



Introduction

Background

- Bronchiolitis obliterans syndrome (BOS), a type of pulmonary chronic Graft versus Host Disease (cGvHD), is an obstructive airway disease of the lungs commonly associated with lung transplantation and allogeneic hematopoietic stem cell transplantation (alloHSCT)¹
- BOS is characterized by T-cell mediated inflammation and fibrosis of bronchiolar walls that reduce the diameter of the bronchioles and causes progressive and irreversible airflow obstruction, respiratory failure, and death
- There is currently no approved therapy for BOS
- Little is known about the impact of BOS on healthcare resource use (HRU) and costs in alloHSCT patients in the United States with Medicare coverage^{2,3}

Study Goal

- Quantify the economic burden of BOS in alloHSCT patients in the United States with Medicare coverage

Methods

Data Source

- Medicare Limited Data Set, 100% sample, with enrollment, demographic and medical claims data for age-eligible (≥ 65 y) and disability eligible (< 65 y) Medicare beneficiaries

Study Patient Identification

- Fee-for-service Medicare patients with an index BOS diagnosis and evidence of prior alloHSCT
- BOS was identified using International Classification of Diseases (ICD) diagnosis codes for severe lung disease because there is no diagnosis code specific to BOS (Table 1)

Table 1. Clinical codes^a used for BOS

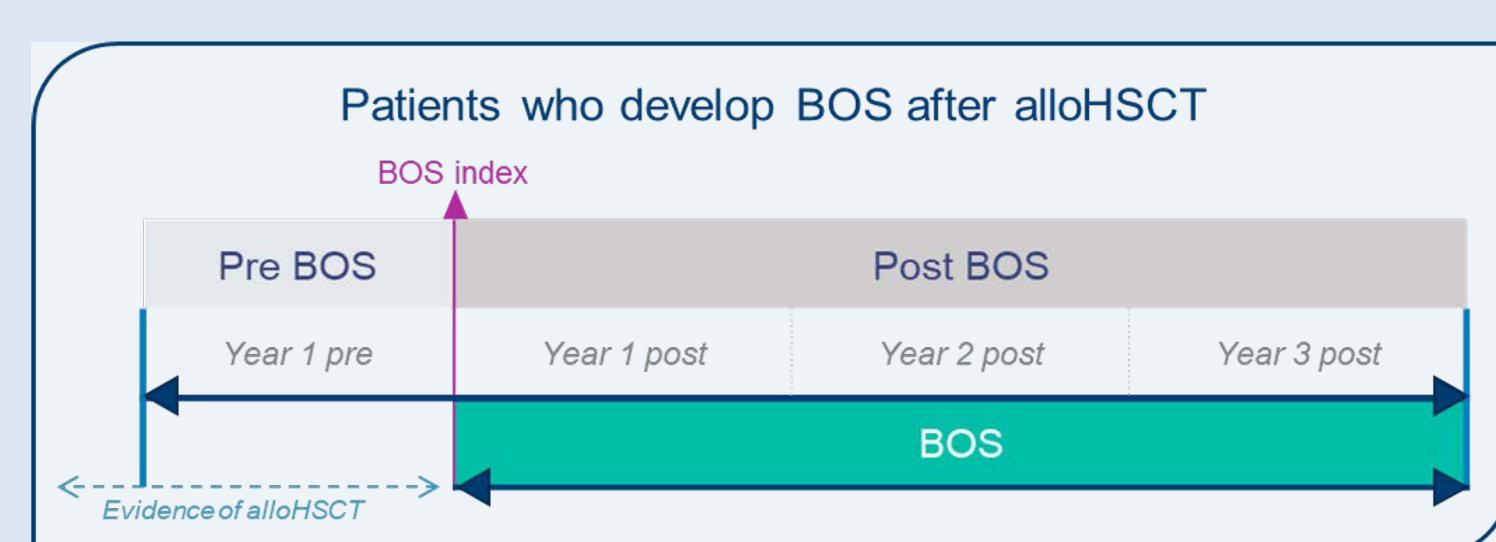
ICD version	Diagnosis codes for BOS
ICD-9	491.8, 491.9, 515, 516.34, 516.8 99684
ICD-10	J41.8, J42, J84.09, J84.115, J84.89, T86818, T86819

^aInternational Classification of Disease (ICD) diagnosis codes

Study Design

- Longitudinal retrospective analysis
- Study period was 1/1/2010 to 12/31/2017 (Figure 1)
- Outcomes were patient characteristics, costs paid by Medicare, and HRU in patients who survived at least 1 year
 - Analyses repeated for patients surviving up to 3 years
 - HRU includes: inpatient admissions, emergency department visits, non emergency outpatient services, home health visits, and skilled nursing facility stays

Figure 1. Study window



References

1. Rangaswamy et al., Updated prevalence and risk factors for bronchiolitis obliterans syndrome after allogeneic stem cell transplantation. *European Respiratory Journal* 2018 52 (Suppl 62): PA5298.
2. Bentley TS, et al. 2017 US organ and tissue transplant cost estimates and discussion. 2017.
3. Broder MS, et al. The cost of hematopoietic stem-cell transplantation in the United States. *Am Heal Drug Benefits*. 2017 Oct 1;10(7):366-73.

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Results

Study Patients

- There were 2,022 patients with an initial diagnosis used for BOS and a prior diagnosis or procedure code for alloHSCT; all were observable for at least 1 year after BOS diagnosis
- Mean age was 62.1 ± 12.5 years; 41% were female
- 861/2,022 patients (43%) were $< \text{age } 65$ y and would have received Medicare coverage because of disability; very few (10%) were age 75 or older (Figure 2)
- The average Charlson Comorbidity Index score was 3.5 ± 2
- Fewer than half of all patients (939/2,022; 46%) were observable 3 years after BOS diagnosis, reflecting high mortality rates

Figure 2. Distribution of patient age (n=2,022)



Healthcare Resource Use

- Patients were hospitalized 1.6 ± 2.0 times, on average, in the first year after BOS diagnosis, with a mean length of stay of 21.2 ± 29.1 days
- These rates declined in years 2 and 3
- Outpatient hospital encounters, ED and home health visits were also highest in year 1
- Rates of Intensive Care Unit (ICU) stays were similar across all years. (Table 2)

Table 2. Health Care Resource Use, (annual, per patient)

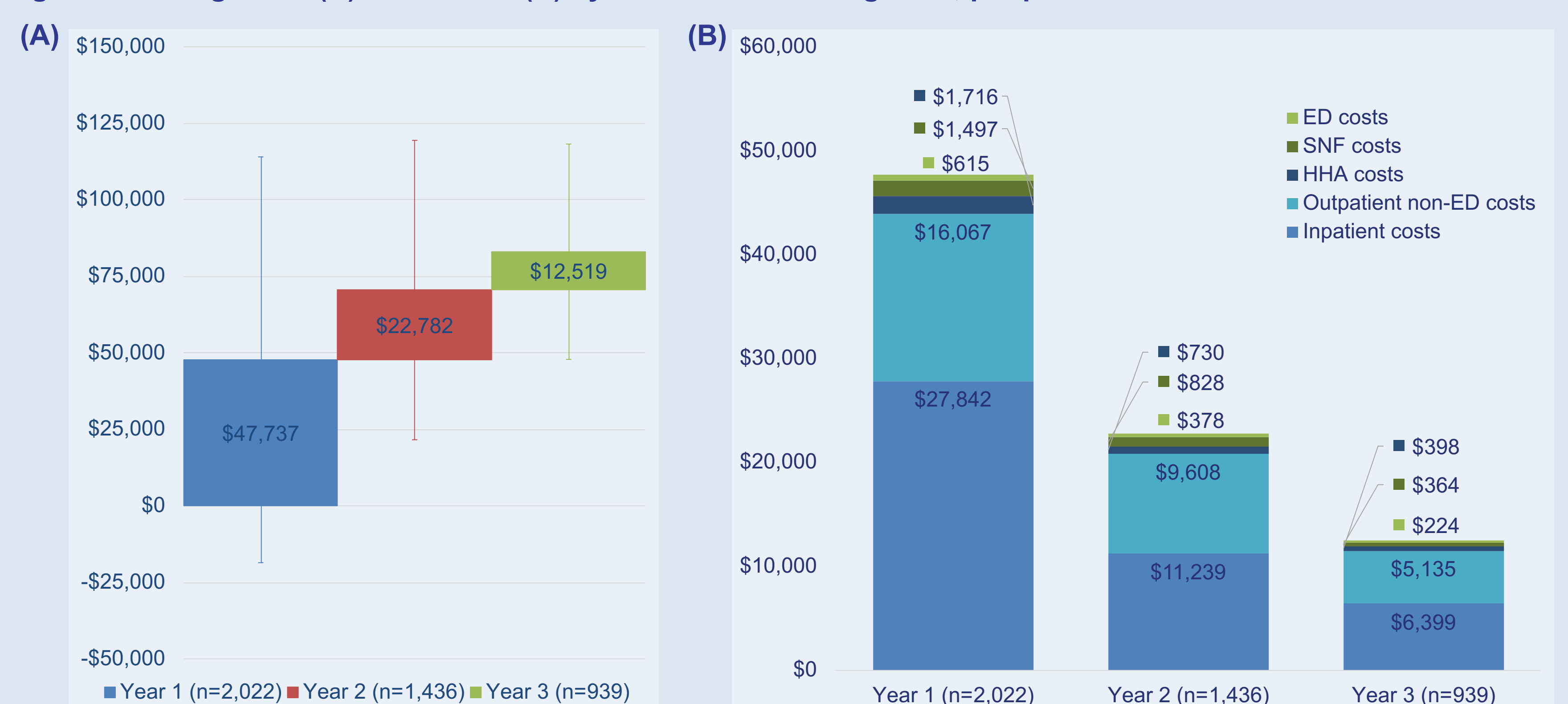
	Year 1 (n=2,022)	Year 2 (n=1,436)	Year 3 (n=939)
	Mean SD	Mean SD	Mean SD
Inpatient admissions	1.6±2.0	0.7±1.6	0.4±1.2
LOS, per admission	21.2±29.1	17.8±31.3	16.4±19.8
ICU stay, per inpatient admission	0.8±1.3	0.8±1.4	0.8±1.2
ICU LOS, per admission	15.1±17.7	13.5±15.9	12.6±14.1
Outpatient non-ED visits	21.4±18.4	11.9±15.7	7.2±12.9
ED visits	1.0±2.2	0.6±1.8	0.4±1.3
HHA visits	0.4±0.9	0.2±0.6	0.1±0.4
SNF stays	0.1±0.6	0.1±0.4	0.0±0.3
SNF LOS, per SNF admission	19.9±53.6	15.9±52.6	1.7±8.2

LOS = Length of stay; ED = Emergency department; HHA = Home health aid; SNF = Skilled nursing facility

Costs

- In the year following BOS diagnosis, mean per-patient costs were $\$47,737 \pm 66,300$ (Figure 3.A)
- Among those who survived, mean per patient costs were $\$22,782 \pm 48,920$ (N=1,436) in year 2 and $\$12,519 \pm 35,195$ (N=939) in year 3
- Inpatient admission costs averaged $\$27,842 \pm 51,770$ in the first year post-diagnosis, decreasing to $\$11,239 \pm 34,761$ (year 2) and $\$6,499 \pm 23,856$ (year 3) (Figure 3.B)

Figure 3. Average cost (A) overall and (B) by HRU after BOS diagnosis, per patient



Conclusion

Among Medicare patients with an ICD diagnosis that is used for BOS following alloHSCT, more than 40% were age < 65 and disability-eligible for Medicare coverage. Across all patients, medical costs were highest in the first year following BOS diagnosis, reflecting costly hospitalizations and ICU stays. Hospitalizations and expenditures were lower in subsequent years, and may reflect survival of healthier patients. Because there is no ICD diagnosis for BOS, these results may reflect the burden of severe lung disease, including BOS, following alloHSCT. These estimates do not reflect indirect costs of BOS, which would add to the overall burden of this disease.