received 2L, 3L, and 4L therapy, respectively, within the study period
  - The dataset comprised 1605 Medicare beneficiaries (63.4%) and 927 patients with records in Inovalon MORE² (36.6%)
- At 1L treatment index, the median age was 69.0 years, nearly 70% of patients were from the Midwest and South, and the majority were White (73.7%; **Table 1**)
- Comorbidities were common, and >70% of patients had COPD

Table 1. Patient characteristics at 1L treatment index

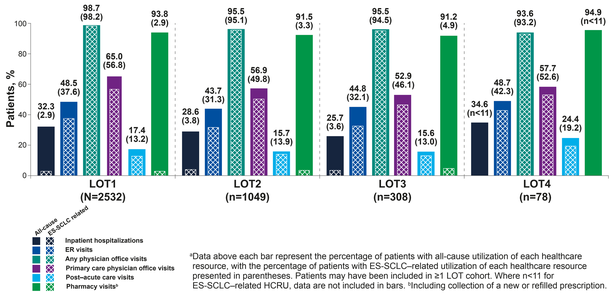
	All patients (N=2532)
Age, years	
Median (Q1, Q3)	69.0 (63.0–74.0)
<65, n (%)	790 (31.2)
65–74, n (%)	1161 (45.9)
≥75, n (%)	581 (22.9)
Sex, n (%)	
Male	1170 (46.2)
Female	1362 (53.8)
Race or ethnicity, n (%)	
Asian	37 (1.5)
Black	166 (6.6)
Hispanic or Latino	28 (1.1)
White	1865 (73.7)
Unknown	436 (17.2)
Geographic region, n (%)	
Northeast	445 (17.6)
Midwest	802 (31.7)
South	936 (37.0)
West	319 (12.6)
Unknown	30 (1.2)
Follow-up time from 1L treatment index, median (Q1, Q3), months	7.9 (4.6, 13.7)
Select comorbidities, n (%)	
COPD	1816 (71.7)
Cardiovascular disease	1315 (51.9)
Anxiety	708 (28.0)
Diabetes	681 (26.9)
Tobacco dependence,[a] n (%)	1524 (60.2)
Time from diagnostic index to metastatic index, median (Q1, Q3), days	13.0 (1.0, 42.0)

[a]Tobacco dependence was determined by ICD-10-CM diagnosis code for billing purposes and is generally underreported in insurance claims.[9]

HCRU

- Across LOTs, the most frequently utilized healthcare resources for any reasons (ie, all-cause, including those related to ES-SCLC) were physician office visits (used by 93.6–98.7% of patients), pharmacy visits (91.2–94.9%), and ER visits (43.7–48.7%; **Figure 1**)
  - In each LOT, the majority of physician office and ER visits were ES-SCLC related
- All-cause and ES-SCLC–related PPPM HCRU generally increased proportionally by LOT (**Table 2**)
  - All-cause ER visits increased sequentially across LOTs, rising to >1 visit per patient every 2 months on average by LOT3
  - On average, patients spent >4 days in the hospital per stay for ES-SCLC–related causes in LOT2 and LOT3, and ~2 days per stay for patients in LOT1 and LOT4
  - While post–acute care visits did not contribute greatly to overall HCRU, most were related to ES-SCLC
  - The proportion of utilization of each healthcare resource category within each LOT remained broadly consistent across LOTs for both all-cause and ES-SCLC–related HCRU
  - While all-cause PPPM HCRU was largely driven by ES-SCLC–related factors for most HCRU categories, hospitalizations and pharmacy visits were mostly utlized for reasons not related to ES-SCLC

Figure 1. Percentage of patients with all-cause and ES-SCLC–related use of each HCRU category by LOT[a]



[a]Data above each bar represent the percentage of patients with all-cause utilization of each healthcare resource, with the percentage of patients with ES-SCLC–related utilization of each healthcare resource presented in parentheses. Patients may have been included in ≥1 LOT cohort. Where n<11 for ES-SCLC–related HCRU, data are not included in bars. [b]Including collection of a new or refilled prescription.

Table 2. HCRU per patient per month[a]

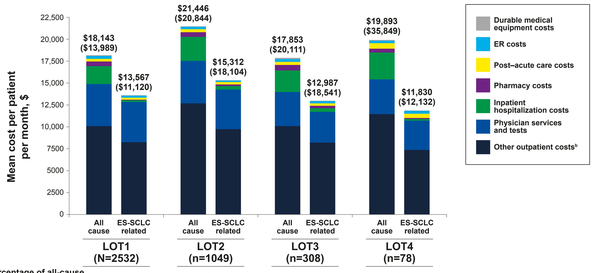
Mean HCRU PPPM	LOT1 (N=2532) All-cause	LOT1 (N=2532) ES-SCLC related	LOT2 (n=1049) All-cause	LOT2 (n=1049) ES-SCLC related	LOT3 (n=308) All-cause	LOT3 (n=308) ES-SCLC related	LOT4 (n=78) All-cause	LOT4 (n=78) ES-SCLC related
Hospitalizations	0.15	0.01	0.20	0.03	0.20	0.03	0.30	0.02
Duration of hospital stay, days	0.69	2.29	0.94	4.36	1.04	4.01	1.39	1.76
ER visits	0.38	0.23	0.46	0.27	0.52	0.33	0.63	0.44
Any physician office visits	2.68	2.26	2.58	2.17	2.69	2.32	2.73	2.32
Primary care physician office visits	0.66	0.56	0.62	0.52	0.72	0.64	0.72	0.61
Post–acute care visits	0.09	0.07	0.13	0.12	0.13	0.11	0.19	0.16
Pharmacy visits[b]	3.42	0.02	3.56	0.03	3.77	0.03	4.30	0.04

[a]Patients may have been included in ≥1 LOT cohort. [b]Including collection of a new or refilled prescription.

Costs

- The mean (±SD) total all-cause PPPM costs were $18,143 ($13,989) for LOT1, $21,446 ($20,844) for LOT2, $17,853 ($20,111) for LOT3, and $19,893 ($35,849) for LOT4 (**Figure 2**)
- The mean (±SD) total ES-SCLC–related PPPM costs were $13,567 ($11,120) for LOT1, $15,312 ($18,104) for LOT2, $12,987 ($18,541) for LOT3, and $11,830 ($12,132) for LOT4
- ES-SCLC–related costs accounted for 74.8% of all-cause costs in LOT1, 71.4% in LOT2, 72.7% in LOT3, and 59.5% in LOT4
- The main driver of all-cause and ES-SCLC–related costs was other outpatient costs, which accounted for 55.6–59.2% and 60.8–63.6%, respectively, across LOT1–4

Figure 2. Mean all-cause and ES-SCLC–related PPPM costs by LOT[a]



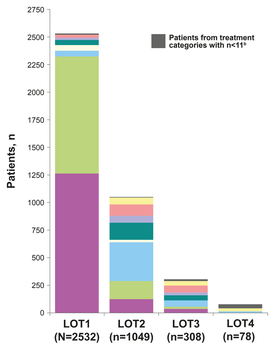
Percentage of all-cause HCRU related to ES-SCLC	LOT1 (N=2532)	LOT2 (n=1049)	LOT3 (n=308)	LOT4 (n=78)
	74.8	71.4	72.7	59.5

[a]Mean total PPPM cost (±SD) in each LOT is presented above each bar. Patients may have been included in ≥1 LOT cohort. [b]Includes costs such as administration of chemotherapy or other in-office–administered treatments, laboratory services, and radiology services (but not costs considered as physician services and tests, ER costs, or post–acute care costs).

Treatment patterns

- In LOT1, the majority of patients received PBC (94%), mostly in combination with either a topoisomerase inhibitor only (50%) or with a topoisomerase inhibitor and an anti–PD-(L)1 agent (42%; **Figure 3**)
- Beyond LOT1, there was no clear standard of care; the most common treatments were:
  - LOT2: Anti–PD-(L)1 monotherapy (34%); PBC + anti–PD-(L)1 + topoisomerase inhibitor (15%)
  - LOT3: Topoisomerase inhibitors administered as monotherapy (21%); anti–PD-(L)1 monotherapy (19%)
  - LOT4: Other chemotherapy regimens that did not meet criteria for inclusion in other categories (32%); anti–PD-(L)1 monotherapy (22%)

Figure 3. Treatment categories by LOT[a]



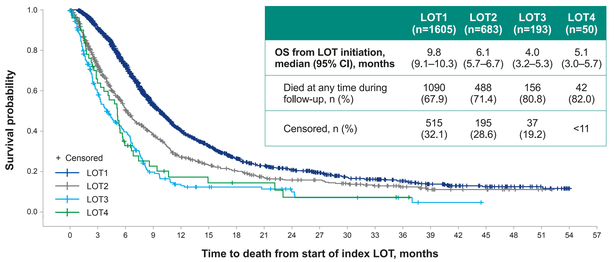
Treatment category, n (%)[b]	LOT1 (N=2532)	LOT2 (n=1049)	LOT3 (n=308)	LOT4 (n=78)
PBC + topoisomerase inhibitor	1266 (50)	127 (12)	34 (11)	*
PBC + anti–PD-(L)1 + topoisomerase inhibitor	1060 (42)	162 (15)	21 (9)	*
Anti–PD-(L)1 monotherapy	52 (2)	355 (34)	59 (19)	17 (22)
PBC "other"[c]	49 (2)	**	*	*
Any lurbinectedin-containing regimen	46 (2)	154 (15)	46 (15)	*
Anti–PD-(L)1 "other"	24 (1)	64 (6)	26 (8)	*
Topoisomerase inhibitor monotherapy	24 (1)	102 (10)	63 (21)	*
Chemotherapy "other"[d]	*	61 (6)	41 (13)	25 (32)
Other	*	*	*	*

*n<11, **n<20.
[a]Patients may have been included in ≥1 LOT cohort. [b]For categories where n<11 in a LOT and where numbers could be back-calculated from data in other rows in the same column, exact numbers and percentages are not provided to align with Centers for Medicare and Medicaid Services reporting requirements. [c]Cisplatin or carboplatin monotherapy, or other PBC regimens that would not meet the criteria for inclusion in other treatment categories. [d]Any chemotherapy regimen that does not include a platinum-based agent, with the exception of: 1) topoisomerase inhibitors administered as monotherapy or in combination with other topoisomerase inhibitors only; 2) any regimen that also contains an anti–PD-(L)1 agent; 3) any regimen that also contains other targeted therapy; and 4) any regimen that also contains lurbinectedin.

Outcomes

- The median OS from LOT1 initiation among 1605 Medicare beneficiaries was 9.8 months (95% CI, 9.1–10.3; **Figure 4**)
- Shorter median OS was observed from initiation of LOT2 (6.1 months [95% CI, 5.7–6.7]) and LOT3 (4.0 months [95% CI, 3.2–5.3])
- Among the 50 patients who received LOT4 (3.1% of those who received LOT1), median OS from treatment initiation was 5.1 months (95% CI, 3.0–5.7)

Figure 4. Survival from initiation of LOT1, LOT2, LOT3, and LOT4 among Medicare beneficiaries (n=1605)[a]



	LOT1 (n=1605)	LOT2 (n=683)	LOT3 (n=193)	LOT4 (n=50)
OS from LOT initiation, median (95% CI), months	9.8 (9.1–10.3)	6.1 (5.7–6.7)	4.0 (3.2–5.3)	5.1 (3.0–5.7)
Died at any time during follow-up, n (%)	1090 (67.9)	488 (71.4)	156 (80.8)	42 (82.0)
Censored, n (%)	515 (32.1)	195 (28.6)	37 (19.2)	<11

[a]Patients may have been included in ≥1 LOT cohort.

DISCUSSION

- HCRU generally increased across LOTs; the main drivers of all-cause HCRU across LOTs were physician office visits (the majority of which were related to ES-SCLC) and pharmacy visits
- Mean all-cause PPPM costs ranged from $17,853 in LOT3 to $21,446 in LOT2, mostly driven by outpatient costs, including laboratory services, radiology services, and administration of chemotherapy or in-office–administered treatments not considered to be physician services
- ES-SCLC–related costs accounted for 71.4–74.8% of total costs in LOT1–3 and 59.5% in LOT4; of note, the duration of ES-SCLC–related hospital stays for patients receiving 4L treatment was shorter than in earlier LOTs
- Median OS from initiation of LOT1 was 9.8 months, and only 12% of patients went on to start LOT3, from which median OS was 4.0 months
- This study was subject to limitations typically associated with administrative claims-based datasets, including misclassification due to miscoding, misdiagnosis, or underreporting, which may have resulted in the misestimation of median OS data and underestimation of comorbidities
- Furthermore, the high prevalence of comorbidities in patients with ES-SCLC may prevent accurate attribution of HCRU and costs to either all-cause or ES-SCLC–related reasons
- The use of proxy criteria to identify patients with ES-SCLC may have resulted in the inclusion of patients with other types of lung cancer and the exclusion of patients with *EGFR*-mutated transformed SCLC with prior EGFR TKI use
- The low numbers of patients receiving treatment in LOT3 and LOT4, as well as the observed shorter duration of treatment as patients progressed through each LOT, may impact the ability to make accurate conclusions about any perceived differences in HCRU and costs across LOTs
- It was not possible to capture data for tarlatamab use since tarlatamab received accelerated approval in the US in May 2024,[10] which was after the end of the study period

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ABBREVIATIONS

1L, first-line; **2L**, second-line; **3L**, third-line; **4L**, fourth-line; **CI**, confidence interval; **COPD**, chronic obstructive pulmonary disease; **EGFR**, epidermal growth factor receptor; **ER**, emergency room; **(ES-)SCLC**, (extensive-stage) small cell lung cancer; **HCRU**, healthcare resource utilization; **ICD-10-CM**, International Classification of Diseases, Tenth Revision, Clinical Modification; **LOT**, line of therapy; **NSCLC**, non-small cell lung cancer; **OS**, overall survival; **PBC**, platinum-based chemotherapy; **PD-(L)1**, programmed death (ligand) 1; **PPPM**, per patient per month; **Q**, quartile; **SD**, standard deviation; **TKI**, tyrosine kinase inhibitor; **US**, United States.

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DISCLOSURES

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