

# Solid Organ Transplantation & Data Mining: Bloodstream Infections Have a Significant

## Impact on One-Year Survival and qSOFA ≥ 2 Predicts 30-Day Mortality

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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 and identify risk factors associated with infection and mortality.

### Methods

The design of the study was a retrospective single center cohort study. Data mining tools were used to extract information from the electronic medical record and merged it with data from the Scientific Registry of Transplant Recipients (SRTR) national database. First SOT from 1/1/2010-12/31/2015 were included. Charts of subjects with positive blood cultures were manually reviewed and adjudicated using CDC/NHSN and SCCM/ESICM criteria. Multidrug resistant organisms (MDRO) were defined using CDC criteria. The 1-year cumulative incidence was calculated using the Kaplan-Meier method. Cox proportional hazards models were used to identify risk factors for BSI acquisition and 1-year mortality. BSI was analyzed as a time-dependent covariate in the mortality model. Fisher's exact test, Chi-Square, and Wilcoxon Rank Sum were used to identify risk factors for 30-day mortality. P values <0.05 were considered statistically significant.

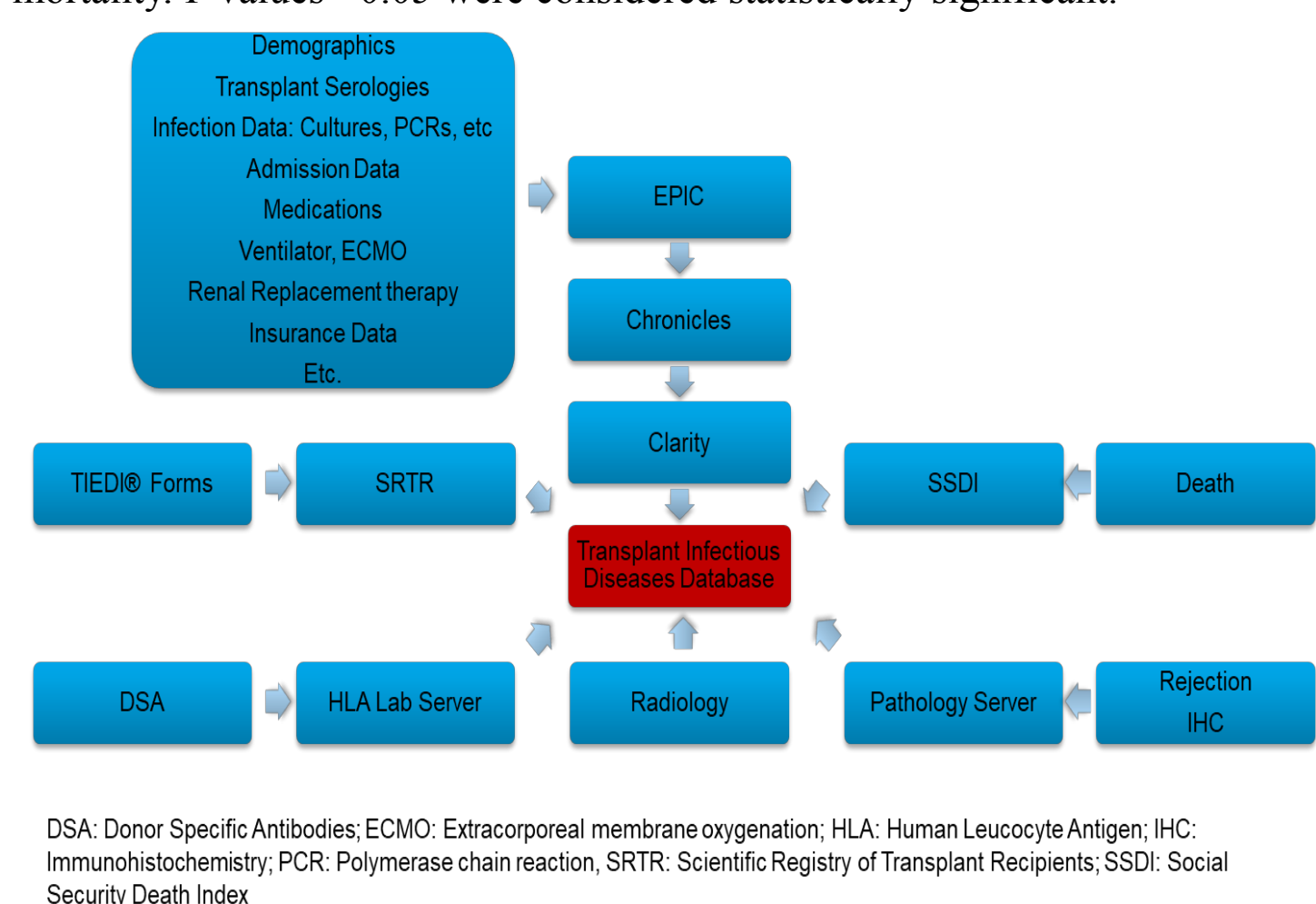


Figure 1. Transplant Infectious Disease Database – Data Flow

### Results

Characteristic	All Transplants n=917	Negative BSI n=842 (91.82%)	Positive BSI n=75 (8.19%)
<b>Sex</b>			
Male	593 (64.67%)	544 (64.61%)	49 (65.33%)
Female	324 (35.33%)	298 (35.39%)	26 (34.67%)
<b>Age</b>			
Mean ± SD	54.00 ± 13.04	53.98 ± 12.96	54.23 ± 13.89
Median (Range)	57 (14-83)	57 (14-80)	57 (16-83)
<b>Race</b>			
Caucasian	619 (67.50%)	571 (67.81%)	48 (64%)
African-American	148 (16.14%)	133 (15.80%)	15 (20%)
Asian	34 (3.71%)	31 (3.68%)	3 (4%)
Other	73 (7.96%)	67 (7.96%)	6 (8%)
Unknown	43 (4.69%)	41 (4.75%)	3 (4%)
<b>Organ</b>			
Heart	167 (18.21%)	149 (17.70%)	18 (24%)
Kidney	236 (25.74%)	225 (26.72%)	11 (14.67%)
Liver	163 (17.78%)	145 (17.22%)	18 (24%)
Lung	324 (35.33%)	300 (35.63%)	24 (32%)
Multiorgan	27 (2.94%)	23 (2.73%)	4 (5.33%)
<b>Year of Transplant</b>			
2010	90 (9.81%)	84 (9.98%)	6 (8%)
2011	124 (13.52%)	117 (13.89%)	7 (9.33%)
2012	159 (17.34%)	146 (17.34%)	13 (17.33%)
2013	165 (17.99%)	153 (18.17%)	12 (16%)
2014	189 (20.61%)	169 (20.07%)	20 (26.67%)
2015	190 (20.72%)	173 (20.55%)	17 (22.67%)
<b>Diabetes</b>			
Yes	252 (27.48%)	224 (26.6%)	28 (37.33%)
No	665 (72.52%)	618 (73.40%)	47 (62.67%)
<b>Ventilator at transplant</b>			
Yes	42 (4.58%)	35 (4.16%)	7 (9.33%)
No	874 (95.31%)	806 (95.72%)	68 (90.67%)
<b>ECMO at transplant</b>			
Yes	15 (1.64%)	13 (1.54%)	2 (2.67%)
No	901 (98.26%)	828 (98.34%)	73 (97.33%)
<b>CMV Serostatus</b>			
D-/R-	115 (12.54%)	109 (12.95%)	6 (8%)
D+/R+, D-/R+	566 (60.63%)	518 (61.52%)	48 (64%)
D-/R-	236 (25.74%)	215 (25.53%)	21 (28%)

Table 1. Patient Characteristics

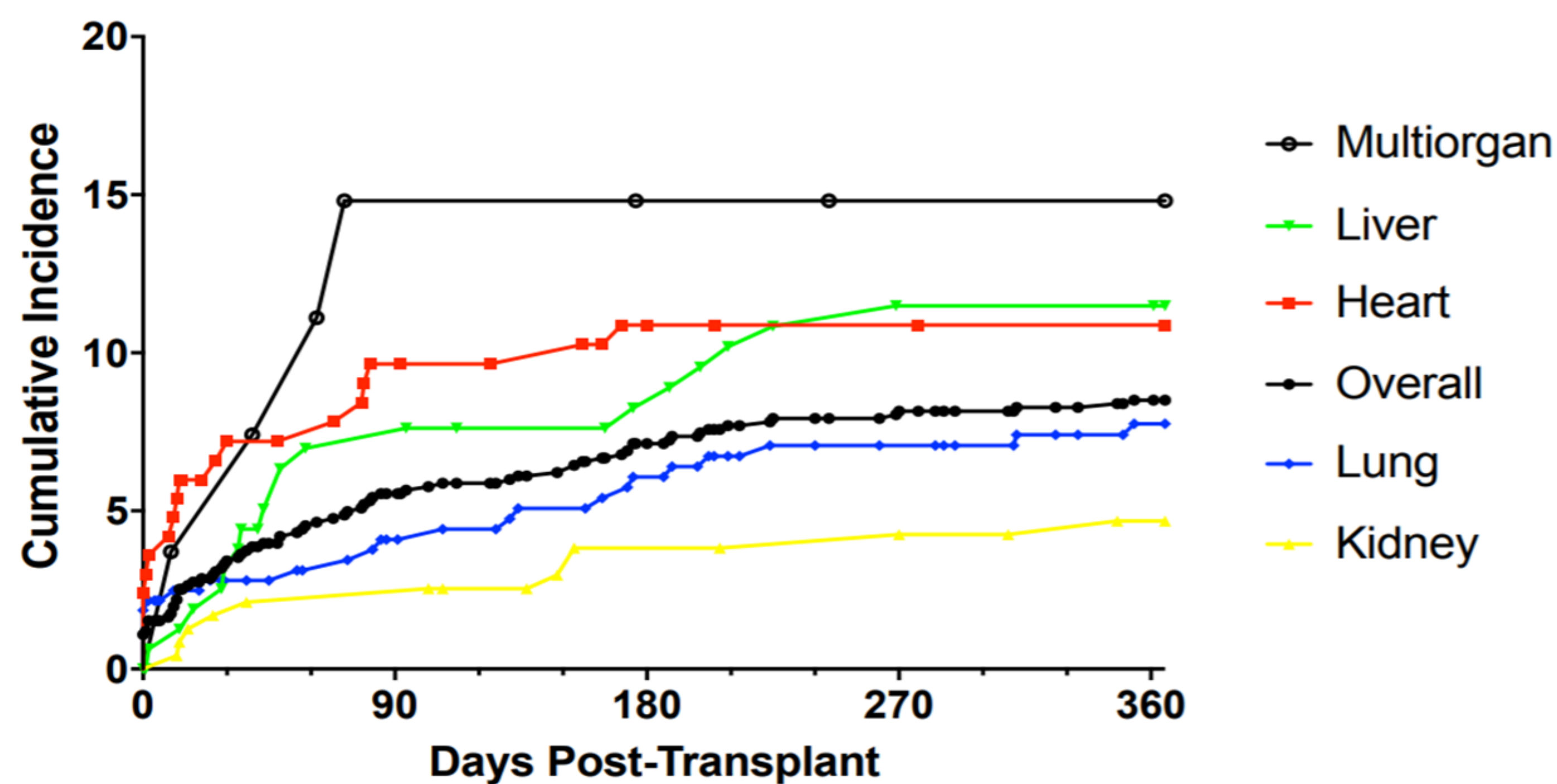


Figure 2. Cumulative Incidence of first BSI at 1 year post-transplant

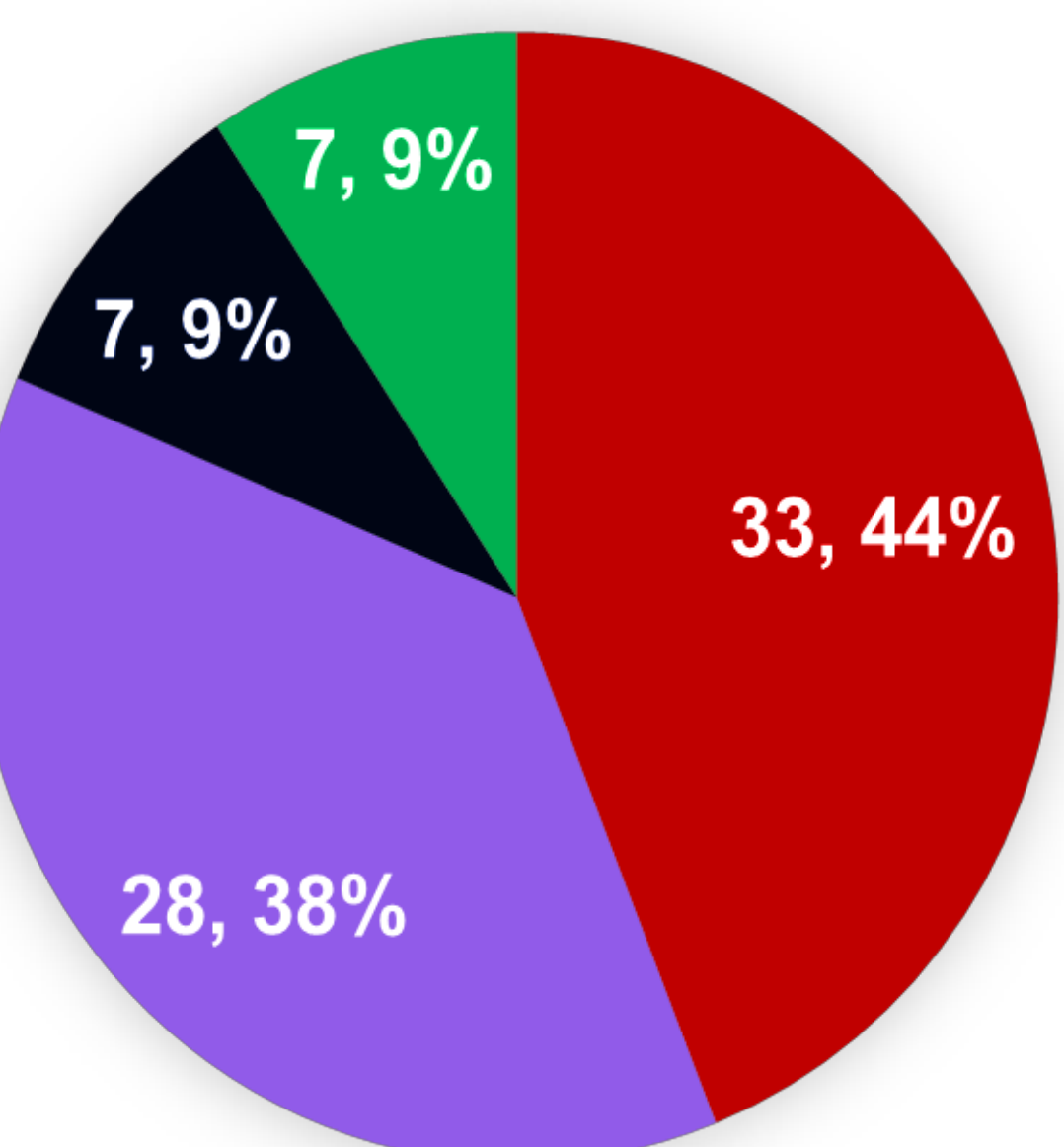


Figure 4. Distribution of BSI episodes by organism

ORGANISM	TOTAL
KLEBSIELLA SP.	12
ESCHERICHIA COLI	9
VANCOMYCIN-RESISTANT ENTEROCOCCUS FAECIUM	9
COAGULASE-NEGATIVE STAPHYLOCOCCI	9
POLYMICROBIAL	7
CANDIDA SP.	7
STAPHYLOCOCCUS AUREUS	6
PSEUDOMONAS AERUGINOSA	5
STENOTROPHOMONA S MALTOPHILIA	2
ACINETOBACTER SP.	2
OTHER	7

FACTOR	RISK RATIO ESTIMATE (95% CI)	P VALUE
AGE AT TRANSPLANT	0.999 (0.981-1.018)	0.9396
BMI	0.977 (0.933-1.024)	0.3274
RACE (BLACK)	1.336 (0.733-2.434)	0.3441
SEX (MALE)	0.971 (0.594-1.589)	0.9071
DIABETES	1.554 (0.949-2.545)	0.0800
TRANSPLANT YEAR	1.079 (0.929-1.254)	0.3202
CMV D/R SEROSTATUS		
D-/R-	0.555 (0.217-1.418)	0.2187
D+/R+, D-/R+	0.941 (0.552-1.603)	0.8225
D-/R-	Ref	
LIFE SUPPORT VENTILATOR ECMO		
VENTILATOR	1.971 (0.839-4.633)	0.1196
ECMO	1.093 (0.235-5.078)	0.9100
TRANSPLANT TYPE		
MULTIORGAN	3.556 (1.092-11.576)	0.0352
LUNG	1.619 (0.763-3.435)	0.2096
LIVER	2.472 (1.126-5.427)	0.0240
HEART	2.370 (1.111-5.057)	0.0256
KIDNEY	Ref	

Table 2. Risk factors for BSI Acquisition

FACTOR	P VALUE
AGE AT TRANSPLANT RECIPIENT RECIPIENT >65	0.7543 0.7315
DAYS TO 1 <sup>ST</sup> BSI POST-TRANSPLANT	0.1866
ORGAN	0.8411
POLYMICROBIAL	0.0201
SEPTIC SHOCK	<.0001
TIMELY ANTIBIOTICS	0.2202
MDRO	0.4572
QSOFA ≥2	0.0154

Table 3. Risk factors for 30-day mortality

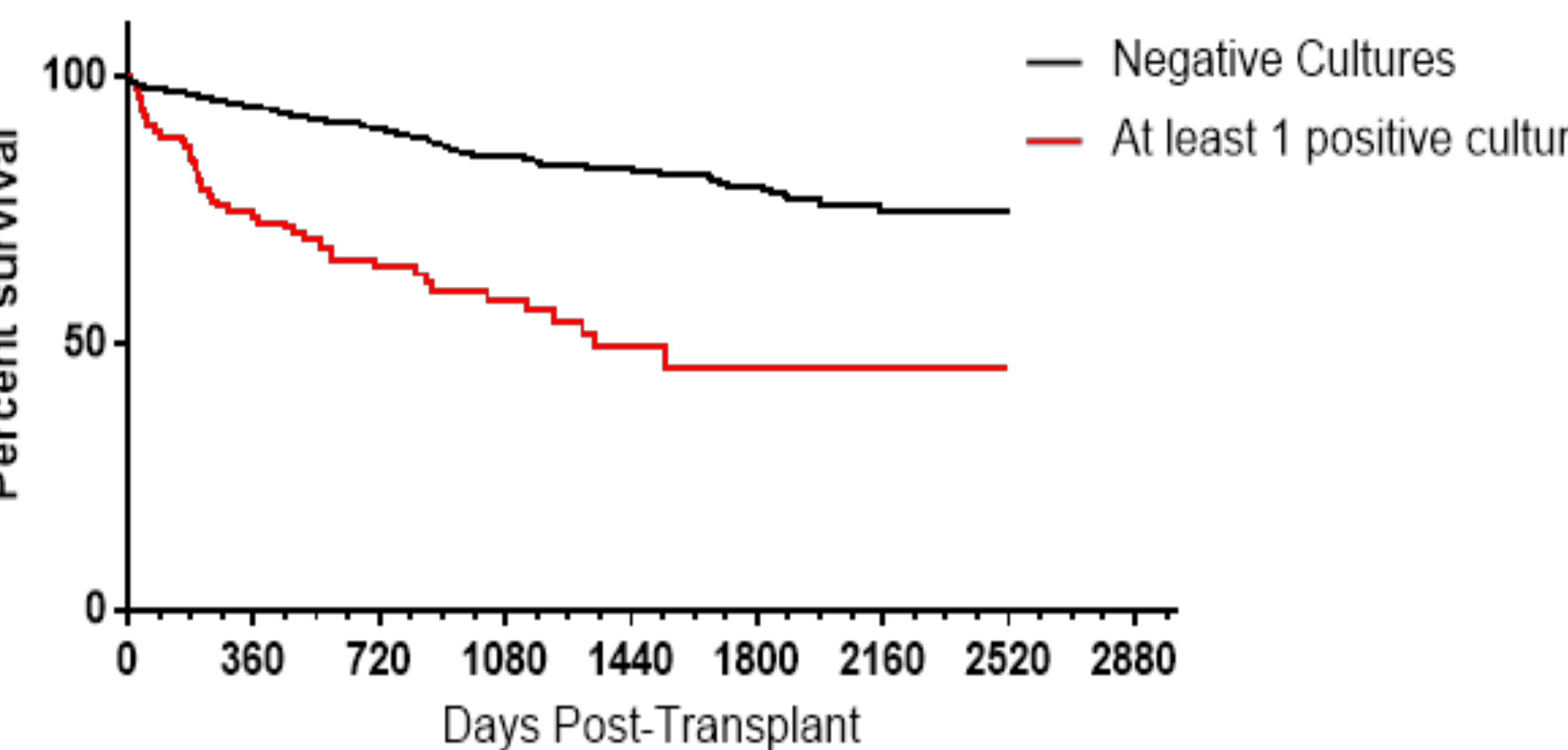


Figure 5. Kaplan Meier survival curve of all-cause mortality among solid organ transplant recipients (SOT) without BSI versus SOT recipients with at least one positive BSI (P <.0001 by log-rank)

### Results (continued)

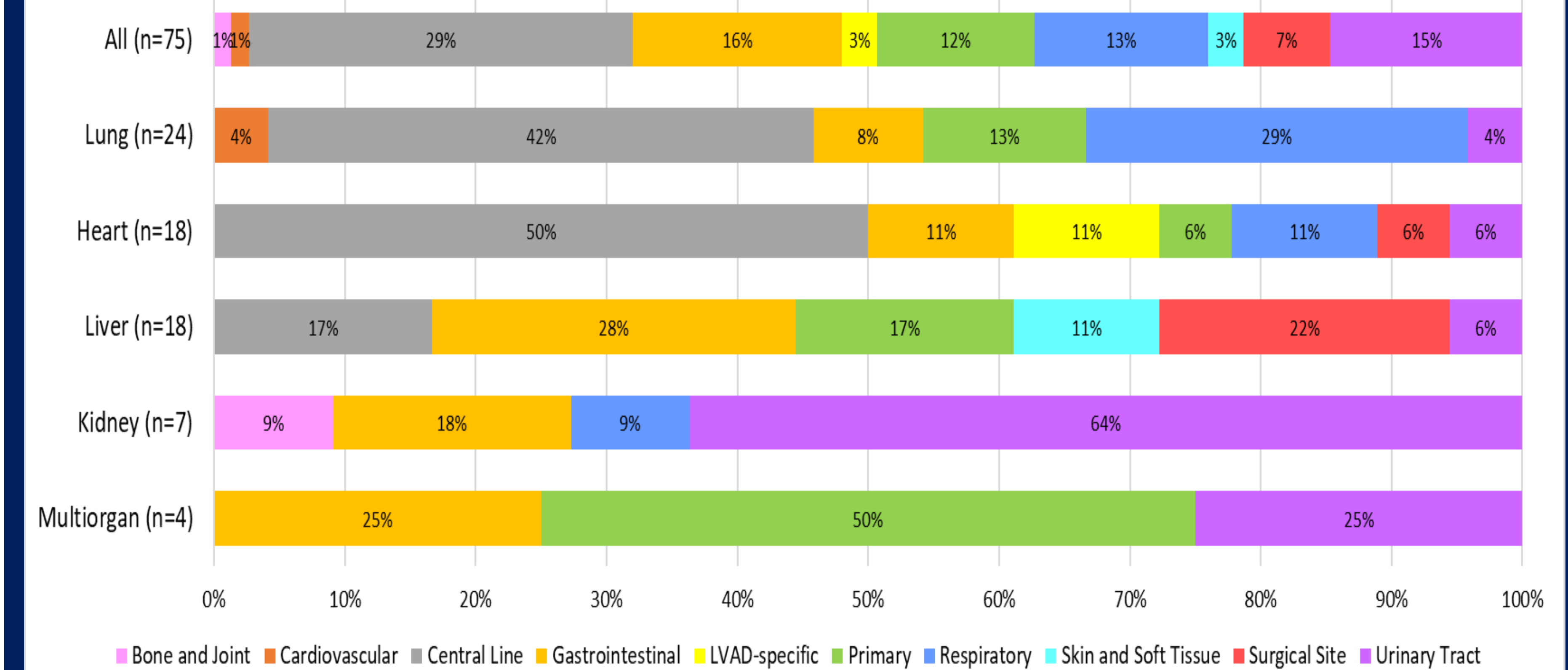


Figure 3. Distribution of BSI episodes by source of infection and transplanted organ

### Conclusion

The cumulative incidence of BSI at 1-year post-transplantation for all organs was 8.4%. On multivariable analysis, multiorgan, liver and heart transplantation were risk factors associated with a increased risk of BSI

On multivariable analysis, a BSI episode within 1-year post-transplantation, lung and liver transplantations were risk factors associated with increased 1-year mortality post-transplantation

On univariable analysis, septic shock, polymicrobial infection and a qSOFA score ≥2 were identified to be associated with increased 30-day mortality post-BSI

The rate of MDRO BSIs increased over time and was statistically significant. The overall prevalence of MDRO BSIs was 25.3% during the study period

Creation of the UT Southwestern Transplant Infectious Disease Database serves as proof of concept that the use of data mining tools can be leveraged to translate clinical data into meaningful research and quality improvement projects

### References

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FACTOR	RISK RATIO ESTIMATE (95% CI)	P VALUE
AGE AT TRANSPLANT	1.010 (0.992-1.028)	0.2838
BMI	1.017 (0.972-1.065)	0.4600
DIABETES	0.853 (0.489-1.489)	0.5755
TRANSPLANT YEAR	0.987 (0.854-1.140)	0.8569
CMV SEROSTATUS		
D-/R-	0.590 (0.231-1.507)	0.2702
D+/R+, D-/R+	0.930 (0.555-1.557)	0.7823
D-/R-	Ref	
LIFE SUPPORT VENTILATOR ECMO		
VENTILATOR	2.227 (0.979-5.065)	0.0562
ECMO	0.000 (0.000-0.000)	0.9842
TRANSPLANT TYPE		
MULTIORGAN	2.362 (0.448-12.452)	0.3110
LUNG	4.424 (1.844-10.613)	0.0009
LIVER	3.178 (1.221-8.268)	0.0178
HEART	2.265 (0.847-6.058)	0.1035
KIDNEY	Ref	
BSI POST-TRANSPLANT	8.691 (5.133-14.716)	<.0001

Table 4. Risk factors for 1-year mortality