Systematic Review of Outbreaks associated with Hot Tubs and Spas — United States, 1978–2010

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Why Interest in Hot Tub–/Spa*-associated Outbreaks?

- Cost of spa-associated illnesses high
  - Legionnaire's disease: 8–12% mortality rate[†]
  - Pulmonary illness caused by nontuberculous mycobacteria: $12,725–$37,579/case[§]
- Exposure common in United States
  - 5.8 million spas[¶]
- Spa=unique aquatics venue
  - Water-aerosolizing jet(s)
  - Smaller water volume, decreased max bather load
  - Higher water temperature (up to 104°F/40°C)

* The term "spa" is used in this presentation to refer to spas, hot tubs, whirlpools, spa pools, etc.

† Phin N, *et al*. Lancet Infect Dis 2014;14(10):1011–21.

§ Collier SA, *et al*. Epidemiol Infect 2012;140(11):2003–13.

¶ PK Data; 2013.

Definitions

- Spa
  - Structure, basin, chamber, or tank containing a body of water intended to be used for recreational or therapeutic purposes
  - Operated at high temperatures
  - Usually contains water jet or aeration system
  - Usually not drained, cleaned, or refilled after each use
- Outbreak: ≥2 people linked by time, illness, and spa exposure

Methods

- Sources
  - CDC's Waterborne Disease and Outbreak Surveillance System (WBDOSS)
  - Published reports (MEDLINE, PubMed)
- Exclusions
  - Hydrotherapy equipment–associated outbreaks
  - Spa-associated outbreaks occurring on cruise ships
- Reports reviewed twice by individual team members, using standardized data collection form; discrepancies resolved by team

Contributing Factors

- 81 contributing factors
  - 6 categories
    - Bather-controlled (e.g., high bather load)
    - Disinfection (e.g., no disinfectant)
    - Filtration (e.g., inadequate filtration)
    - Ventilation (e.g., no ventilation)
    - Operation (e.g., delayed detection of breakdown)
    - Records (e.g., records poorly maintained)

Spa-associated Outbreaks United States, 1978–2010: Preliminary Data

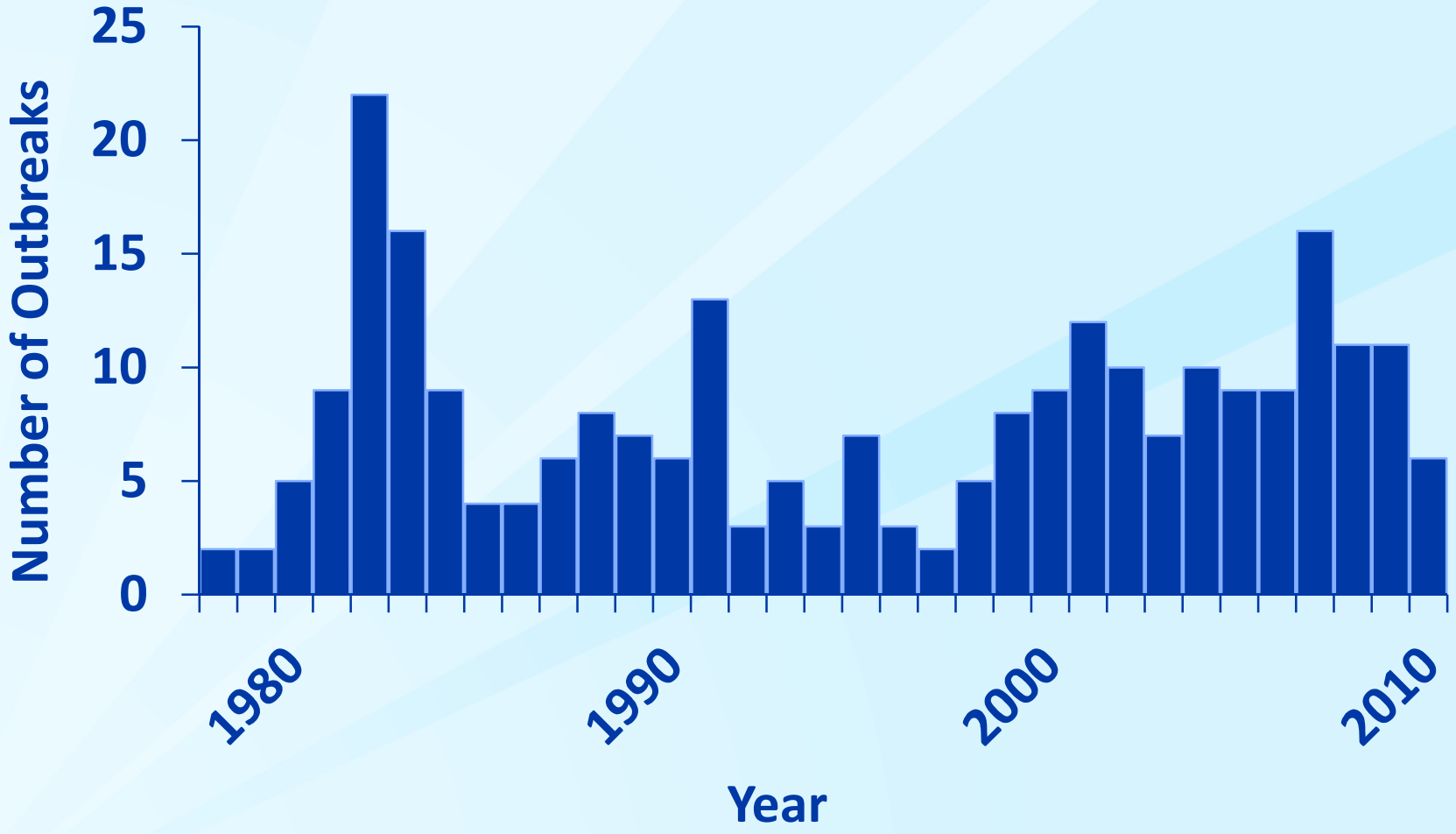
- Total
  - 259 outbreaks
  - ≥5,586 cases
  - Median outbreak size: 9 cases (range: 2–500 cases)
- Not reported to WBDOSS
  - 21 (8%) outbreaks
  - 165 (3%) cases

Patterns of Exposure: Preliminary Data

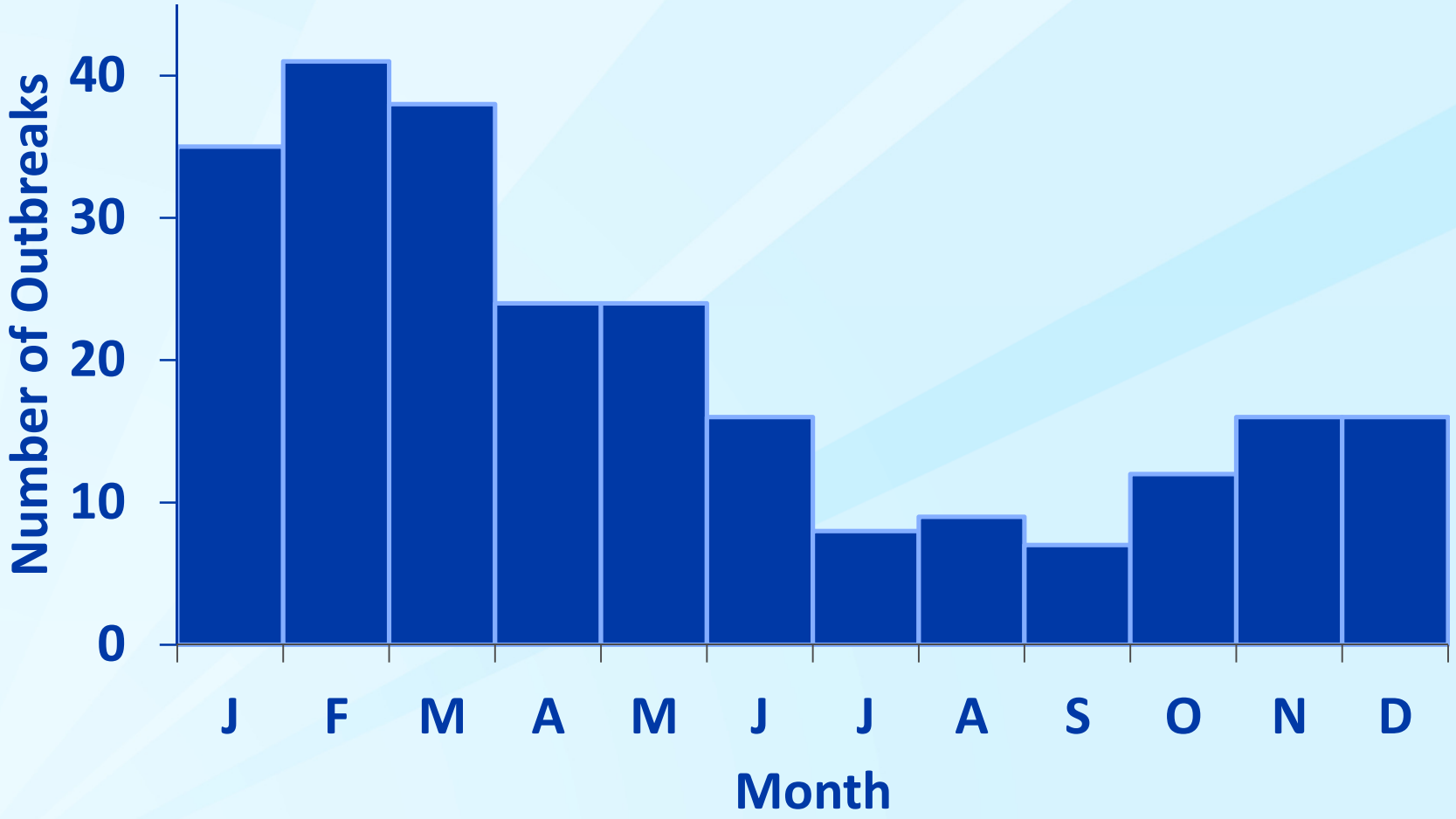
	Outbreaks (% total)*	Cases (% total)*
Spa only	188/259 (73%)	3,252/5,586 (58%)
Group event	85/104 (82%)	2,085/2,290 (91%)
Weekend exposure	83/115 (72%)	2,010/2,425 (83%)

* Denominators vary as investigations and reporting not standardized.

Spa-Linked Outbreaks, by Year—United States, 1978–2010 (n=259): Preliminary Data

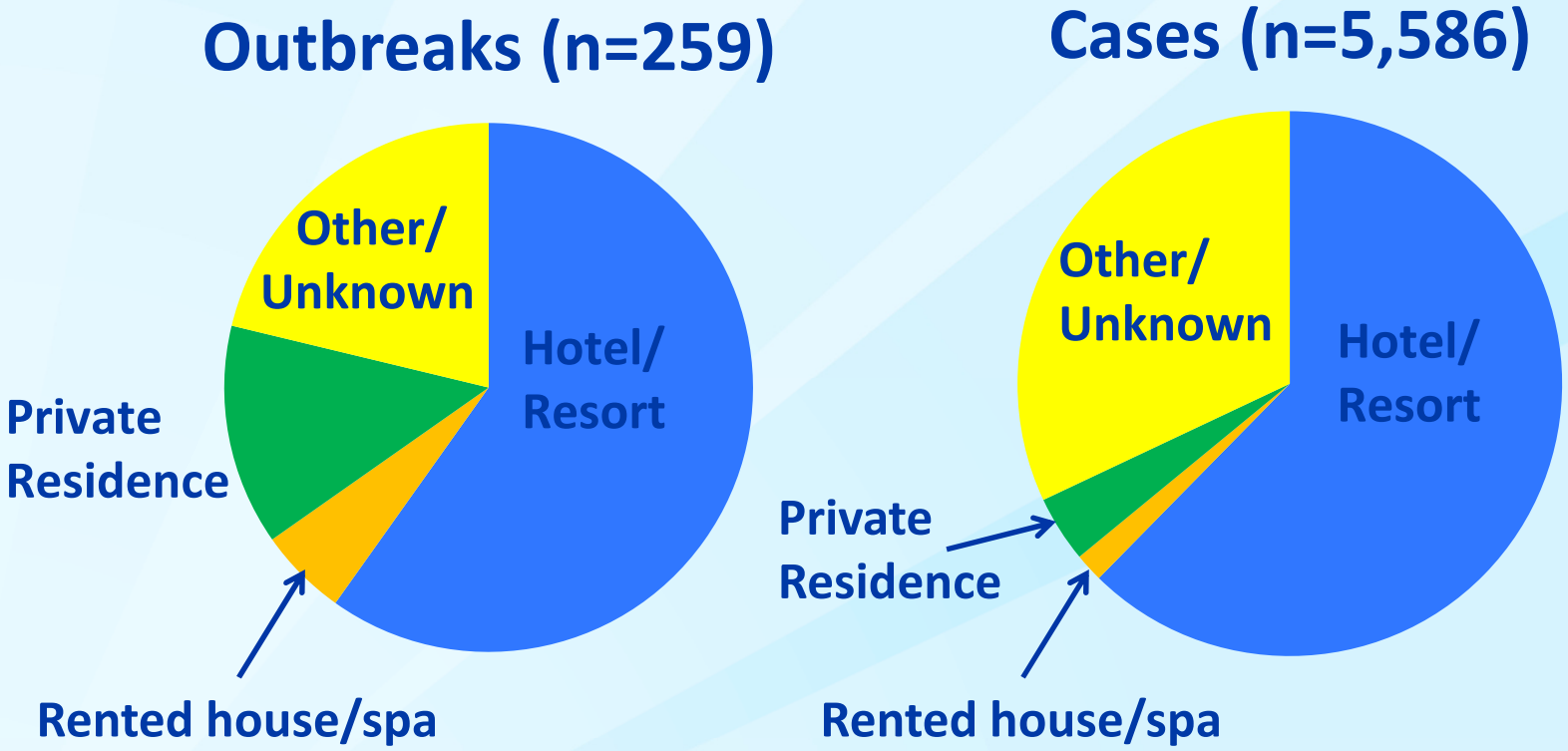


Spa-Linked Outbreaks, by Month—United States, 1978–2010 (n=246*): Preliminary Data

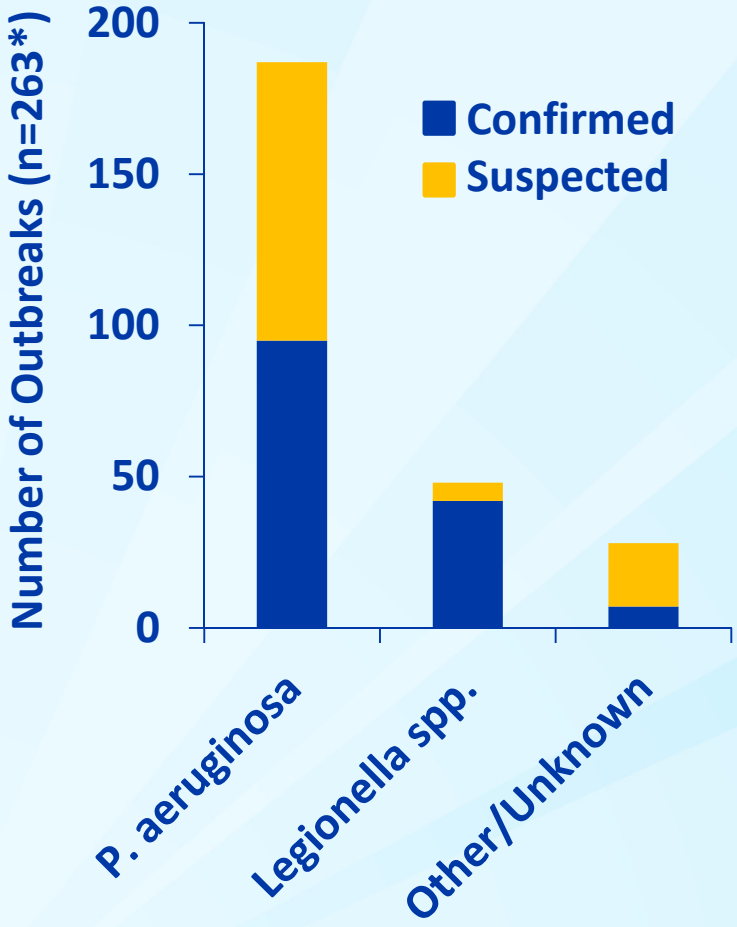


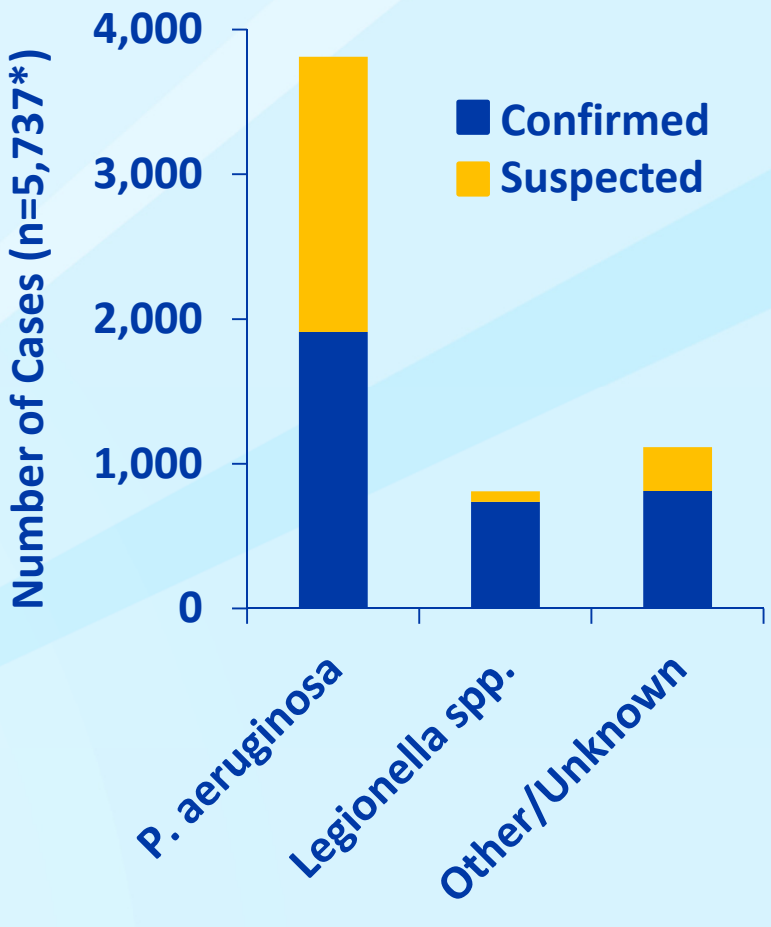
* 13 published reports of outbreaks, not captured WBDOSS, did not include data on earliest illness onset date.

Spa-Linked Outbreaks, by Setting United States, 1978–2010: Preliminary Data



Spa-Linked Outbreaks, by Etiology
United States, 1978–2010: Preliminary Data





* 4 outbreaks, with two etiologies, affected 151 cases (i.e., these outbreaks and cases are counted twice).

Spa-Linked Outbreaks, by Etiology and Healthcare Usage—United States, 1978–2010: Preliminary Data

Etiology	Outpatient	ER	Hospitalized	EMS/ UNK Type*	Total Medical Care	% of Total Medical Usage
Pseudomonas aeruginosa	265	19	9	206	499	59
Legionella pneumophila	26	12	103	91	232	27
Other/ Unknown	26	16	11	68	121	14
Total	317	47	123	365	852	100

* 4 outbreaks, with two etiologies, affected 151 cases (i.e., these outbreaks and cases are counted twice).

Top Five Contributing Factors: Preliminary Data

Contributing Factor	Outbreaks (% total)	Cases (% total)
Improper disinfectant levels	91 (35%)	1,515 (27%)
High bather load	68 (26%)	2,529 (45%)
Inadequate testing frequency	49 (19%)	884 (16%)
No water quality records	24 (9%)	620 (11%)
Recent construction (<6 months)	21 (8%)	989 (18%)

Take-Home Messages

- Person
  - Group events
- Time
  - Weekends, early 1980s and during 2000s, winter
- Place
  - Hotel
- Etiology & healthcare usage
  - *Pseudomonas aeruginosa*: outpatient
  - *Legionella* spp.: hospital
- Contributing factors
  - Improper disinfectant level (operator-controlled), high bather load (bather-controlled)

Limitations

- WBDOSS = passive surveillance system
- Clinicians reporting in literature not necessarily epidemiologists
- Investigations and reporting not standardized
- Conditions at time of investigation might NOT be same as conditions at time of outbreak exposure

Discussion & Conclusions

- Spa-associated outbreaks PREVENTABLE when all stakeholders engaged
- Public spa operators and residential spa owners
  - Get trained, maintain to standards
- Bathers
  - Check disinfectant level and pH before entering and follow other healthy swimming steps
- Public health
  - Enforce codes
  - Educate public spa operators, residential spa owners, and bathers about healthy swimming

Next Steps

- Review reports of outbreaks linked to other aquatic venues
- Collaborate with state partners to revise CDC outbreak reporting form
- Develop venue-specific environmental health outbreak investigation forms
  - Contributing factors
  - Written reports
- Update additional healthy swimming promotion materials for bathers
- Guide revisions of Model Aquatic Health Code
  - Michael Beach: Tomorrow @ 13:40–14:00

For more information please contact Centers for Disease Control and Prevention

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Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

Visit: www.cdc.gov | Contact CDC at: 1-800-CDC-INFO or www.cdc.gov/info

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.