

Receipt of antibiotics in hospitalized patients increases risk for *C. difficile* infection in subsequent patients who occupy the same bed

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Background

- Individual exposure to antibiotics is the crucial risk factor for *C. difficile* infection (CDI).
- Ward-level use of antibiotics also associates with risk for CDI.
- When the previous occupant of a given hospital room has CDI, the subsequent patient in that room is at increased risk for CDI.

Aims

- To determine whether receipt of antibiotics by prior bed occupants is associated with increased risk for CDI in subsequent patients who occupy the same bed.

Methods

- Retrospective cohort study in adults admitted to any one of 4 large hospitals from 2010-2015.
- Exclusion criteria: recent CDI (90 days), CDI within 48 hours, spent <48 hours in the first hospital bed after admission, prior bed occupant spent <24 hours in the bed.
- The primary exposure was receipt of non-CDI antibiotics by the prior bed occupant.
- The outcome was incident CDI in the subsequent patient in the same bed, defined as a positive stool PCR for toxin B and receipt of treatment for CDI.

Results

Table 1. Characteristics of study subjects.

Characteristics of subjects	Patient Developed CDI (n=576)	Patient Did Not Develop CDI (n=100,039)	P-value
Sex			
Male	279 (48%)	49,192 (49%)	0.73
Female	297 (52%)	50,847 (51%)	
Age			
Under 55	142 (25%)	34,183 (34%)	<0.01
55 to 70	175 (31%)	29,116 (29%)	
Over 70	259 (45%)	36,740 (37%)	
Race/ethnicity			
White	240 (42%)	39,316 (39%)	0.17
Black	47 (8.2%)	10,208 (10%)	
Hispanic	119 (21%)	22,790 (23%)	
Other	170 (30%)	27,725 (28%)	
Ward type			
Medical	193 (34%)	40,830 (41%)	<0.01
Cardiac	72 (13%)	15,308 (15%)	
ICU	178 (31%)	12,109 (12%)	
Surgical	100 (17%)	21,788 (22%)	
Neurological	33 (5.7%)	10,004 (10%)	
Charlson Index			
1 (0-3)	2 (0.3%)	1 (0.2%)	<0.01
Lab values			
Creatinine	1.0 (0.8-1.7)	0.9 (0.7-1.2)	<0.01
Albumin	3.2 (2.7-3.7)	3.9 (3.3-4.5)	<0.01
WBC	10.6 (7.3-14.5)	8.6 (6.3-11.7)	<0.01
LOS (days)			
17 (11-26)	17 (11-26)	6 (4-10)	<0.01
Treatments			
Antibiotics	386 (67%)	27,045 (27%)	<0.01
Hemodialysis	75 (13%)	2,434 (2.4%)	<0.01
Acid suppression	441 (77%)	45,949 (46%)	<0.01
Immunosuppressants	178 (31%)	13,750 (14%)	<0.01

Figure 1. Kaplan-Meier plot showing survival free from *Clostridium difficile* infection (CDI) through 14 days, stratified according to the antibiotics received by the prior bed occupant.

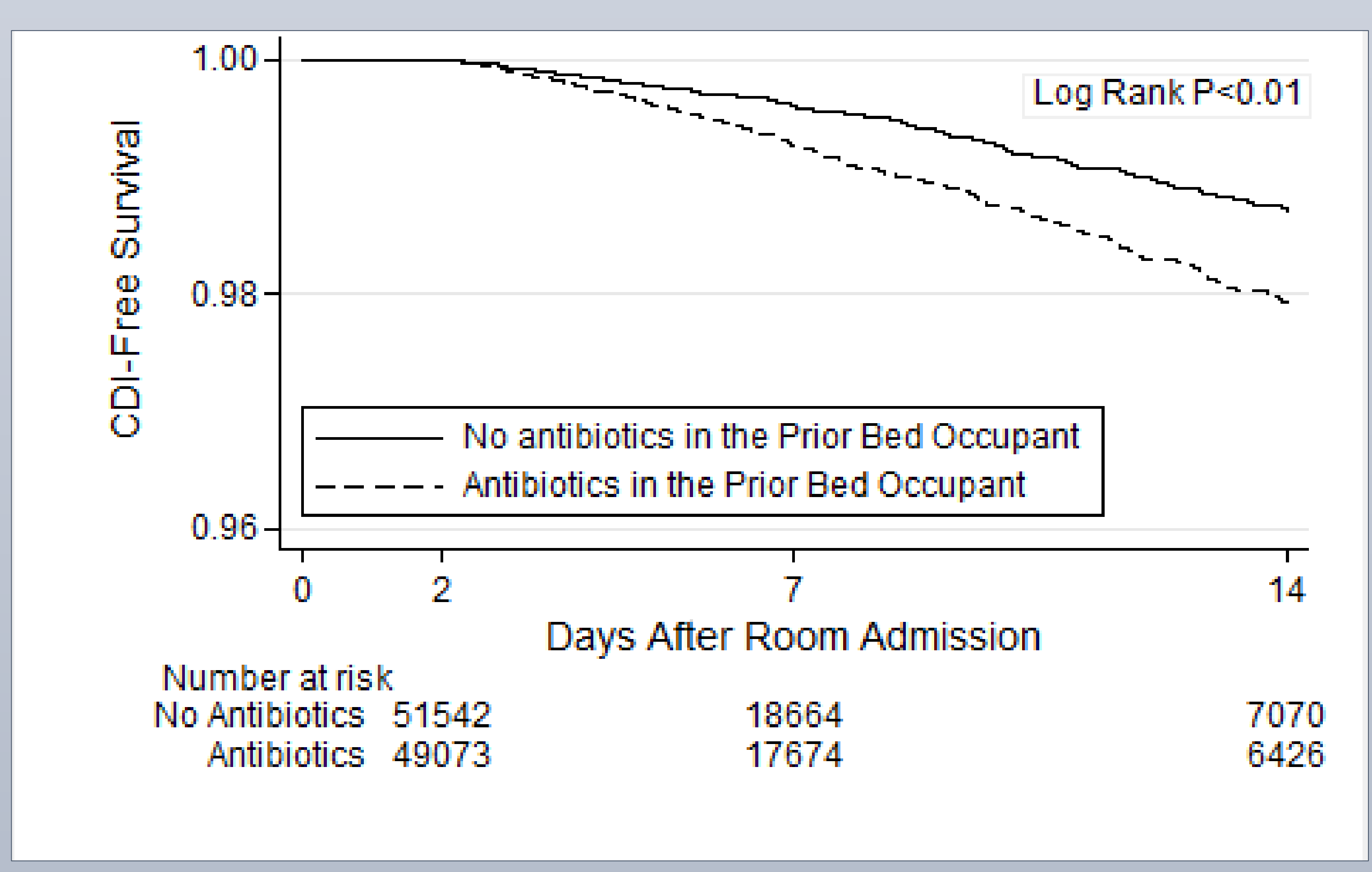


Table 2. Characteristics of prior bed occupants, organized according to whether or not the subsequent patient in the same bed developed CDI.

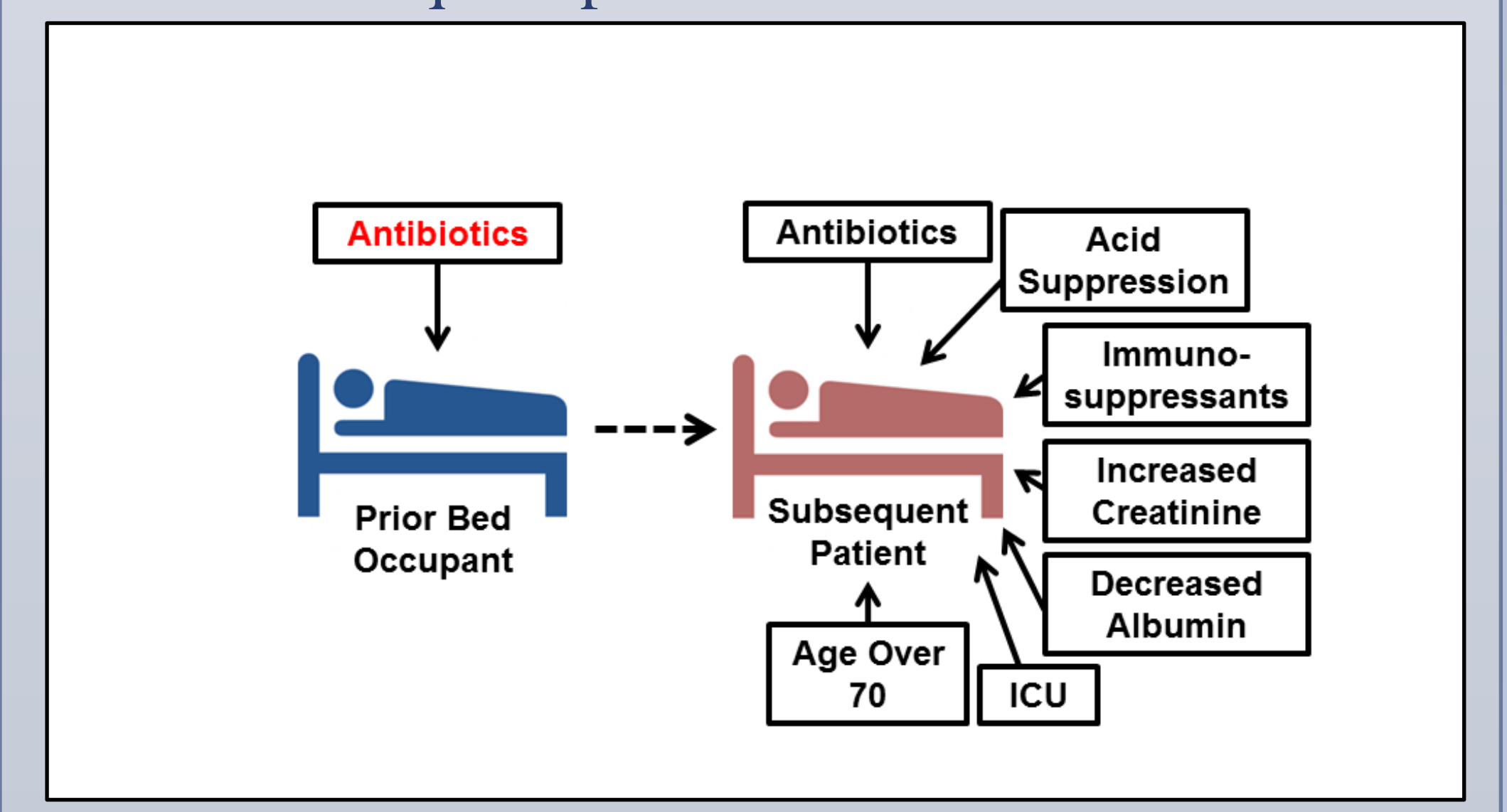
Characteristics of the prior bed occupant	Subsequent Patient Developed CDI (n=576)	Subsequent Patient Did Not Develop CDI (n=100,039)	P-value
Sex			
Male	293 (51%)	49,494 (49%)	0.51
Female	283 (49%)	50,545 (51%)	
Age			
Under 55	161 (28%)	32,922 (33%)	0.04
55 to 70	178 (31%)	29,648 (30%)	
Over 70	237 (41%)	37,469 (37%)	
Race/ethnicity			
White	247 (43%)	38,605 (39%)	0.07
Black	66 (11%)	10,513 (11%)	
Hispanic	135 (23%)	24,709 (25%)	
Other/Unknown	128 (22%)	26,212 (26%)	
Charlson Index			
1 (0-3)	1 (0.3%)	1 (0.2%)	<0.01
Lab values			
Creatinine	1.0 (0.8-1.3)	0.9 (0.7-1.3)	0.13
Albumin	3.5 (2.9-4.3)	3.8 (3.2-4.5)	<0.01
WBC	8.9 (6.5-12.4)	8.3 (6.3-11.5)	0.01
Treatments			
Antibiotics	353 (61%)	48,720 (49%)	<0.01
Hemodialysis	41 (7.1%)	3,960 (4.0%)	<0.01
Acid suppression	368 (64%)	54,959 (55%)	<0.01
Immunosuppressants	172 (29%)	21,718 (22%)	<0.01
<i>C. difficile</i> infection			
Within 90 days prior to admission	1 (0.17%)	146 (0.15%)	0.57
During room admission	11 (1.9%)	1,339 (1.3%)	0.24

Results (contd.)

Table 3. Final Cox proportional hazards model.

Risk Factors	Subjects with CDI/ Total Exposed (%)	Hazard Ratio (95% CI)
Prior bed occupant		
Antibiotics	353/49,073 (0.7%)	1.21 (1.02-1.44)
Subject risk factors		
Age (years)		
Under 55	142/34,325 (0.4%)	Ref
55 to 70	175/29,291 (0.6%)	1.14 (0.91-1.42)
Over 70	259/36,999 (0.7%)	1.42 (1.15-1.75)
Ward type		
Medical	193/41,023 (0.5%)	Ref
Cardiac	72/15,380 (0.5%)	0.87 (0.65-1.13)
Intensive care unit	178/12,287 (1.4%)	1.75 (1.42-2.17)
Surgical	100/21,888 (0.5%)	1.11 (0.87-1.42)
Neurological	33/10,037 (0.3%)	0.88 (0.61-1.23)
Antibiotics	386/27,431 (1.4%)	4.18 (3.50-4.99)
Acid suppression	441/46,390 (1.0%)	2.13 (1.74-2.60)
Immunosuppressants	178/13,928 (1.3%)	1.58 (1.31-1.91)
Creatinine	---	1.07 (1.04-1.11)
Albumin	---	1.30 (1.17-1.45)

Figure 2. Multiple risk factors were identified related to the subsequent patient but, of all the potential risk factors examined that were related to the prior bed occupant, only antibiotics associated with increased risk for CDI in subsequent patients.



Conclusions

- Receipt of antibiotics by prior bed occupants increases risk for CDI in subsequent patients who later occupy the same bed.
- More generally, antibiotics given to one patient may alter the local microenvironment to influence a different patient's risk for CDI.