# Epidemiology of Bloodstream Infections in Solid Organ Transplant Recipients

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## Introduction

Infection represents one of the most common and serious complications following solid organ transplantation (SOT). In particular, bloodstream infections (BSIs) are associated with considerable morbidity and mortality in transplant patients. Creating a transplant database that characterizes key infectious disease parameters such as risk factors, bacterial etiology, and antibiotic susceptibility could have tremendous implications for reducing the burden of infectious complications in transplant recipients. Our aim in this study is to describe the epidemiology of BSI in SOT recipients at UTSW.

## Methods

The design of the study was a retrospective single center cohort study. A total of 837 solid organ transplantations performed at UTSW between 1/1/2010 and 6/30/2015 were included in the study. The duration of follow-up was 1 year. BSI episodes were defined as positive cultures separated by ≥7 days. Positive cultures of the same organism in a patient <7 days apart counted as a single BSI episode. Positive cultures of different organisms in a patient <7 days apart counted as discrete BSI episodes for that particular organism. Innovative data mining tools were utilized to extract demographic, clinical and laboratory information from the electronic medical record. Through the UTSW Clinical Research Data Warehouse, we were able to extract over 600 discreet variables from a database server (Clarity) through an automated process with high precision. We connected this database with additional databases such as the Social Security Death Index (SSDI) and Scientific Registry of Transplant Recipients database (SRTR) to obtain data necessary for construction of Kaplan-Meier survival curves with censorship. Based on our inclusion criteria, we identified study subjects and extracted the following variables: patient demographics, positive blood cultures, date of surgery, transplanted organ and date of death.

## Results

**Table 1. Demographics**

| Characteristic | All transplant patients (n=837) | Patients with negative cultures (n=777) | Patients with ≥1 positive culture (n=60) |
|---|---|---|---|
| **Sex** | | | |
| **Male** | 541 (65%) | 502 (65%) | 39 (65%) |
| **Female** | 296 (35%) | 275 (35%) | 21 (35%) |
| **Age** | | | |
| **Mean ± SD** | 53.8 ± 13.2 | 53.8 ± 13 | 53.6 ± 15 |
| **Median (Range)** | 57 (14-83) | 57 (14-80) | 57 (16-83) |
| **Race** | | | |
| **White** | 560 (67%) | 522 (67%) | 38 (63%) |
| **African American** | 128 (15%) | 119 (15%) | 9 (15%) |
| **Asian** | 27 (3%) | 25 (3%) | 2 (3%) |
| **Other** | 76 (9%) | 68 (9%) | 8 (14%) |
| **Unknown** | 46 (6%) | 43 (6%) | 3 (5%) |
| **Organ** | | | |
| **Heart** | 152 (18%) | 140 (18%) | 12 (20%) |
| **Kidney** | 217 (26%) | 206 (26%) | 11 (18%) |
| **Liver** | 147 (18%) | 133 (17%) | 14 (23%) |
| **Lung** | 296 (35%) | 277 (36%) | 19 (32%) |
| **Simultaneous** | 25 (3%) | 21 (3%) | 4 (7%) |

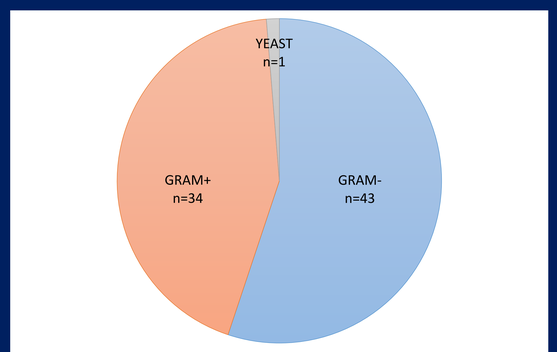


**Figure 1. Distribution of BSI episodes by Gram staining of causative organism**

## Results (continued)

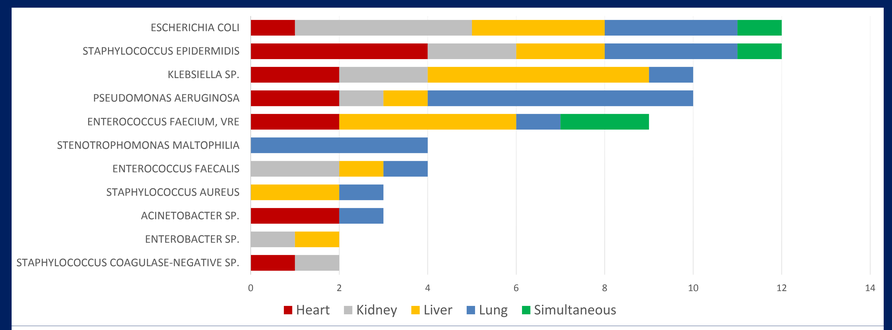


**Figure 2. Distribution of BSI episodes by major causative organisms and transplanted organ**

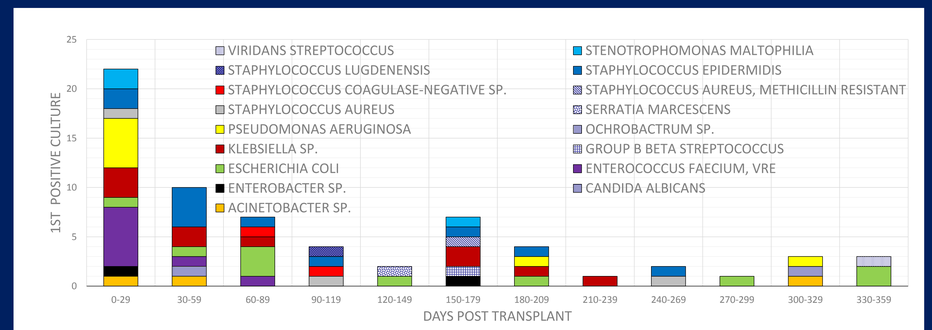


**Figure 5. Onset of first BSI episode post transplantation**

**Table 2. Cumulative incidence and incidence rate of first positive blood culture over one year of follow-up**

| | Overall | Heart | Kidney | Liver | Lung | Simultaneous |
|---|---|---|---|---|---|---|
| **Cumulative Incidence (%)** | 11.8 | 15.1 | 7.4 | 14.3 | 11.8 | 16 |
| **Incidence Rate (per 100 Person-days)** | 1.1 | 1.9 | 0.77 | 1.1 | 0.99 | 2.2 |

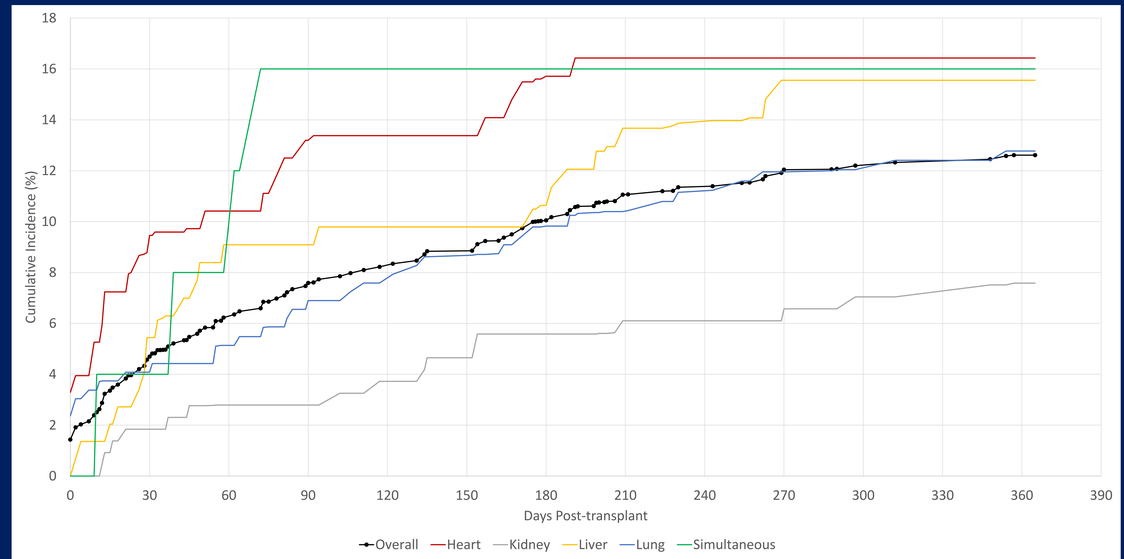


**Figure 3. Cumulative Incidence of first positive blood culture by day post-transplant**

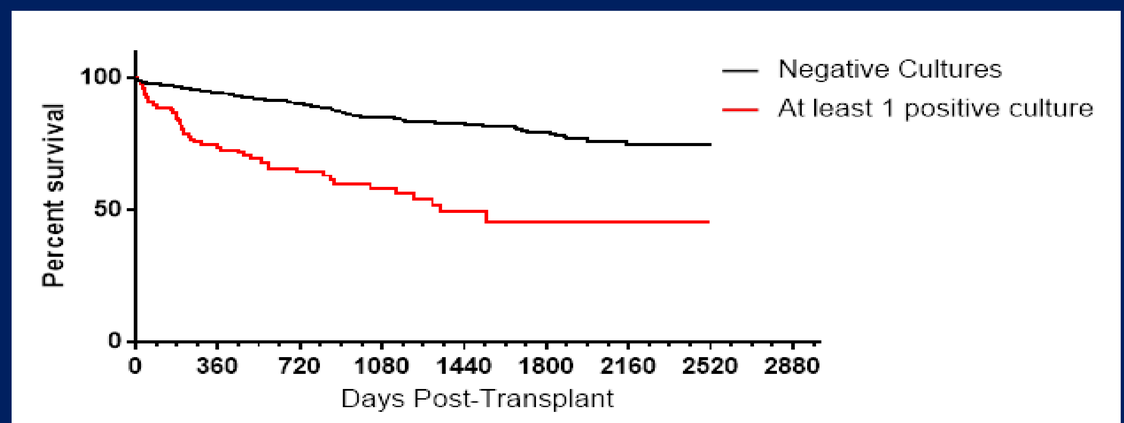


**Figure 4. Kaplan Meier survival curve of all-cause mortality among solid organ transplant recipients (SOT) with negative cultures versus SOT recipients with at least one positive culture (P <0.0001 by log-rank)**

## Conclusion

- The cumulative incidence of BSI at 1-year post-transplantation for all organs was 11.8%. The highest BSI cumulative incidence occurred in simultaneous SOT recipients (16.0%), suggesting that patients undergoing simultaneous organ transplantation may be at a higher risk of acquiring a BSI compared to other types of transplantations. The organ group with the next highest BSI cumulative incidence were heart transplants (15.1%)

- The most common microorganisms identified were *S. epidermidis* (15.38%), *E. Coli* (15.38%), *Klebsiella sp*. (12.82%), *P. aeruginosa* (12.82%), and Vancomycin-resistant *E. faecium* (11.54%). Further analysis is necessary to determine source of infection and whether they constitute true BSIs or contaminants under CDC/NHSN guidelines

- The timing of the first episode of BSI was as follows: twenty-one episodes (35%) occurred during the first month, 27 (45%) between 1 and 6 months and 12 (20%) after 6 months post-transplantation. Most of the first BSI episodes occurred > 1 month post-transplantation (39, 65%), potentially highlighting a particularly vulnerable period for SOT recipients

- The median time to onset of first BSI episode after transplantation was 67 days (range: 0-354 days)

- The all-cause mortality in SOT recipients with at least one positive culture was greater than the SOT recipients with negative cultures

- Further studies and multivariate analysis are underway to identify independent risk factors for BSI acquisition and patient outcomes

## References

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## Acknowledgements

UT Southwestern Medical Student Research Program
Department of Internal Medicine, UTSW

Research reported in this publication was supported by the National Center for Advancing Translational Sciences of the National Institutes of Health" under award Number UL1TR001105. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH