

Illinois Carbapenem-Resistant *Acinetobacter baumannii* (CRAB) Surveillance Report, July 2019 – December 2020

Introduction

Carbapenem-Resistant *Acinetobacter baumannii* (CRAB) is an emerging pathogen in health care settings in the United States. Few antibiotics are available to treat CRAB infections, and attributable mortality for *Acinetobacter baumannii* infections can range from 8% to 37% [1]. CRAB is a highly persistent pathogen in inpatient health care settings due to its ability to easily contaminate the environment and remain viable for extended periods of time on surfaces, as well as spread from colonized individuals [2-4].

In 2019, the Illinois Department of Public Health (IDPH) developed a pilot surveillance program for CRAB in cooperation with a subset of both hospital and commercial labs. IDPH submits clinical CRAB isolates from these partners to the Centers for Disease Control and Prevention's (CDC's) Antimicrobial Resistance (AR) Laboratory Network for carbapenemase identification and further antibiotic resistance testing.

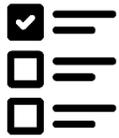
Since July 1, 2019, all isolates identified by this program are reported in the XDRO registry, a web-based interface for reporting and notification of extensively drug-resistant organisms. Facilities are encouraged to query the database or enroll in automated alerts upon patient admission to identify patients with drug-resistant infections and to implement infection control precautions.

To support efforts to limit the spread of CRAB in Illinois, this report examines the trends and patterns of CRAB infections reported to the XDRO registry from the start of pilot surveillance in July 2019 through December 31, 2020.

Key Points

- ❖ CRAB is a highly persistent pathogen in health care environments, and enhanced environmental cleaning is essential to controlling outbreaks.
- ❖ Of cases with carbapenemase testing performed, 91% had isolates with an OXA-24/40 carbapenemase; only 7% had no carbapenemase identified.
- ❖ During the COVID-19 pandemic, high patient loads combined with personnel and supply pressures have contributed to outbreaks of CRAB in Illinois.
- ❖ Mandating reporting of CRAB colonization and infection would allow for improved surveillance and interfacility notification through the XDRO registry.

Methods



Surveillance Criteria and Case Definition

- All CRAB reports from July 1, 2019 through December 31, 2020 submitted to the XDRO registry as part of the pilot laboratory-based surveillance program were included.
- Isolates are included in the pilot surveillance if it has been more than 90 days since any previous isolates have been submitted for that patient, or if the isolate comes from a more invasive source (e.g., a blood specimen following a urine specimen, or any clinical specimen following a screening specimen).

Case Definition

- *CRAB Case* – the first positive specimen, by specimen collection date, of a given mechanism, per patient from July 1, 2019-December 31, 2020. If the first positive specimen is a screening specimen, the first subsequent positive clinical specimen is also included as a case.
- *Clinical CRAB Case* – a CRAB case from a specimen obtained from an individual over the course of clinical care (e.g., blood, respiratory, or wound specimens).
- *Pan-nonsusceptible* – non-susceptible (intermediate or resistant) to all antibiotics tested at AR Lab Network (amikacin, aztreonam, cefepime, cefotaxime, ceftazidime, ciprofloxacin, colistin, doripenem, doxycycline, ertapenem, gentamicin, imipenem, levofloxacin, meropenem, minocycline, piperacillin/tazobactam, polymixin b, ticarcillin/ clavulanic acid, tigecycline, tobramycin, and trimethoprim/sulfamethoxazole).

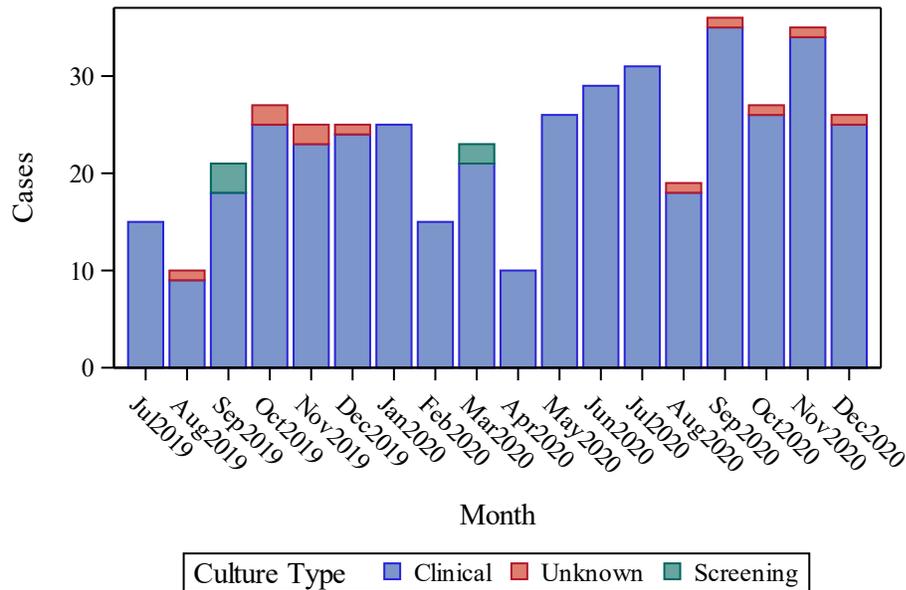


Deduplication

- Patients were de-duplicated over the entire reporting period by patient last name, first initial, and date of birth. The report with the earliest culture date per patient was included.
- For case-level analyses, the first report by culture date of a given mechanism per person was included; the first clinical case of a given mechanism was also included if it followed the screening case (see case definition above).

Surveillance Data

Figure 1. CRAB cases¹ reported to the Illinois XDRO registry by date of earliest specimen collection, 7/1/2019-12/31/2020



- ❖ A total of 441 CRAB isolates were reported to the XDRO registry between July 1, 2019 and December 31, 2020, of which 425 were incident cases of CRAB.
 - ❖ Of reported cases, 409 (96%) were clinical cases. Screening cases were identified as part of outbreak response to clinical cases.
- ¹ Cases include 1 (0.2%) colonized to clinical case.

Box 1. Patient characteristics

- ❖ Between July 1, 2019 and December 31, 2020, 413 unique individuals were reported to the registry with evidence of CRAB colonization or infection.
- ❖ The median age among individuals with CRAB cases was 64 (range: 0-99).
- ❖ Most patients were male (248/413, 60%).
- ❖ Due to the reliance on laboratory reporting, no race/ethnicity data was available.
- ❖ Approximately one third (119/413, 29%) of patients with CRAB also had a *Candida auris* (60, 15%) or carbapenem-resistant *Enterobacterales* (CRE; 102, 25%) isolate reported to the XDRO registry between November 2013 and December 2020.

Organism Characteristics

Table 1. Mechanism of resistance among clinical CRAB cases², 2019-2020.

Mechanism of Resistance	Year of Specimen Collection		
	2019 (N = 114)	2020 (N = 295)	Total (N = 409)
<i>OXA-24/40</i>	73 (64%)	228 (77%)	301 (74%)
<i>OXA-23</i>	1 (1%)	1 (0.3%)	2 (1%)
<i>NDM-1, OXA-23</i>	2 (2%)	1 (0.3%)	3 (1%)
<i>None detected</i>	7 (6%)	17 (6%)	24 (7%)
<i>No mechanism testing performed</i>	31 (27%)	48 (16%)	79 (19%)

- ❖ Of 409 clinical cases, 330 (81%) had mechanism testing performed; the most common mechanism was *OXA-24/40* (301/330, 91%).
- ❖ The only multiple-mechanism combination seen was *OXA-23* and *NDM-1*, which was associated with three cases.

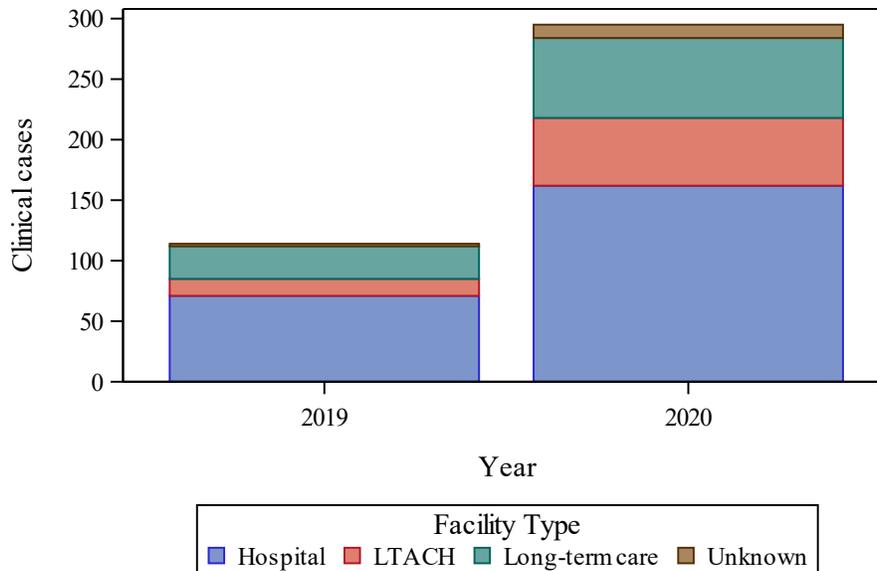
² N = 409 cases. No patient had reports of multiple clinical isolates with differing mechanisms.

Box 2. Susceptibility characteristics

- ❖ Of 333 CRAB cases with susceptibility testing performed through the AR Laboratory Network, 74 (22%) were pan-nonsusceptible.
- ❖ Only one of 88 (1%) cases in 2019 were pan-nonsusceptible, increasing to 73/245 (30%) in 2020.
- ❖ Of the 74 pan-nonsusceptible isolates, 23 were associated with an intensive care unit outbreak in an acute care hospital that began in 2020 (see Box 3).

Facility and Specimen Characteristics

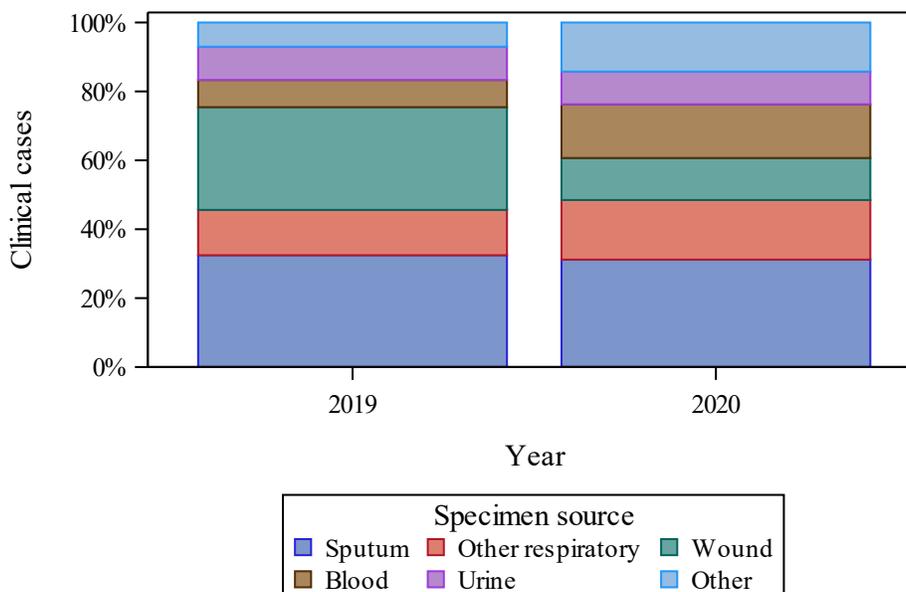
Figure 3. Facility type³ where incident clinical CRAB specimens were collected, by year of culture (N=6,315)



- ❖ Most cases were identified in patients in short-term acute care hospitals (262/440, 60%).
- ❖ Because this is a sentinel surveillance system with targeted outreach, these percentages may not be reflective of the statewide distribution.

³Hospital = short-term acute care hospital, LTACH = long-term acute care hospital

Figure 4. Specimen source for incident clinical CRAB cases, by year of culture (N=409)



- ❖ The most common specimen source was sputum, (145/440, 33%).

Box 3. Outbreak of pan-nonsusceptible CRAB at an acute care hospital.

- ❖ A Chicago-area short-term acute care hospital experienced an outbreak of pan-nonsusceptible CRAB associated with an intensive care unit beginning in March 2020.
 - Between March 2020 and April 2021, 33 pan-nonsusceptible isolates were identified in patients at this facility.
 - 16 of 33 (48%) of patients also had tested positive for COVID-19.
- ❖ Multiple challenges due to the COVID-19 outbreak were identified as contributing factors in the CRAB outbreak, including high staff turnover, shortages in environmental disinfectants leading to improper use of a substitute disinfectant with a high contact time, and shortages of personal protective equipment.
- ❖ Outbreak response included multiple site visits by state and local public health infection prevention personnel and whole genome sequencing to confirm isolate relatedness.
- ❖ Following the initial site visit, the AR lab network and local public health worked with the facility to facilitate repeated point prevalence surveys and admission screenings for the affected unit to identify colonized patients. Following identification, all colonized patients were placed on contact precautions.
- ❖ Resolution of the outbreak was achieved following the implementation of point prevalence surveys, increased monitoring of environmental cleaning, and a switch to a more appropriate disinfectant.
- ❖ The last pan-nonsusceptible CRAB isolate was reported in April of 2021.

Discussion

The implementation of a targeted sentinel surveillance system for CRAB has improved IDPH's understanding and response to this emerging pathogen. CRAB reporting in Illinois has also allowed the detection of outbreaks and subsequent outbreak response and demonstrated the potential of the XDRO registry to improve information-sharing for highly drug-resistant organisms beyond CRE and *C. auris*. Identification of resistance mechanisms through the AR Lab Network has also shaped containment by establishing that more than 90% of Illinois CRAB isolates in the pilot exhibit OXA-24/40 and allowing for the identification and prioritization of rare mechanisms. This local epidemiological context is particularly relevant as it stands in contrast to California [5] and national [6] data on carbapenemase prevalence in CRAB, which have found OXA-23 to be the most common mechanism of resistance.

The high prevalence of CRE and *C. auris* co-infection or co-colonization may reflect either common risk factors for XDROs or an overlap of high prevalence settings and facilities. This overlap may indicate the effectiveness of combining CRAB prevention efforts with existing XDRO prevention programs, such as through including CRAB testing into existing screening programs.

During 2020, the COVID-19 pandemic posed unique challenges to infection control and has been cited as a precipitating factor in outbreaks of *C. auris*, CRE, and CRAB in units serving both COVID-19 and non-COVID-19 patients during periods of high COVID-19 case rates [7-11]. Facilities experienced staff shortages combined with high patient loads, and supply chain disruptions led to challenges in both

personal protective equipment use (e.g., extended use and reuse of gowns) and environment disinfectants (e.g., frequent changes in product availability). In Illinois, these health care system stresses precipitated an outbreak of CRAB in an intensive care unit treating primarily COVID-19 patients. The outbreak was ultimately controlled through a combination of serial point prevalence surveys and attention to environmental cleaning, which is consistent with the established role of environmental contamination in other CRAB outbreaks [3-4]. As the health care system adapts to COVID-19, attention to restoring and to prioritizing infection prevention practices to prevent transmission of CRAB and other highly resistant infections is essential.

Due to the limited scope of the sentinel surveillance system, the cases identified here may not be fully representative of the distribution of CRAB in the state. In particular, the high proportion of cases identified in acute care hospitals may reflect which facilities collect and submit specimens to IDPH, rather than where CRAB cases are most prevalent. A more representative system would require mandatory reporting of CRAB to the XDRO registry. Additionally, the addition of lab and hospital partners during the surveillance period, combined with the short time frame, preclude any analysis of trends.

IDPH and its partners continue to work to improve CRAB surveillance and prevention in Illinois. Current efforts include increasing CRAB screenings in response to clusters and outbreaks and evaluating the feasibility of mandating CRAB reporting statewide. Additionally, IDPH is working to improve infection prevention and control capacity at the facility level through remote and onsite assessments, technical assistance, and trainings. These increased efforts will be essential to developing improved capacity for addressing CRAB and other emerging infections in the Illinois health care system.

IDPH and XDRO Resources

- Additional information on reporting requirements for XDRO can be found at: <http://dph.illinois.gov/topics-services/prevention-wellness/patient-safety-quality/cre/reporting>
- Surveillance reports are also available for *C. auris* and Carbapenem-Resistant *Enterobacterales* at: http://www.healthcarereportcard.illinois.gov/contents/view/State_Reports_of_Current_Interest.
- For questions about this report or assistance with reporting, contact DPH.XDRORegistry@illinois.gov.

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