

# National Prevalence of Multidrug-Resistant *Acinetobacter baumannii* (MDR AB) infections in the Ambulatory and Acute Care Settings, Including Carbapenem-Resistant *Acinetobacter* Infections, in the United States in 2015-2016

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## Abstract

**BACKGROUND:** In 2013 the CDC classified MDR AB infections as a serious threat. The purpose of this study was to estimate the national prevalence of MDR AB events in the acute care and ambulatory settings based on a large database from Becton Dickinson & Company.

**METHODS:** Susceptibility data from non-duplicate isolates were collected from 348 hospitals nationwide from July 2015 to June 2016 and identified as MDR per NHSN definitions. Organisms were classified into ambulatory, admission, and hospital-onset periods based on collection time. All data were consolidated into CMS National Hospital Data Provider IDs. The raking methodology was applied to results across the CMS national hospital distribution by location, teaching status, urban/rural status, and bed size to produce projections of national prevalence estimates.

**RESULTS:** Of 5,882 isolates tested, 2,137 were MDR AB. The national projection of MDR AB events was 18,066 (see Table). The MDR AB rates were highest in the hospital onset period, followed by admission and ambulatory. National projections for the proportion of MDR AB by period across regions were: ambulatory (23.0%, 16.4%, 22.4%, & 11.8%), admission (54.3%, 44.6%, 30.1% & 47.4%) and hospital-onset (61.5%, 64.5%, 39.2% & 49.5%) for the Midwest, Northeast (NE), South & West regions, respectively

Period Tested	Observed Events (348 hospitals)			National Projection		
	Isolates tested	Confirmed MDR AB	% MDR AB	Isolates tested	MDR AB Events	% MDR AB
Ambulatory	2,537	551	21.7%	21,001	4,309	20.5%
Admission	1,209	502	41.5%	9,859	4,196	42.6%
Hospital-onset	2,136	1,084	50.7%	18,018	9,561	53.1%
<b>Total</b>	<b>5,882</b>	<b>2,137</b>	<b>36.3%</b>	<b>48,878</b>	<b>18,066</b>	<b>37.0%</b>
Regions						
Midwest	1,474	654	44.4%	14,906	6,455	43.3%
NE	978	396	40.5%	9,699	4,234	43.7%
South	2,844	838	29.5%	19,234	5,679	29.5%
West	586	249	42.5%	5,039	1,699	33.7%
<b>Total</b>	<b>5,882</b>	<b>2,137</b>	<b>36.3%</b>	<b>48,878</b>	<b>18,066</b>	<b>37.0%</b>

**CONCLUSION:** The estimates of national hospital onset MDR AB rates in July 2015 to June 2016 are higher than previously reported estimates. The highest rates of MDR AB events occurred in the hospital-onset period, however 27% of MDR AB events occurred in the ambulatory period. The highest rates and number of events of MDR AB in the hospital-onset period were seen in the Midwest and Northeast regions.

## Introduction

*Acinetobacter baumannii* is traditionally a nosocomial pathogen, but it is now emerging in the outpatient setting. Approximately 2% of healthcare-associated infections (HAIs) reported to CDC's National Healthcare Safety Network (NHSN) are caused by *Acinetobacter* species. In 2013, the CDC classified MDR A. *baumannii* (MDR AB) infections as a serious threat.<sup>1</sup>

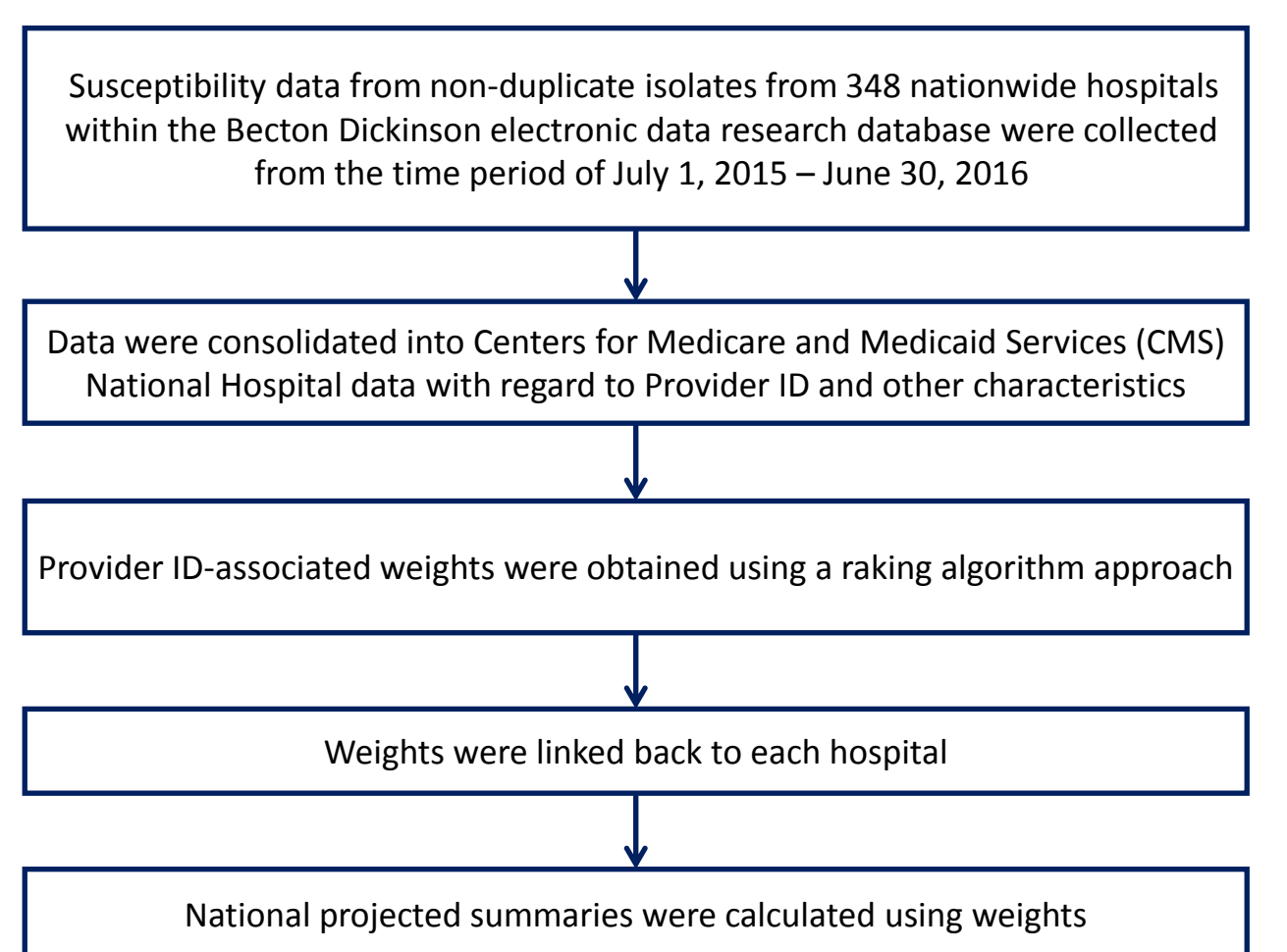
Additionally, HAIs caused by *Acinetobacter* species often result in high mortality and economic burden.<sup>2</sup> According to an NHSN report of antimicrobial resistance patterns for HAIs in 2009-2010, of *Acinetobacter baumannii* HAIs MDR AB was found in 60% of catheter-associated urinary tract infections, central line-associated infections, and ventilator associated pneumonia in the US.<sup>3</sup> The CDC estimates ~12,000 HAIs caused by *Acinetobacter* species occur annually in the US, and of these, ~7,000 (>60%) are multidrug-resistant. A recent study that used a Veterans Affairs EMR database estimated the incidence of MDR AB HAIs to be >12,000 per year.<sup>2</sup> However, little have been reported on the prevalence of infections in non-hospital settings.

The purpose of this study was to estimate the national prevalence of MDR AB events in the acute care and ambulatory settings in the US in July 2015 to June 2016 based on a large database from Becton Dickinson & Company.

## Methods

- Non-duplicate isolates (first isolate of a species per 30 day period) collected from 348 nationwide hospitals (Table 1) from respiratory, blood, urine, skin, intra-abdominal, and other sources were identified as MDR per NHSN definitions<sup>3</sup>
  - Multidrug resistance for *Acinetobacter baumannii* (MDR AB) was defined as a pathogen that tested as intermediate or resistant to at least 1 drug in 3 of the 6 following classes: extended-spectrum cephalosporins (ceftazidime, cefepime, ceftriaxone, or cefotaxime), fluoroquinolones, aminoglycosides, carbapenems, piperacillin or piperacillin/tazobactam, and ampicillin/sulbactam
- Isolates were categorized into three settings by the specimen collection time:
  - Admission:** Within 3 days of an inpatient admission and no previous admission within 14 days
  - Hospital-onset:** 3 days or more post-admission or within 14 days of discharge
  - Ambulatory:** Neither a or b
- All data were consolidated into CMS (Centers for Medicare and Medicaid Services) National Hospital Data Provider IDs
- The raking method was applied per CMS national hospital distribution by location, teaching status, urban/rural status, and bed size to project the national prevalence estimates. Raking has been borrowed from survey research methods. Raking uses an iterative proportional fitting algorithm to force estimates to match known underlying distribution totals.
- Figure 1 demonstrates the projection methodology for determining national prevalence estimates

Figure 1. Projection Methodology for determining national prevalence estimates



## Results

- For the 348 facilities 5,882 non-duplicate *A. baumannii* isolates were identified and tested for susceptibility in 5,113 patients
  - 2,137 (36.3%) of the isolates were determined to be MDR AB (Figure 3, Table 2) in 1,685 patients
  - The proportion of observed MDR AB events was highest in the hospital onset period (50.7%), followed by admission (41.5%) and ambulatory (21.7%) settings (Table 2)
- The top three sources identified as MDR A. *baumannii* isolates were: skin (37.0% of isolates), respiratory (36.9% of isolates), and urine (17.4% of isolates) (Figure 2)
- The national projected number of events and proportion of MDR A. *baumannii* events were 18,066 (37.0%) (Table 2)
- National projections for MDR AB for each region were: ambulatory (23.0%, 16.4%, 22.4%, & 11.8%), admission (54.3%, 44.6%, 30.1% & 47.4%) and hospital-onset (61.5%, 64.5%, 39.2% & 49.5%) for the Midwest, Northeast, South & West regions, respectively (Table 3)

Table 1. Hospital Characteristics

Hospital Characteristics	BD Database N=348 Hospitals	CMS Database N=4,650 Hospitals
Teaching Status		
Major	12.9%	9.6%
Limited	19.3%	13.2%
Graduate	4.6%	2.8%
No Affiliation	63.2%	74.5%
Bed Size		
<100 beds	22.8%	50.8%
100-300 beds	41.3%	30.3%
≥300 beds	35.8%	19.0%
Urban/Rural Status		
Urban	75.9%	57.8%
Rural	24.1%	42.2%
Region		
Northeast	9.5%	8.9%
South	47.7%	41.1%
Midwest	27.0%	30.1%
West	15.8%	19.9%

BD= Becton Dickinson; CMS= Centers for Medicare and Medicaid Services

Figure 2: Source distribution for MDR A. *baumannii* (N=2,137) from 348 facilities

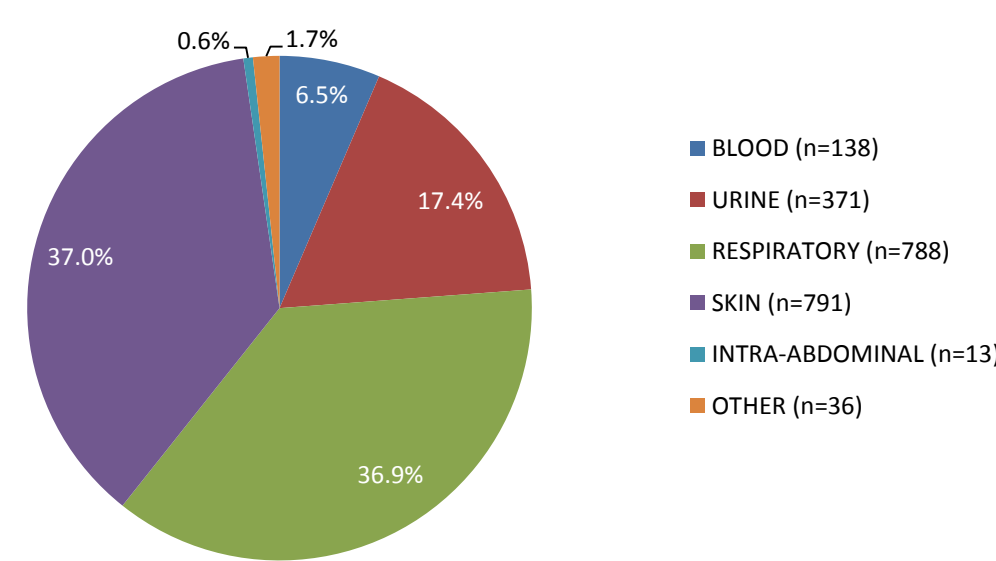


Figure 3: Source distribution of MDR A. *baumannii* for projections of national prevalence by setting type

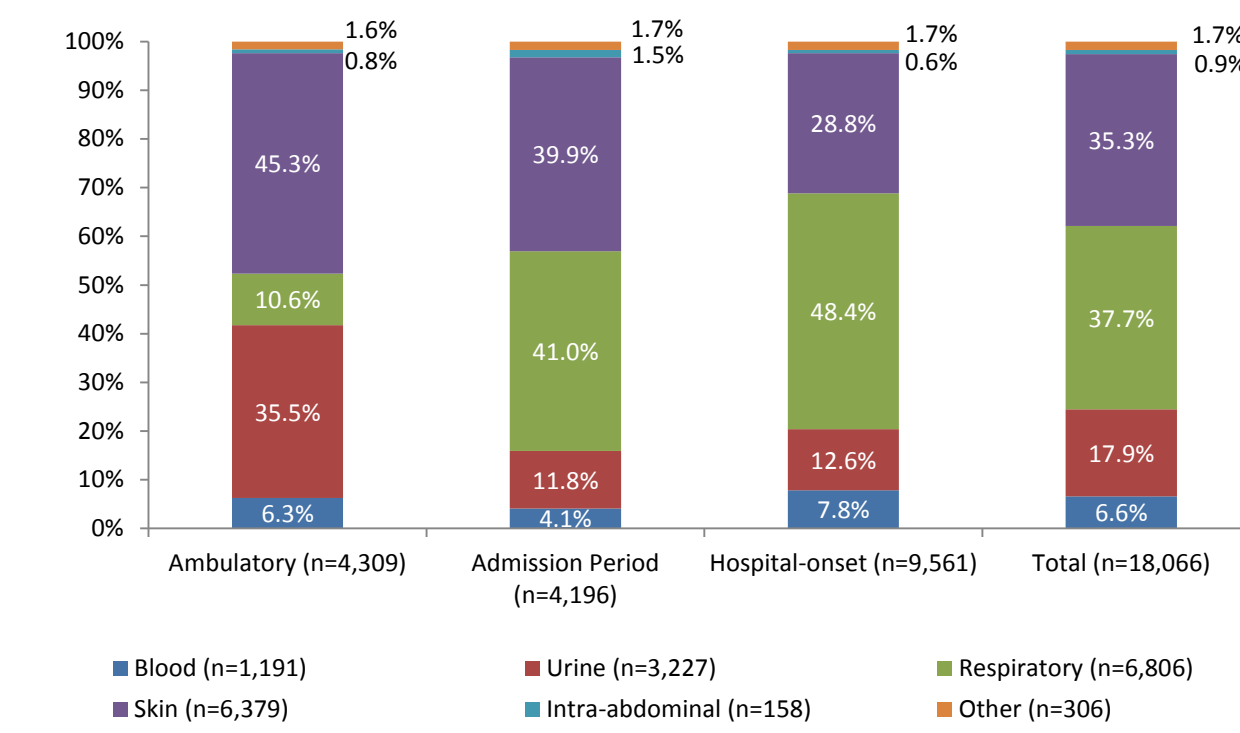


Table 2. National projection of MDR A. *baumannii* events estimated from observed events from the 348 hospitals in the BD database

Period	348 Facilities Observed			NATIONAL PROJECTIONS		
	Total Tested, N	MDR, N	% MDR	Projected Org Tested, N	Projected MDR, N	Projected % MDR
Ambulatory	2,537	551	21.7%	21,001	4,309	20.5%
Admission	1,209	502	41.5%	9,859	4,196	42.6%
Hospital-Onset	2,136	1,084	50.7%	18,018	9,561	53.1%
<b>Grand Total</b>	<b>5,882</b>	<b>2,137</b>	<b>36.3%</b>	<b>48,878</b>	<b>18,066</b>	<b>37.0%</b>

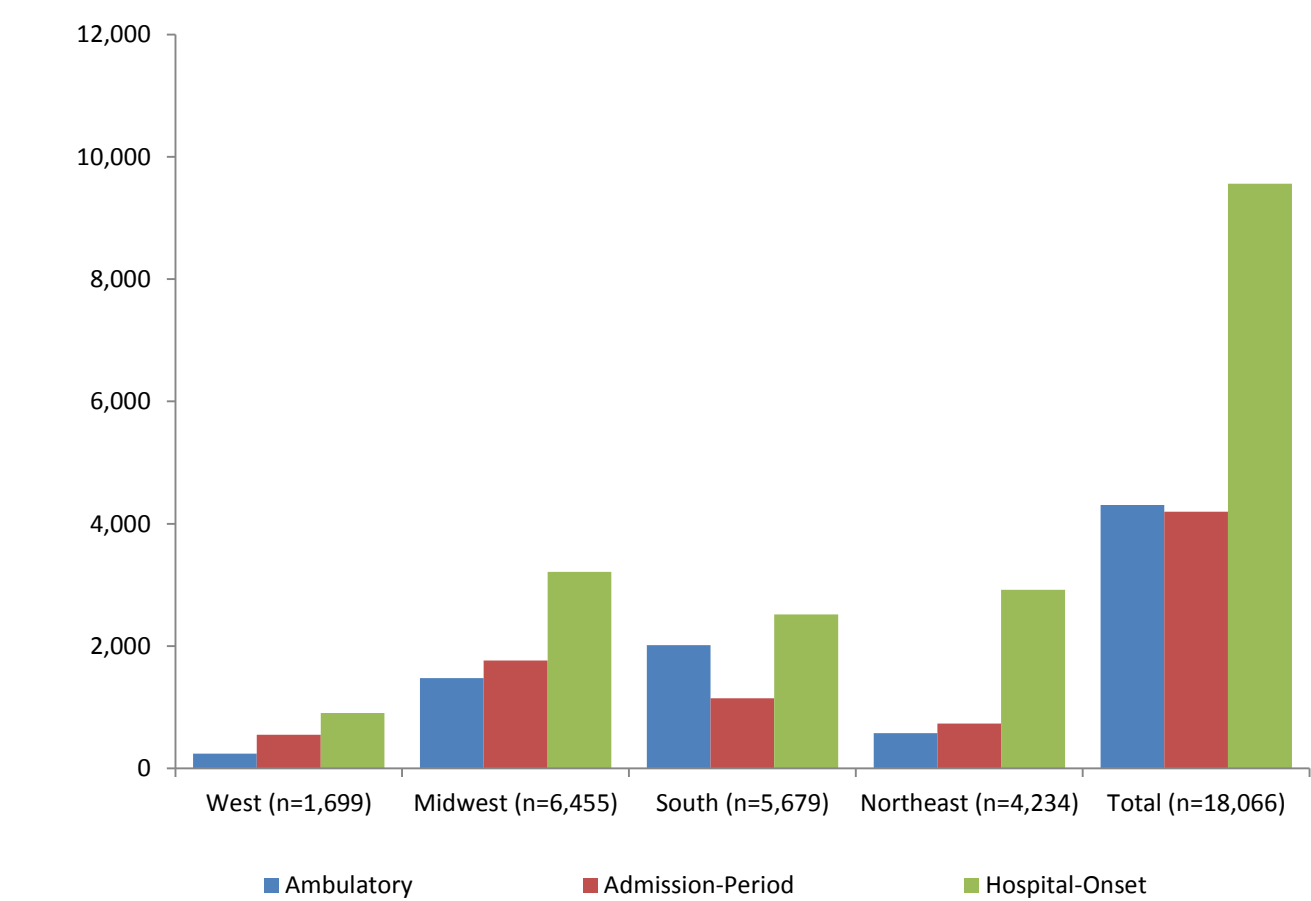
Table 3. National projections of MDR AB events (n) and MDR AB rates (%) by period tested and region. Subtotal "N" represents number of projected events. MDR AB rates are shown as a percentage of projected organisms tested.

Region	Setting	MDR % (n)
West	Ambulatory	11.8% (243/2,048)
	Admission	47.4% (550/1,161)
	Hospital-Onset	49.5% (906/1,830)
<b>Subtotal</b>		<b>33.7% (1,699/5,039)</b>
Midwest	Ambulatory	23.0% (1,476/6,430)
	Admission	54.3% (1,765/3,248)
	Hospital-Onset	61.5% (3,214/5,229)
<b>Subtotal</b>		<b>43.3% (6,455/14,906)</b>
South	Ambulatory	22.4% (2,014/9,004)
	Admission	30.1% (1,146/3,802)
	Hospital-Onset	39.2% (2,519/6,428)
<b>Subtotal</b>		<b>29.5% (5,679/19,234)</b>
Northeast	Ambulatory	16.4% (577/3,519)
	Admission	44.6% (736/1,648)
	Hospital-Onset	64.5% (2,921/4,531)
<b>Subtotal</b>		<b>43.7% (4,234/9,699)</b>

### Author Disclosure Information

V. Gupta: D. Employee; Self; BD; M Olesky: D. Employee; Self; Tetraphase Pharmaceuticals; J Mohr: D. Employee; Self; Medical Affairs Strategic Solutions, LLC; YP Tabak: D. Employee; Self; BD; H Hoffman-Roberts: D. Employee; Self; Theravance Biopharma; P Scoble: D. Employee; Self; Cempra; RS Johannes: D. Employee; Self; BD.

Figure 4. National projection of MDR A. *baumannii* events by region and setting



Total "N" represents number of projected events

## Conclusions

- These data suggest that national hospital onset MDR AB rates in the 12 months ending June 2016 may be higher than previously reported estimates<sup>1-3</sup>
- The highest rates of MDR AB events occur in the hospital-onset period, however 24% of MDR AB events occur in the ambulatory period
- The predominant sources were skin and urine in the ambulatory setting whereas respiratory and skin were predominant in the inpatient setting
- The highest number of MDR AB events were seen in the Midwest and South regions
- The limitations to this study include that many methodologies are available to determine projections, and projections beyond the underlying data sample always have underlying assumptions and carry some risk

### References

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