Antibiotic Resistance Patient Safety Atlas
Antibiotic Resistance HAI Data

Executive Summary

The Antibiotic Resistance (AR) Healthcare Associated Infection (HAI) dataset of the AR Patient Safety Atlas is a portal that allows users to visualize national, regional, and state-level antibiotic resistance data from device and procedure related healthcare-associated infections (HAIs) commonly reported to the CDC's National Healthcare Safety Network (NHSN):

- central line-associated bloodstream infections (CLABSI)
- catheter-associated urinary tract infections (CAUTI)
- surgical site infections (SSI).

Thirty-one resistant phenotypes (bug-drug combinations) are presented, including methicillin-resistant *Staphylococcus aureus* (MRSA) and carbapenem-resistant Enterobacteriaceae (CRE). We encourage the public, healthcare facility staff, as well as state, local, and federal public health authorities to explore the data for educational purposes and to inform efforts to combat the growing threat of antibiotic resistance in healthcare facilities.

KEY TAKEAWAYS

- **More work is needed. The Atlas data show we are moving the right direction, but improvements have been small.**
- **The Atlas data show signals that resistant *E. coli* HAIs may be increasing.**
- **Resistant HAIs affect both young and old patients, and occur in all three of the common event types reported in the Atlas.**
- **These data are from four years of surveillance, during a time when there was a great increase in the number of HAIs reported because of changed reporting requirements.**

Data Sources

These data were reported to NHSN from 2011-2014 by 4,403 healthcare facilities, including

- general acute care hospitals (n=3,676)
- long term acute care hospitals (n=506)
- free-standing inpatient rehabilitation hospitals (n=221).

Long term care and skilled nursing facilities were not included at this time due to insufficient available data. More information about the types of data included in the Atlas can be found in the Methodology document, on the home page of the Atlas.

The summary metrics produced by this Atlas only reflect HAIs reported to NHSN, and are not adjusted to produce national estimates of antibiotic resistance, as was reported in the 2013 Antibiotic Resistance Threats report, available at: http://www.cdc.gov/drugresistance/pdf/ar-threats-2013-508.pdf

Percent Resistance

The main summary measure is the percent of bacteria causing the HAI that were resistant to a specific antibiotic (percent resistant). Caution is advised when comparing the percent resistant across states, territories, and Census regions, as HAI reporting requirements vary by state, as the percent resistance are not adjusted for patient-level factors like demographics or severity of illness (e.g. receiving care in an intensive care unit). More information is available in the Footnotes that appears under the Map View.

States/territories reported a wide range of percentages of bacteria resistant to antibiotics causing HAIs. These include pathogens identified by CDC a "Urgent or Serious" threats, such as

- carbapenem-resistant Enterobacteriaceae (CRE)
- methicillin resistant *Staphylococcus aureus* (MRSA)
- multidrug-resistant (MDR) *P. aeruginosa*
- MDR *Acinetobacter*

The AR HAI dataset shows:

- The percent of Enterobacteriaceae resistant to carbapenems (CRE) causing HAIs among states ranged from 0–27.9% (3.5% nationally), with higher percent resistance in several Northeast states and sporadically across the country.
- The percent of *Staphylococcus aureus* resistant to methicillin (MRSA) causing HAIs among states ranged from 32.5–67.8% (46.4% nationally), with higher percent resistance reported among Southeastern states.
- The percent of *P. aeruginosa* resistant to antibiotics in at least 3 categories (Multidrug-resistant *P. aeruginosa*) causing HAIs among states ranged from 3.1–46.9% (14.2% nationally), with higher percent resistance reported among several Southeastern states and sporadically across the country.
- The percent of *Acinetobacter* resistant to antibiotics in at least 3 categories (Multidrug-resistant *Acinetobacter*) causing HAIs among states ranged from 5.0–88.1% (54.8% nationally), with highly variable reporting of this less common pathogen across the country.
- The percent of Enterobacteriaceae resistant to Extended-spectrum cephalosporins (indicative of extended-spectrum β lactamase presence) causing HAIs among states varied by organism:
  - *E. coli*: 0–24.4% (13.4% nationally), with higher percent resistance reported among some Northeastern, Western states, and territories.
  - *Klebsiella* spp.: 0–73.0% (20.0% nationally), with higher percent resistance reported among some Northeastern, Western states, and territories.
  - *Enterobacter* spp.: 15.0–43.2% (28.5% nationally), with less variability reported across states comparted to other ESBL pathogens.
- The percentage of *Enterococcus* resistant to vancomycin (Vancomycin-resistant *Enterococcus* spp. [VRE]) causing HAIs in states varied by species:
  - *E. faecium*: 38.5–86.5% (77.3% nationally), with high resistance prevalence reported among most states.
  - *E. faecalis*: 0–17.8% (6.9% nationally), with higher resistance prevalence reported among some Midwestern, Northeastern, Mid-Atlantic, and Western states.

Additional pathogens included in the AR HAI dataset that may be of interest include:

- The percent of *Staphylococcus aureus* resistant to methicillin (MRSA) and additional antibiotics suggesting origin in the community (Community-associated MRSA) causing HAIs among states ranged from 10.0–55.5% (31.2% national resistance), with higher prevalence reported in some Southern states.
- The percent of *Staphylococcus aureus* resistant to methicillin (MRSA) and additional antibiotics commonly used to treat MRSA: linezolid, daptomycin, or intermediate/resistance to vancomycin, causing HAIs were rarely reported (0.7%, 1.3%, 0.2% respectively) across the country.
- The percent of *E. coli* resistant to fluoroquinolone (a commonly prescribed class of antibiotics for infections thought to be caused by *E.coli* and related organisms) causing HAIs among states ranged from 12.1–50.5% (33.0% national resistance), with higher percent resistance reported in many Southern states, some Western states, and territories.
- The percent of *P. aeruginosa* resistant to piperacillin/tazobactam causing HAIs among states ranged from 0–41.7% among states (10.0% national resistance), with higher prevalence reported in several Southern states and sporadically across the country.

Data Limitations

Between 2011 and 2014, small changes were seen in the percent resistance for many phenotypes. Some of these changes may be due to increases in types of HAIs reported or changes limited to certain facility types; reporting for CAUTI and from non-intensive care units, for example, increased dramatically during this period. However, these changes are not of clinical relevance and should not change clinical recommendations made by CDC in the past. These changes may indicate a general direction but not necessarily a definitive trend.

With these data limitations in mind, the percent of *E.coli* with three antibiotic resistance patterns: Extended-spectrum cephalosporins (indicative of extended-spectrum βlactamase presence) resistance, multidrug-resistance, and fluoroquinolone

resistance, increased slightly (e.g. Extended-spectrum cephalosporin percent resistance increase from 12.1% to 14.7%), but not likely enough to affect clinical practice. Further assessments are needed to identify the key drivers of any increases, including community-based infections and those linked to various types of healthcare delivery.

Acknowledging the data limitations above, the percent resistance of many other bacteria, including CRE, Multidrug-resistant *Acinetobacter*, and Multidrug-resistant *Pseudomonas*, show signals of a slight decrease but not enough to affect clinical practice. Still, continued improvements in antibiotic prescribing and use (or stewardship), infection prevention, and stopping spread are critically needed to stop the emergence and spread of antibiotic resistance and can help lower percent resistance in facilities and communities.

For more information about the AR Patient Safety Atlas Antibiotic Resistance HAI dataset, visit: http://www.cdc.gov/hai/surveillance

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