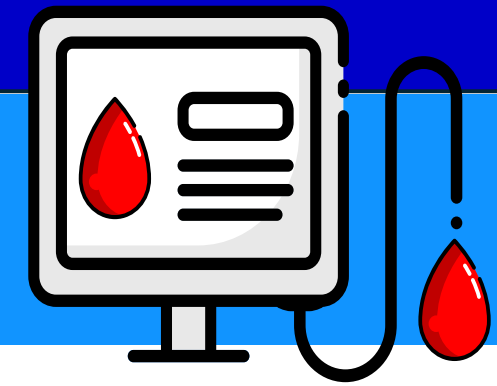


Estimated Cost of Automated Red Cell Exchange Transfusion (ARCET) for Treatment of Sickle Cell Disease (SCD) in the English NHS: Data From a Longitudinal Real-World Cohort

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Aim: To estimate the annual costs of ARCET in England amongst patients with SCD receiving regular transfusion therapy (RTT).



Background

- Blood transfusions are a cornerstone of treatment for SCD¹; they can reduce the proportion of sickle-shaped cells,² improve blood oxygenation,² and prevent complications like stroke,³ which can involve long-term sequelae.⁴
- In England, ARCET is the generally recommended method for SCD-related RTT.⁵ ARCET is preferred over other methods for RTT because it lowers the level of sickle cells rapidly and avoids iron overload.^{1,6}
- The full costs of ARCET to the English National Health Service (NHS) are difficult to estimate and have not been adequately quantified.⁷ Until fiscal year 2019/20, NHS reimbursement codes did not differentiate ARCET from simple transfusion.^{8,9}
- Accurate cost estimates for ARCET are needed⁷ to estimate true healthcare costs for SCD so that decision-makers can make informed decisions on resource allocation.

Methods

- We conducted a retrospective cohort study of patients with SCD in England who received RTT between 01-Apr-2007 and 31-Mar-2019.
- We used primary care electronic health record (Clinical Practice Research Datalink Aurum)¹⁰ and hospital reimbursement (Hospital Episode Statistics)¹¹ datasets to select a cohort of patients with SCD and identify patients receiving RTT (Figure 1).
- We estimated costs for ARCET across the RTT cohort, applying several assumptions (Box 1) and NHS-reported costs per unit (Table 1).
- Estimated ARCET procedure costs included the per-session cost of ARCET and a one-time cost for port insertion (when applicable; Box 1). Procedure costs excluded costs of machine purchase, machine maintenance, and blood products.
- No discounting was applied, and no future costs were projected.
- Annual costs for blood products were estimated separately, applying NHS-reported costs per unit of blood products (Box 1) and assuming use of 12.2 units of blood products per ARCET session.¹²

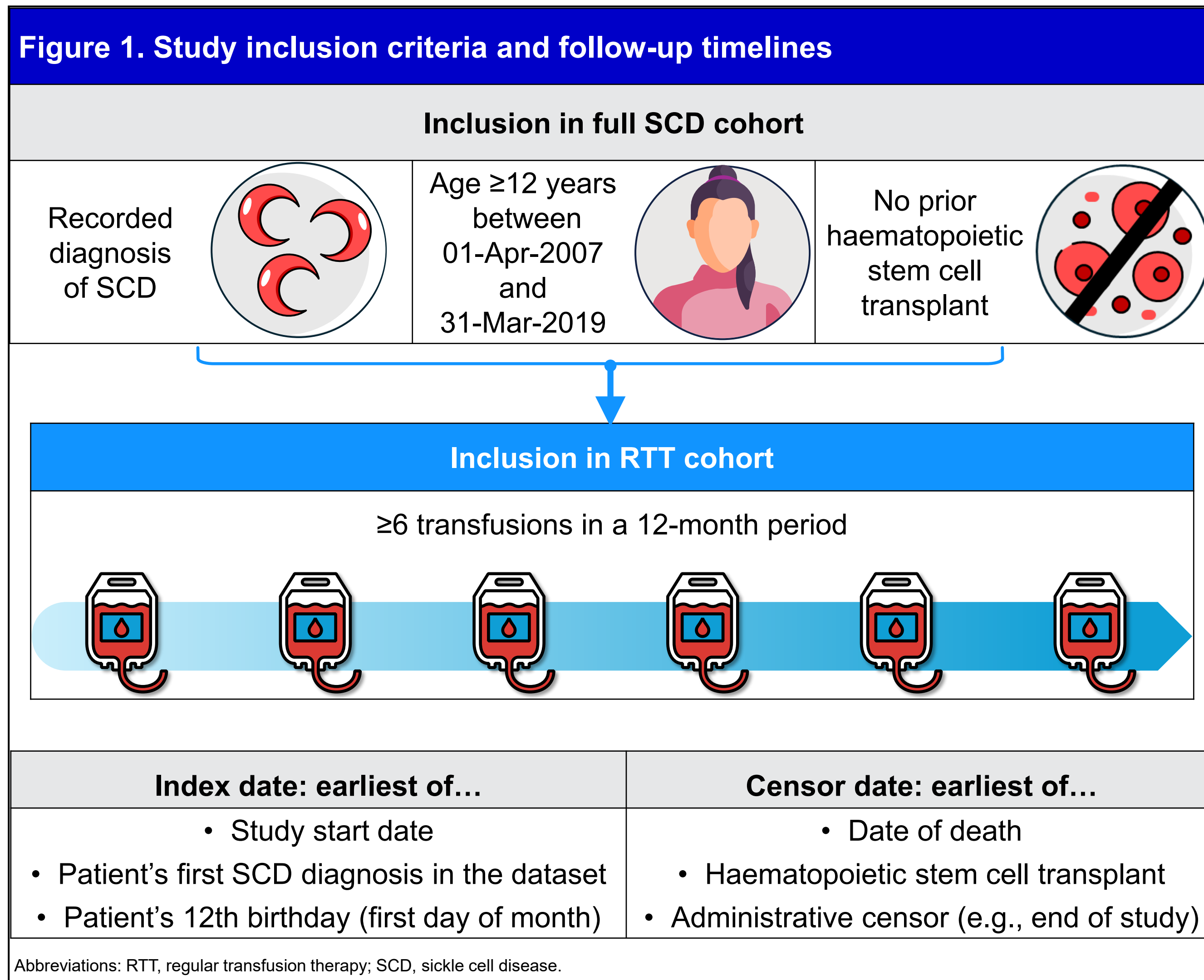


Table 1. Component costs used to estimate costs of ARCET		
Model input	Data source	Cost
Cost per session for providing ARCET	National Schedule of NHS Costs 2020/21, ¹³ HRG SA41Z	£1,568.39
Cost for insertion of subcutaneous port ^{a,b}		
For patients ≥19 years old	National Schedule of NHS Costs 2018/19, ⁸ HRG YR45A	£1,686.00
For patients <19 years old	National Schedule of NHS Costs 2018/19, ⁸ HRG YR45B	£2,915.00
Cost per unit of red cells for exchange transfusion ^{b,c}	NHS Blood and Transplant Pricing Proposals for 2018–19 ¹⁴	£200.64

Abbreviations: ARCET, automated red cell exchange transfusion; HRG, Healthcare Resource Group; NHS, National Health Service.
^a One-time cost applied if ARCET was first started during the study period. ^b Costs used were inflated to 2020/21 pounds using the NHS Cost Inflation Index.¹⁵
^c Not included for procedure cost estimates; added separately for estimates of procedure costs + costs of blood products

Box 1. Necessary assumptions for estimating costs of ARCET

- All patients who received RTT were eligible for ARCET.
- All RTT patients started ARCET once they were identified as receiving RTT (i.e., on the date of their sixth transfusion fulfilling the RTT criteria).
- Once ARCET was started, it continued once every 6 weeks^{8,16,17} until the patient was censored.
- Patients who first started ARCET during the study period received a dual lumen port.
- Patients who started RTT prior to the study start date had appropriate venous access in place and did not incur any costs for port insertion.
- Patients received no other transfusion therapy whilst on ARCET.
- Reference costs from NHS source data excluded blood products.

Abbreviations: ARCET, automated red cell exchange transfusion; NHS, National Health Service; RTT, regular transfusion therapy.

Results

Patient population

- 7,662 patients were included in the full SCD cohort (Figure 2; Table 3).
- 5.1% (n=391) of patients received RTT (Table 3). These patients had a median follow-up time of 3.8 years (interquartile range [IQR]: 1.5–7.3 years).
- Patients receiving RTT had a median age of 24 years at baseline. About half (48.1%) were female, and most (80.8%) reported black ethnicity. Overall, demographic characteristics were similar between patients receiving RTT and those in the overall SCD cohort (Table 3).
- 32.7% of patients receiving RTT had ≥1 comorbidity (Charlson Comorbidity Index score ≥1),¹⁸ whereas only 1.4% of those in the full SCD cohort had ≥1 comorbidity (Table 3). This reflects worse predicted long-term mortality in the RTT cohort than in the full SCD cohort.¹⁸

Limitations

- Source data did not differentiate patients receiving ARCET from those receiving other types of red cell transfusions. As such, our estimations are sensitive to several assumptions, including that all RTT patients were eligible for ARCET and that ARCET would continue at a rate of once every 6 weeks without patient discontinuation.
- This analysis did not include the costs of complications related to ARCET. These costs should be considered separately if used in economic models.

Conclusions



Estimated use and costs of ARCET amongst patients receiving RTT

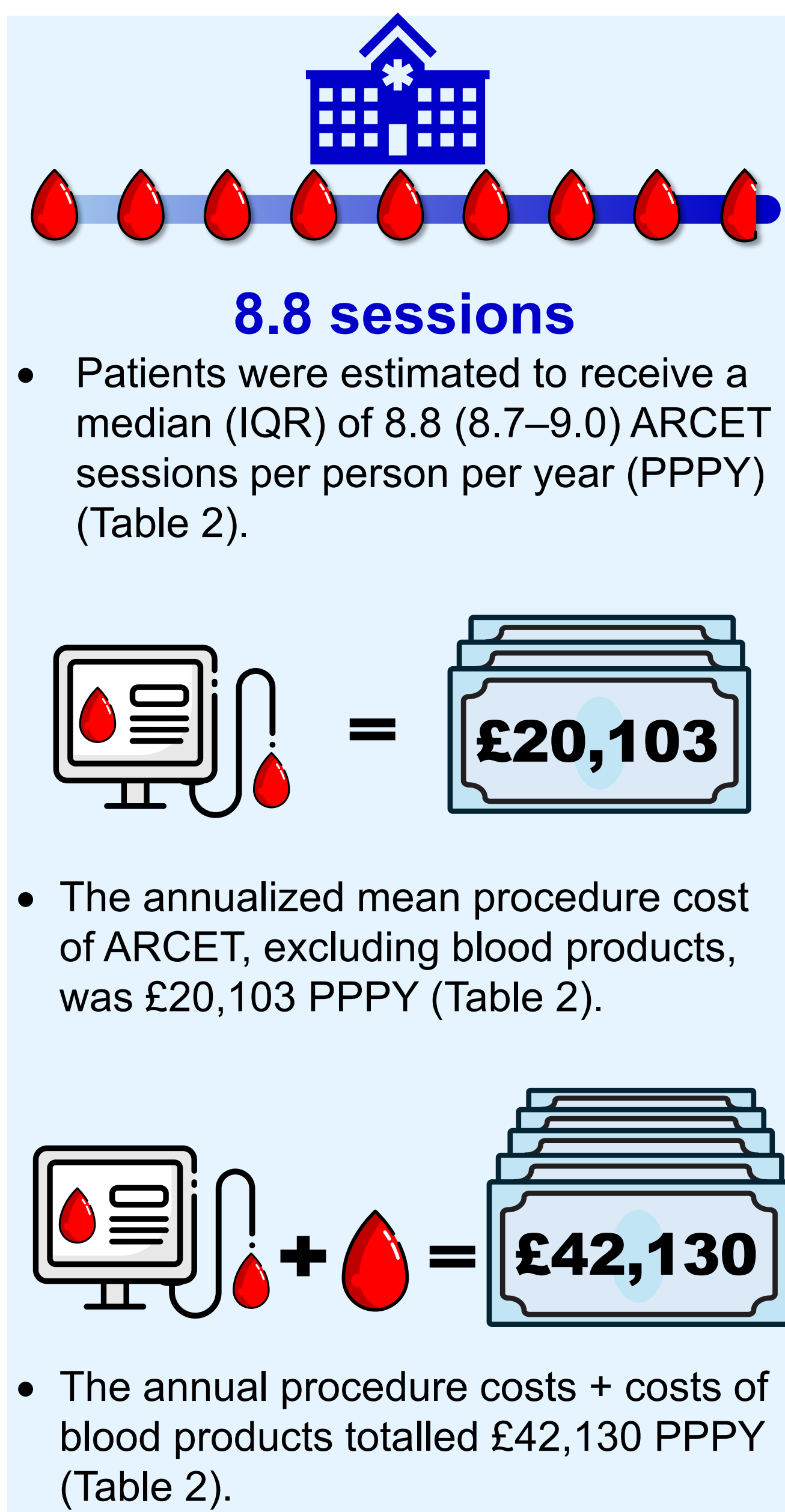


Table 2. Estimated use and costs of ARCET	
Estimated item	Patients receiving RTT (n=391)
Number of ARCET sessions, total	16,441
Number of ARCET sessions, PPPY	
Mean (SD)	9.7 (9.0)
Median (IQR)	8.8 (8.7–9.0)
Range	8.7–182.8
ARCET cost excluding blood, total	£30,418,643
ARCET cost excluding blood, PPPY	
Mean (SD)	£20,103 (£33,775)
Median (IQR)	£16,319 (£16,053–£17,118)
Range	£15,721–£639,488
Blood cost, PPPY ^a	£22,027
ARCET cost including blood, PPPY	£42,130

Abbreviations: ARCET, automated red cell exchange transfusion; IQR, interquartile range; PPPY, per person per year; RBC, red blood cell; RTT, regular transfusion therapy; SD, standard deviation.

^a Assuming 12.2 RBC units per session over 8.8 sessions per year.

Figure 2. Study population flow chart

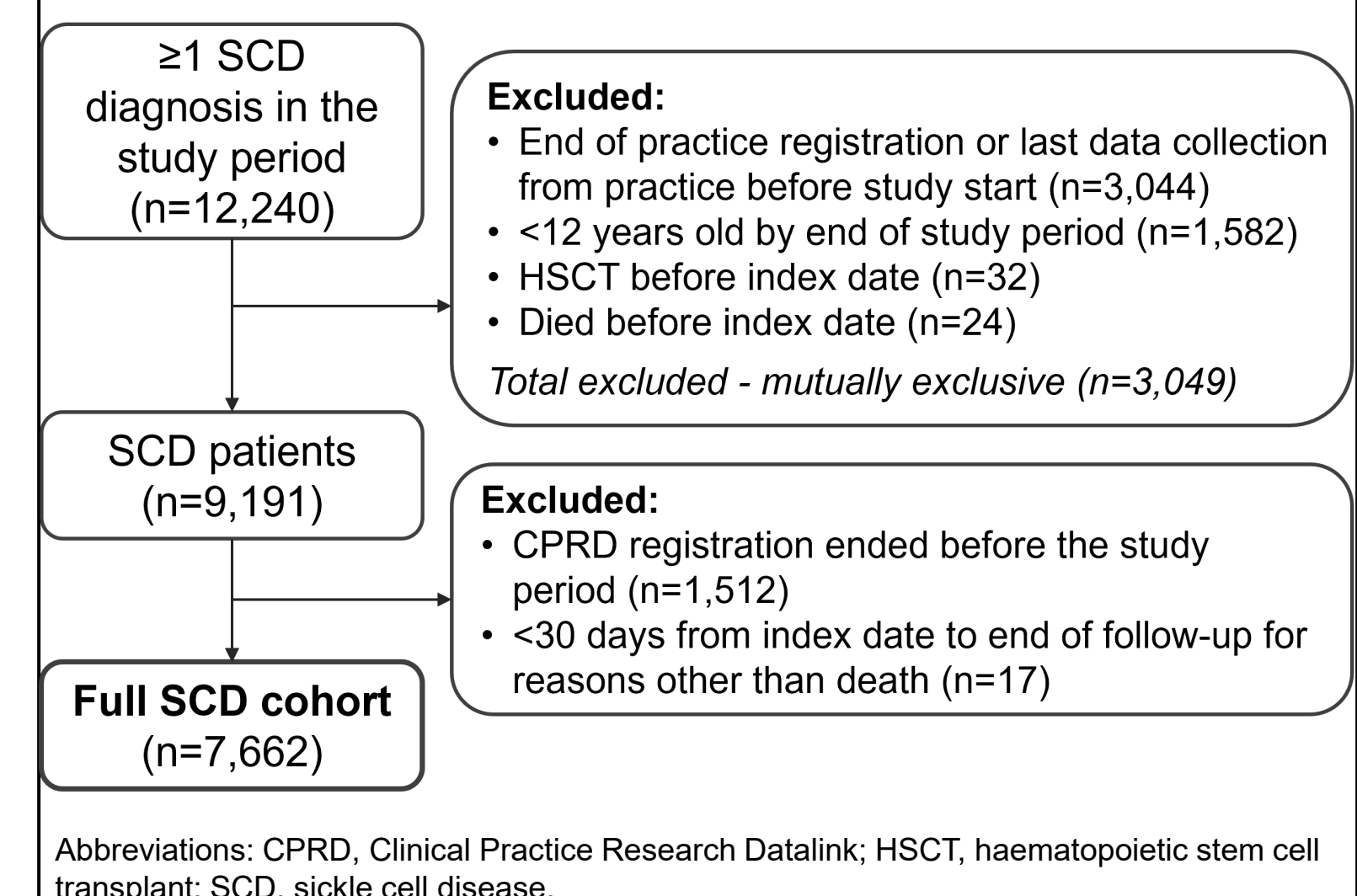


Table 3. Baseline characteristics		
Characteristic	Patients receiving RTT (n=391)	Full SCD cohort (n=7,662)
Age in years, median (IQR)	24.2 (14.2–40.4)	25.7 (16.8–38.7)
Female sex, n (%)	188 (48.1)	4,691 (61.2)
Ethnicity		
Black	316 (80.8)	5,827 (76.1)
White	23 (5.9)	685 (8.9)
South Asian	23 (5.9)	308 (4.0)
Mixed or "Other"	27 (6.9)	690 (9.0)
Unknown	2 (0.1)	152 (2.0)
CCI score, ¹⁸ n (%)		
0	263 (67.3)	7,552 (98.6)
1–2	91 (23.3)	104 (1.4)
≥3	37 (9.5)	6 (0.0)

Abbreviations: CCI, Charlson Comorbidity Index; IQR, interquartile range; RTT, regular transfusion therapy; SCD, sickle cell disease.

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Disclosures

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