Economic Burden for Adults With Sickle Cell Disease and Matched Controls in the United States: Retrospective Analysis of a Commercial Insurance Database

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Background

- SCD is a lifelong inherited blood disorder, with long-term complications including multisystem organ damage.[1,2]
- Complications not only reduce quality of life but are also associated with increased HCRU.[3]

Objective

- This analysis evaluates HCRU and costs associated with SCD for US adults with commercial insurance coverage.
  - Adults with SCD were compared with matched controls without SCD.

Methods

- Cohorts were retrospectively identified from the IBM® MarketScan® Commercial Database.
  - This database captures real-world treatment patterns and costs by logging claims received by various US health plans.
  - Records from January 1, 2016, to December 31, 2020 were included in this analysis.
- Eligible patients with SCD were aged ≥18 years and had ≥3 SCD diagnosis codes recorded during the index-identification period (July 1, 2016, to December 31, 2019).
  - ICD-10 diagnosis codes could be inpatient or outpatient (D57.0–D57.219 or D57.4–D57.819); the first code recorded during the index-identification period was the index date.
  - Enrollment for ≥6 months pre-index and ≥12 months post-index was also required.
  - Patients with a bone marrow transplant before the index date were excluded.
- Controls were exact-matched 1:1 to adults with SCD for age, gender, and US geographic region.
  - For controls, an index date was randomly selected within the index-identification period.

ANALYSES

- Procedures and SCD-related complications were identified by ICD-10 codes, and SCD treatments were identified from a prespecified list.
- HCRU categories assessed were hospitalizations, outpatient medical claims, and prescription drug claims (pharmacy usage).
  - Outpatient claims included office visits, laboratory and diagnostic tests, biopsies, imaging, urgent care, and ER visits.
  - The subcategories, 'office visits' and 'ER visits' were also reported separately.
- All claims were included regardless of relationship to SCD.
- HCRU and costs in the 12 months post-index were determined, and PPPY HCRU and annual costs were calculated.
- Costs were inflated to 2020 US dollars using the Consumer Price Index medical care component.
- OOP costs were calculated by subtracting health plan payments from total payments.
- Differences between groups were evaluated using ANOVA.

Results

PATIENTS

- The analysis included 2792 adults with SCD and 2792 matched controls (**Table 1**).
- Mean (SD) follow-up was 32.6 (13.8) months for the SCD cohort and 31.0 (13.5) months for controls.
- During the follow-up period, 25.6% of patients with SCD received hydroxyurea, 27.3% had ≥1 blood transfusion, and 77.9% received ≥1 prescription for an opioid pain medication.
- The most common complications during follow-up for patients versus controls were:
  - Acute complications: vaso-occlusive crisis (68.5% vs 0.0%), dactylitis (64.5% vs 0.0%), and acute kidney injury (22.1% vs 3.9%).
  - Chronic complications: retinopathy (17.7% vs 0.7%), avascular necrosis (16.3% vs 0.1%), and chronic kidney disease (14.2% vs 3.1%).

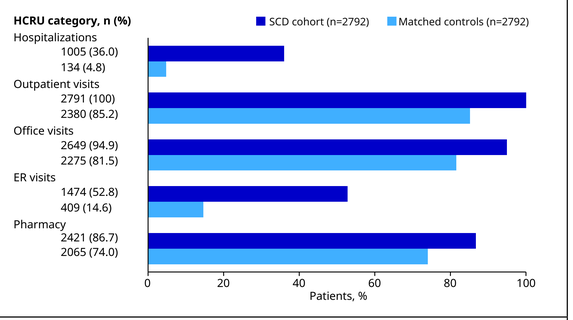
Table 1: Patient demographics and characteristics

	SCD cohort (n=2792)	Matched controls (n=2792)
Age, y		
Mean (SD)	38.0 (13.2)	38.0 (13.2)
Age group, n (%)		
18–30 y	968 (34.7)	968 (34.7)
31–44 y	872 (31.2)	872 (31.2)
45–54 y	564 (20.2)	564 (20.2)
55–64 y	388 (13.9)	388 (13.9)
Gender, n (%)		
Female	1722 (61.7)	1722 (61.7)
Male	1070 (38.3)	1070 (38.3)
US geographic region, n (%)		
North Central	344 (12.3)	344 (12.3)
Northeast	593 (21.2)	593 (21.2)
South	1703 (61.0)	1703 (61.0)
West	140 (5.0)	140 (5.0)
Missing/unknown	12 (0.4)	12 (0.4)
Type of health plan, n (%)		
Comprehensive	109 (3.9)	85 (3.0)
Exclusive provider organization	24 (0.9)	14 (0.5)
Health maintenance organization	496 (17.8)	301 (10.8)
Point of service	281 (10.1)	304 (10.9)
Preferred provider organization	1278 (45.8)	1399 (50.1)
Other	541 (19.4)	635 (22.7)
Missing/unknown	63 (2.3)	54 (1.9)

HEALTH CARE RESOURCE UTILIZATION

- In the 12 months post-index, patients with SCD had higher HCRU than controls for all resource categories (**Figure 1**; **Table 2**).
- For hospitalizations, the mean lengths of stay for the full cohorts were 4.3 days for the SCD cohort versus 0.2 days for matched controls (**Table 2**).
  - Even among subgroups with ≥1 hospitalization, the difference remained significant, with mean (SD) lengths of stay of 12.0 (18.1) versus 3.8 (4.0) days for the respective cohorts.
- For ER visits, the number of visits was significantly higher for patients with SCD (**Table 2**).
  - Among those who had ≥1 ER visit, the mean (SD) number of visits was 3.2 (5.0) for the SCD cohort versus 1.5 (1.4) for controls.

Figure 1: Patients with ≥1 utilization of each health care resource



All comparisons *P*<0.0001 for SCD cohort vs matched controls.
Office and ER visits are subcategories of outpatient visits, which also included laboratory and diagnostic tests, biopsies, imaging, and urgent care.

Table 2: Average annual health care resource utilization

	HCRU PPPY, mean (SD)		Difference	
	SCD cohort (n=2792)	Matched controls (n=2792)	Fold	*P* value
Hospitalizations	0.8 (1.8)	0.1 (0.3)	8×	<0.0001
Length of stay, days	4.3 (12.3)	0.2 (1.2)	21.5×	<0.0001
Outpatient visits	21.1 (25.1)	8.8 (14.4)	2.5×	<0.0001
Office visits	10.7 (10.8)	6.7 (9.5)	1.5×	<0.0001
ER visits	1.7 (4.0)	0.2 (0.8)	8.5×	<0.0001
Pharmacy	20.3 (23.0)	11.5 (19.1)	2×	<0.0001

Office and ER visits are subcategories of outpatient visits, which also included laboratory and diagnostic tests, biopsies, imaging, and urgent care.

COSTS

- Compared with controls, the SCD cohort incurred higher costs overall and in all HCRU categories (**Table 3**).
  - The difference in overall costs was primarily driven by hospitalization costs (which were ~16-fold those of controls) and ER visit costs (which were ~8-fold those of controls).
  - The SCD cohort also incurred higher OOP costs versus controls (**Table 4**).

Table 3: Average annual total costs

	Total costs, PPPY, US$		Difference	
	SCD cohort (n=2792)	Matched controls (n=2792)	Fold	*P* value
Overall costs	41,205 (72,885)	6,650 (19,011)	6×	<0.0001
Hospitalizations	19,071 (48,376)	1,153 (6,847)	16.5×	<0.0001
Outpatient visits	17,327 (35,582)	3,786 (12,151)	4.5×	<0.0001
Office visits	2,358 (4,878)	1,387 (6,891)	1.5×	<0.0001
ER visits	2,362 (6,447)	299 (1,313)	8×	<0.0001
Pharmacy	4,807 (19,178)	1,711 (8,412)	3×	<0.0001

All values are mean (SD).
Office and ER visits are subcategories of outpatient visits, which also included laboratory and diagnostic tests, biopsies, imaging, and urgent care.

Table 4: Average OOP costs

	OOP costs, PPPY, US$		Difference	
	SCD cohort (n=2792)	Matched controls (n=2792)	Fold	*P* value
Overall	2,496 (2,832)	971 (1,574)	2.5×	<0.0001
Hospitalizations	643 (1,446)	78 (496)	8×	<0.0001
Outpatient visits	1,614 (2,220)	703 (1,224)	2.5×	<0.0001
Office visits	392 (544)	329 (585)	1×	<0.0001
ER visits	303 (723)	67 (299)	4.5×	<0.0001
Pharmacy	240 (460)	190 (608)	1.5×	<0.001

All values are mean (SD).
Office and ER visits are subcategories of outpatient visits, which also included laboratory and diagnostic tests, biopsies, imaging, and urgent care.

Limitations

- All retrospective analyses of claims data have limitations, such as potential lack of standardization across settings.
  - Furthermore, in this analysis, health care during 2020 may have been underutilized by patients with SCD and controls due to the COVID-19 pandemic.
  - In addition to these general limitations, this study excluded adults without commercial insurance, who may have a higher disease burden.

Conclusions

- This analysis highlights the substantial economic burden of SCD for adults living in the US who have commercial insurance coverage.
  - Adults with SCD had substantially increased HCRU compared with matched controls.
  - Across all HCRU categories, costs for payers and OOP costs were higher.
  - Overall costs for the SCD cohort were 6-fold those of matched controls.
- Treatments that reduce the need for HCRU have the potential to significantly reduce the economic burden of SCD.
  - For adults in the US, therapies that reduce the need for hospitalization may have the greatest impact.

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References: **1.** GBD 2021 Sickle Cell Disease Collaborators. Lancet Haematol 2023;10:e585–99. **2.** Vichinsky E. Hematology Am Soc Hematol Educ Program 2017;2017:435–9. **3.** Shah N, et al. PLoS One 2019;14:e0214355.

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Abbreviations: ANOVA=analysis of variance; ER=emergency room; HCRU=health care resource utilization; ICD-10=International Classification of Diseases, 10th edition; OOP=out of pocket; PPPY=per-patient per-year; SCD=sickle cell disease; US=United States

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