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Multidrug Resistant *Pseudomonas aeruginosa* (MDR-PSA) in USA Hospitals by Geographic Region in 2015-2016

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Abstract

Background: We examined the prevalence of multidrug resistant *Pseudomonas aeruginosa* (MDR-PSA) in hospitalized patients across different USA geographic regions.

Methods: Utilizing an electronic research dataset established by Becton Dickinson & Company from 348 USA hospitals from July 2015 – June 2016, non-duplicate PSA isolates (first isolate of a species per 30 day period) from all sources were identified as MDR if intermediate/resistant, as defined by NHSN, to > 1 antibiotic in 3 of the 5 drug classes: ceftazidime or cefepime; ciprofloxacin or levofloxacin; aminoglycosides, carbapenems; and piperacillin/tazobactam. Isolates were categorized as either: admission (< 3 days of an inpatient admission and no previous admission within 14 days) or hospital-onset (≥ 3 days or more post-admission or within 14 days of discharge). Geographic regions were classified into NHSN categories,[2] with Region 1, 7, and 8 being grouped into "other" due to small number of hospitals. We conducted pairwise comparison between regions using the region with the lowest MDR-PSA rate as the reference group.

Results: The overall MDR-PSA rate was 15.1% (7,069/46,729) with admission and hospital-onset settings rates of 12.3% (2,393/19,491) vs 17.2% (4,676/27,238), respectively (p<0.0001). Significant regional differences were noted within admission and hospital-onset settings compared to Region 10 in both settings (see Table 2).

Conclusions: The overall MDR-PSA rate was significantly higher for the hospital-onset setting in the US hospitals, with 1 in 6 PSA isolates being MDR positive. There is a significant regional difference in MDR-PSA rates. Hospitals in different geographic regions need to be aware of their local epidemiology for MDR-PSA when selecting empiric antibiotics for patients at risk of infection with PSA.

Background

Each year in the United States, at least 2 million people acquire serious infections with bacteria that are resistant to one or more of the antibiotics designed to treat those infections.[1] *Pseudomonas aeruginosa* is a common cause of healthcare-associated infections with some isolates resistant to multiple antibiotics.

Purpose

We examined the prevalence of MDR-PSA in hospitalized patients across different USA geographic regions.

Methods

- A cohort of the same 348 hospitals reporting data from July 2015 to June 2016 from the Becton Dickinson electronic data research database were analyzed.
- All non-duplicate PSA isolates (first isolate of a species per 30 day period) from respiratory, blood, urine, skin, intra-abdominal, and other sources were identified as MDR if intermediate or resistant to at least 1 in 3 of the 5 drug classes: ceftazidime or cefepime; ciprofloxacin or levofloxacin; aminoglycosides, carbapenems; and piperacillin or piperacillin/tazobactam[2].
- Isolates were categorized into three settings by the specimen collection time:
  1) Admission: within 3 days of an inpatient admission and no previous admission within 14 days
  2) Hospital-onset: ≥3 days post-admission or within 14 days of discharge
  3) Ambulatory (neither a or b)
- Geographic regions were classified into National Healthcare Safety Network (NHSN) categories, with Region 1, 7, and 8 being grouped into "other" due to small number of hospitals.[2] We conducted pairwise comparison between regions using the region with the lowest MDR-PSA rate as the reference group.

Results

- The overall MDR-PSA rate was 15.1% (7,069/46,729) with admission and hospital-onset settings rates of 12.3% (2,393/19,491) vs 17.2% (4,676/27,238), respectively (p<0.0001).
- Significant regional differences were noted within admission and hospital-onset settings compared to Region 10 in both settings (see Table 3).

Conclusion

- The overall MDR-PSA rate was significantly higher for the hospital-onset setting in the US hospitals, with 1 in 6 PSA isolates being MDR positive.
- There was a significant regional difference in MDR-PSA rates. Hospitals in different geographic regions need to be aware of their local microbiological epidemiology for MDR-PSA in selecting empiric antibiotics for patients at risk of infection with PSA.

Limitations

- These data were collected from the laboratory information system feeds provided by participating hospitals and relied on interpretive results reported at each facility.
- These data were collected and analyzed from the perspective of unique non-duplicate collected cultures and not from the perspective of unique patients. The goal was to understand the volume and frequency of these organisms that were seen at the level of the hospital/microbiology laboratory across a large number of geographical diverse institutions.

Table 1: Hospital characteristics

Region	States	Hospital N (%)
2	NJ, NY, PR, VI	28 (8.0%)
3	DE, DC, MD, PA, VA, WV	11 (3.2%)
4	AL, FL, GA, KY, MS NC, SC, TN	101 (29.0%)
5	IL, IN, MI, MN, OH, WI	91 (26.2%)
6	AR, LA, NM, OK, TX	55 (15.8%)
9	AZ, CA, HI, Pacific Islands	27 (7.8%)
10	AK, ID, OR, WA	22 (6.3%)
1, 7, 8*	Other	13 (3.7%)
Overall		**348**
Urban/Rural		
Urban	75.9%	
Rural	24.1%	
Medical School Affiliation		
Major	12.9%	
Limited	19.3%	
Graduate	4.6%	
No Affiliation	63.2%	
Bed size		
<100	22.7%	
100-300	40.2%	
>300	37.1%	

* Regions were combined due to insufficient facility count within each individual region (CT, ME, MA, NH, RI, VT, IA, KS, MO, NE, CO, MT, ND, SD, UT, and WY).

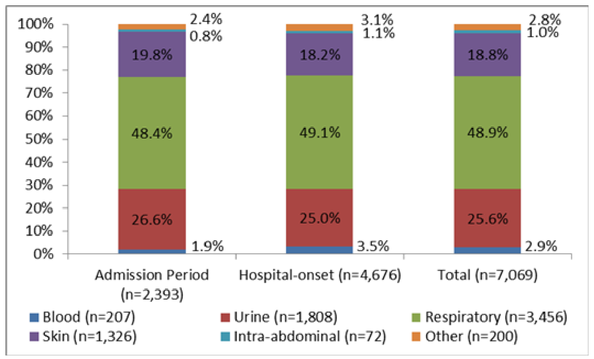
Table 2: MDR PSA rates by region and hospital setting

Region	States	Admission period	Hospital-onset	Total
2	NJ, NY, PR, VI	12.1% (217/1,795)	18.2% (592/3,251)	16.0% (809/5,046)
3	DE, DC, MD, PA, VA, WV	9.5% (71/749)	11.3% (91/803)	10.4% (162/1,552)
4	AL, FL, GA, KY, MS, NC, SC, TN	11.9% (734/6,155)	17.6% (1,445/8,203)	15.2% (2,179/14,358)
5	IL, IN, MI, MN, OH, WI	13.1% (632/4,832)	16.7% (1,077/6,434)	15.2% (1,709/11,266)
6	AR, LA, NM, OK, TX	14.0% (416/2,980)	18.8% (819/4,361)	16.8% (1,235/7,341)
9	AZ, CA, HI, Pacific Islands	12.9% (237/1,842)	18.6% (499/2,690)	16.2% (736/4,532)
10	AK, ID, OR, WA	9.0% (46/510)	9.1% (75/826)	9.1% (121/1,336)
1, 7, 8	Other	6.4% (40/628)	11.6% (78/670)	9.1% (118/1,298)
Total		**12.3% (2,393/19,491)**	**17.2% (4,676/27,238)**	**15.1% (7,069/46,729)**

Table 3: MDR *P. aeruginosa* rates by setting and source

Source	Setting	MDR *P. aeruginosa*
All sources	Admission Period	12.3% (2,393/19,491)
	Hospital-onset	17.2% (4,676/27,238)
	Subtotal	15.1% (7,069/46,729)
Blood	Admission Period	6.0% (45/746)
	Hospital-onset	11.7% (162/1,384)
	Subtotal	9.7% (207/2,130)
Urine	Admission Period	11.6% (637/5,505)
	Hospital-onset	12.8% (1,171/9,141)
	Subtotal	12.3% (1,808/14,646)
Respiratory	Admission Period	18.0% (1,159/6,425)
	Hospital-onset	24.5% (2,297/9,386)
	Subtotal	21.9% (3,456/15,811)
Skin	Admission Period	8.3% (475/5,695)
	Hospital-onset	14.1% (851/6,017)
	Subtotal	11.3% (1,326/11,712)
Intra-abdominal	Admission Period	6.2% (20/321)
	Hospital-onset	16.2% (52/321)
	Subtotal	11.2% (72/642)
Other	Admission Period	7.1% (57/799)
	Hospital-onset	14.5% (143/989)
	Subtotal	11.2% (200/1,788)

Figure 1: MDR *P. aeruginosa* source distribution by hospital setting



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