One-year incidence of hospital readmission in hematopoietic cell transplant recipients and reasons for readmissions

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INTRODUCTION

- Hematopoietic cell transplantation (HCT) is a potentially curative therapy for patients with certain high-risk hematologic diseases.[1]
- Complications from graft-versus-host disease (GVHD) and immunosuppression result in significant hospital readmission risks for patients following HCT.[2]
- In this study we describe the readmission rates, and reasons for readmission, among HCT recipients during the first year following the HCT procedure.

METHODS

Data source

Data for this study were extracted from the MarketScan Research Databases, which contain electronic healthcare insurance claims records for commercial and Medicare patients.

Patients

Patients were included in the study if they had a relevant International Classification of Diseases, Ninth Revision (ICD-9) or Current Procedural Terminology (CPT®) procedure code for an allogeneic or autologous HCT between June 26 2010 and June 30 2014. Patients must have been discharged alive from the HCT admission, and have had at least 360 days of health plan enrollment prior to the HCT procedure. No minimum health plan enrollment was required post-procedure. The first admission for an HCT procedure for each patient was defined as the index procedure, with subsequent hospital admissions being defined as readmissions.

Hospital readmissions

Hospital readmissions were identified through insurance claims. Reasons for readmissions were categorized based on ICD-9 diagnosis codes for the following reasons:

- opportunistic infections (any infections including bacterial, fungal, and viral infections)
- GVHD
- Renal impairment
- Neutropenia
- Other reasons.

RESULTS

Patient population

Table 1 details the baseline characteristics of the study population, which consisted of 2926 allogeneic HCT and 4761 autologous HCT recipients.

- The mean age of the allogeneic and autologous HCT recipients was 47.3 years and 53.4 years, respectively.
- 1662 of 2926 (56.8%) of allogeneic HCT recipients and 2855 of 4761 (60.0%) autologous HCT recipients were male.
- Total healthcare expenditure for each patient was calculated during the 365 days prior to the transplant procedure as an indicator of disease severity.
  - Mean (median) total healthcare reimbursements were $247,178 ($202,866) for allogeneic HCT recipients and $176,753 ($150,103) for autologous HCT recipients during the 365 days prior to the transplant.

Table 1. Baseline characteristics

		Allogeneic HCT recipients (n=2926)	Autologous HCT recipients (n=4761)
Age, mean (SD)		47.3 (17.8)	53.40 (15.2)
Male sex, n (%)		1662 (56.8)	2855 (60.0)
Total reimbursement in the 365 days prior to admission for HCT procedure	Mean (SD)	$247,178 (202,992)	$176,753 (128,153)
	Median (IQR)	$202,866 ($110,756–$333,110)	$150,103 ($97,213–$225,581)
Insurance plan type, n (%)	Medicare	212 (7.3)	723 (15.2)
	Commercial HMO	344 (11.8)	581 (12.2)
	Commercial PPO/POS	1906 (65.1)	2782 (58.4)
	Commercial high deductible	231 (7.9)	320 (6.7)
	Comprehensive*	66 (2.3)	117 (2.5)
	Unknown	167 (5.7)	238 (5.0)

* Insurance plans without incentive for the patient to use a particular list of providers. Coverage is handled by only 1 policy, with a deductible and co-insurance.

HCT: hematopoietic cell transplantation; HMO: Health Maintenance Organization; IQR: interquartile range; POS: Point-of-Service; PPO: Preferred Provider Organization; SD: standard deviation.

Hospital readmissions

Table 2 details the number of hospital readmissions during the 365 days following the HCT procedure by the type of HCT procedure.

- In the first year after transplant, 1639 of 2926 (56.0%) of allogeneic HCT recipients had at least one hospital readmission.
  - The total number of readmissions across these patients was 3949.
- 1665 of 4761 (35.0%) autologous HCT recipients had at least one hospital readmission.
  - There were a total of 3250 readmissions among these patients.

Table 2. Hospital readmissions by type of HCT

	Allogeneic HCT recipients (n*=2926)	Autologous HCT recipients (n*=4761)
Number of patients with at least 1 hospital readmission, n (%)	1639 (56.0)	1665 (35.0)
Total number of readmissions per patient within 365 days of procedure, mean (SD)	1.35 (1.84)	0.68 (1.37)

* Number of patients.

HCT: hematopoietic cell transplantation; SD: standard deviation.

Reasons for hospital readmissions

The reasons for hospital readmissions are provided in **Table 3**. Across all readmissions, opportunistic infections were associated with the majority of hospital readmissions.

- In allogeneic HCT recipients, 3067 of 3949 readmissions (77.7%) had at least 1 of the following diagnostic codes:
  - Opportunistic infections were associated with 2198 of 3949 (55.7%) of all hospital readmissions, of which:
  - 592 readmissions were associated specifically with double stranded DNA (dsDNA) viral infections, which is 26.9% of 2198 opportunistic infection readmissions and 15.0% of all 3949 readmissions.
  - In addition to infections, there were 1314 of 3949 (33.3%) admissions with GVHD, 618 of 3949 (15.7%) admissions with renal impairment, and 627 of 3949 (15.9%) admissions for neutropenia-related diagnostic codes.
- Autologous HCT recipients had 1768 of 3250 readmissions with at least 1 of the following diagnostic codes (54.4% of all readmissions):
  - Opportunistic infections were associated with 1236 of 3250 (38.0%) of all hospital readmissions, of which:
  - 98 readmissions were associated with dsDNA viral infections, which is 7.9% of 1236 opportunistic infection readmissions and 3.0% of 3250 all readmissions.
  - There were 60 of 3250 (1.9%) readmissions with GVHD, 380 of 3250 (11.7%) readmissions with renal impairment, and 625 of 3250 (19.2%) readmissions with neutropenia-related diagnostic codes.

Table 3. Reasons for hospital readmissions by type of HCT

	Allogeneic HCT recipients (n*=3949) n (%)	Autologous HCT recipients (n*=3250) n (%)
Opportunistic infections**	2198 (55.7)	1236 (38.0)
Graft-versus-host disease	1314 (33.3)	60 (1.9)
Renal impairment	618 (15.7)	380 (11.7)
Neutropenia	627 (15.9)	625 (19.2)
Other reasons	882 (22.3)	1482 (45.6)

*Number of readmissions.

** Any infections including bacterial, fungal, and viral infections (including dsDNA viral infections).

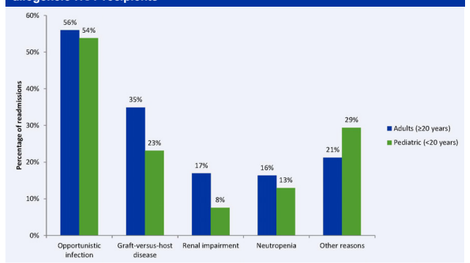
HCT: hematopoietic cell transplantation.

Readmissions for adult and pediatric populations

Figures 1 and **2** show readmissions among adult and pediatric populations who underwent allogeneic and autologous HCT procedures, respectively.

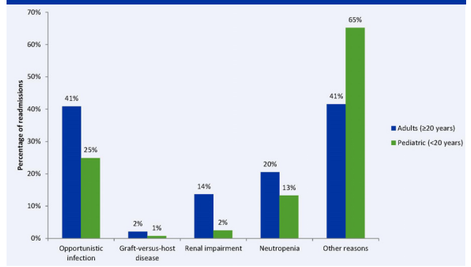
- Limited differences were observed between adult and pediatric populations receiving allogeneic HCT transplants.
- Adults appeared to be slightly more likely to be readmitted for GVHD and renal impairment.
- The findings were similar for autologous HCT recipients; in addition to renal impairment, there was evidence that adults had more hospitalizations associated with opportunistic infections.

Figure 1. Reasons for hospital readmissions among adult and pediatric allogeneic HCT recipients



HCT: hematopoietic cell transplantation

Figure 2. Reasons for hospital readmissions among adult and pediatric autologous HCT recipients



HCT: hematopoietic cell transplantation

DISCUSSION

- **Over one-third of autologous and over half of all allogeneic HCT recipients had at least one hospital readmission during the year following the procedure.**
- **Readmissions among allogeneic HCT recipients were predominantly associated with opportunistic infections and GVHD.**
- **Among autologous HCT recipients, opportunistic infections were associated with 38.0% of hospital readmissions.**
- **Renal impairment and neutropenia might be associated with current therapies that are commonly applied for dsDNA viral infections.**

LIMITATIONS

A limitation of our study is potential underreporting of ICD-9 diagnosis codes; thus the number of readmissions for each reason may be underestimated.

REFERENCES

1.Tyndall A et al. *Bone Marrow Transplant*. 1999; 24(7):729–34.

2.Spring L et al. *Biol Blood Marrow Transplant*. 2015; 21(3):509–16.

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DISCLOSURES

Roman Casciano, Vernon F. Schabert, and Yi-Chien Lee have received compensation for database analysis from Chimerix. Essy Mozaffari is an employee of Chimerix and has been granted stock and stock options.

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