Georgia Department of Public Health

Outbreak of *Mycobacterium abscessus* Infections Among Patients of a Pediatric Dentistry Practice—Georgia, 2015

Presentation to: CSTE Peer-to-Peer Webinar

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We Protect Lives.

Learning Objectives

1. Describe the demographics, symptoms and treatment of affected patients

2. Understand the current guidelines for dental water quality and the public health impact of poor dental water quality

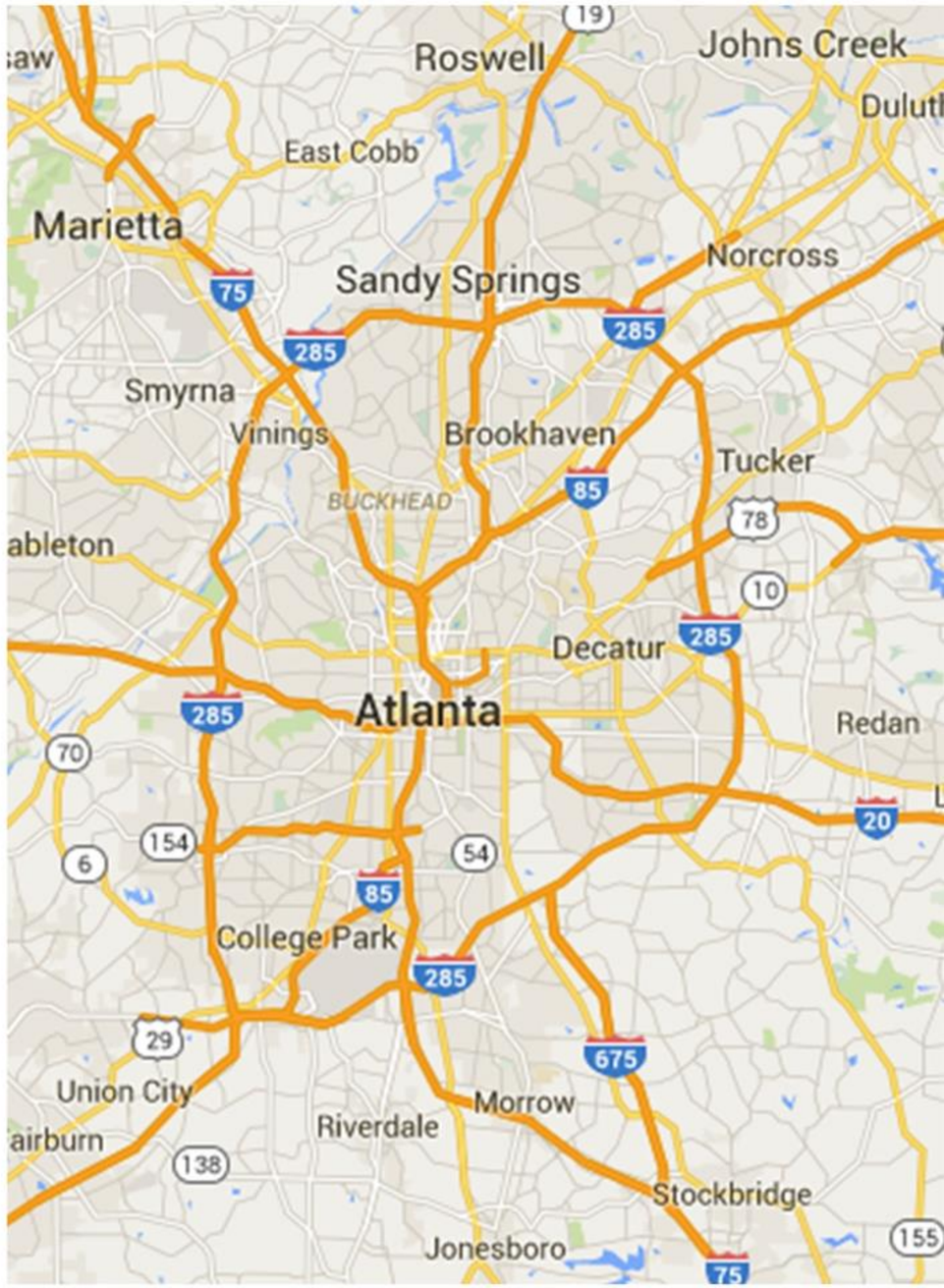
3. Discuss prevention and intervention methods to reduce transmission of potentially pathogenic bacteria through water used for dental procedures

Background

- GA Department of Public Health (DPH) notified September 2015

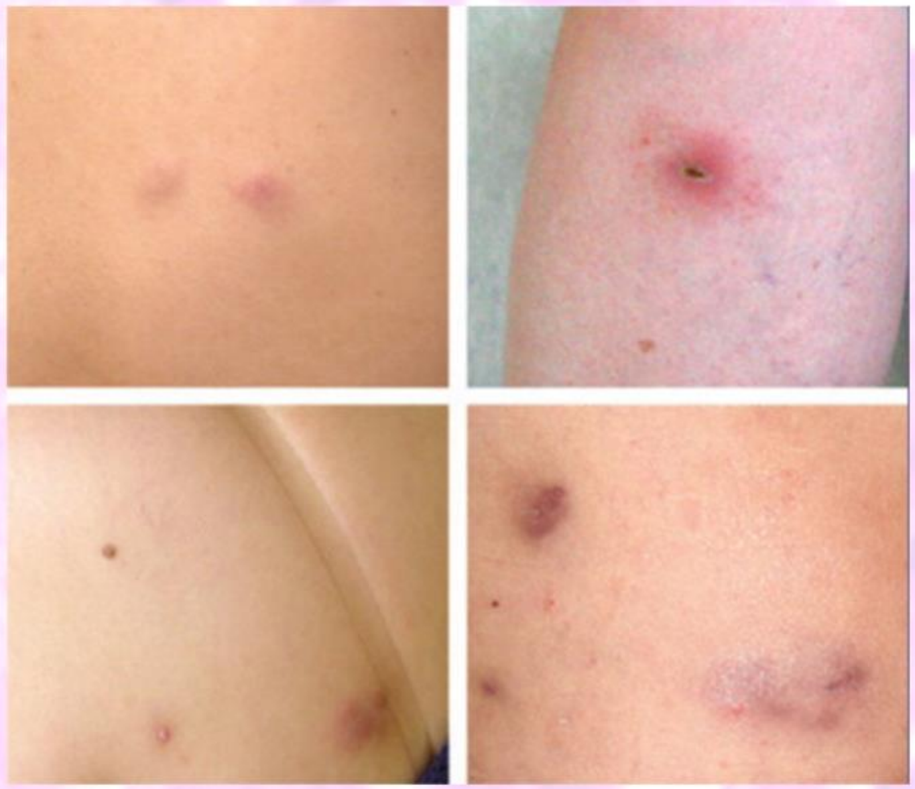
- Cluster of children with *M. abscessus* infection (n=9) after having a pulpotomy procedure

- All seen at various locations of a large pediatric dental chain
  - Majority at a single location south of Atlanta



Mycobacterium abscessus

- Rapidly growing, multi-drug resistant, nontuberculous mycobacteria (NTM)



http://www.sciencedirect.com/science/article/pii/S1198743X1461747X

- Commonly found in soil and water

- Causes skin and soft tissue infection

Mycobacterium abscessus

- Can be found in plumbing
- Can form biofilm in waterline tubing

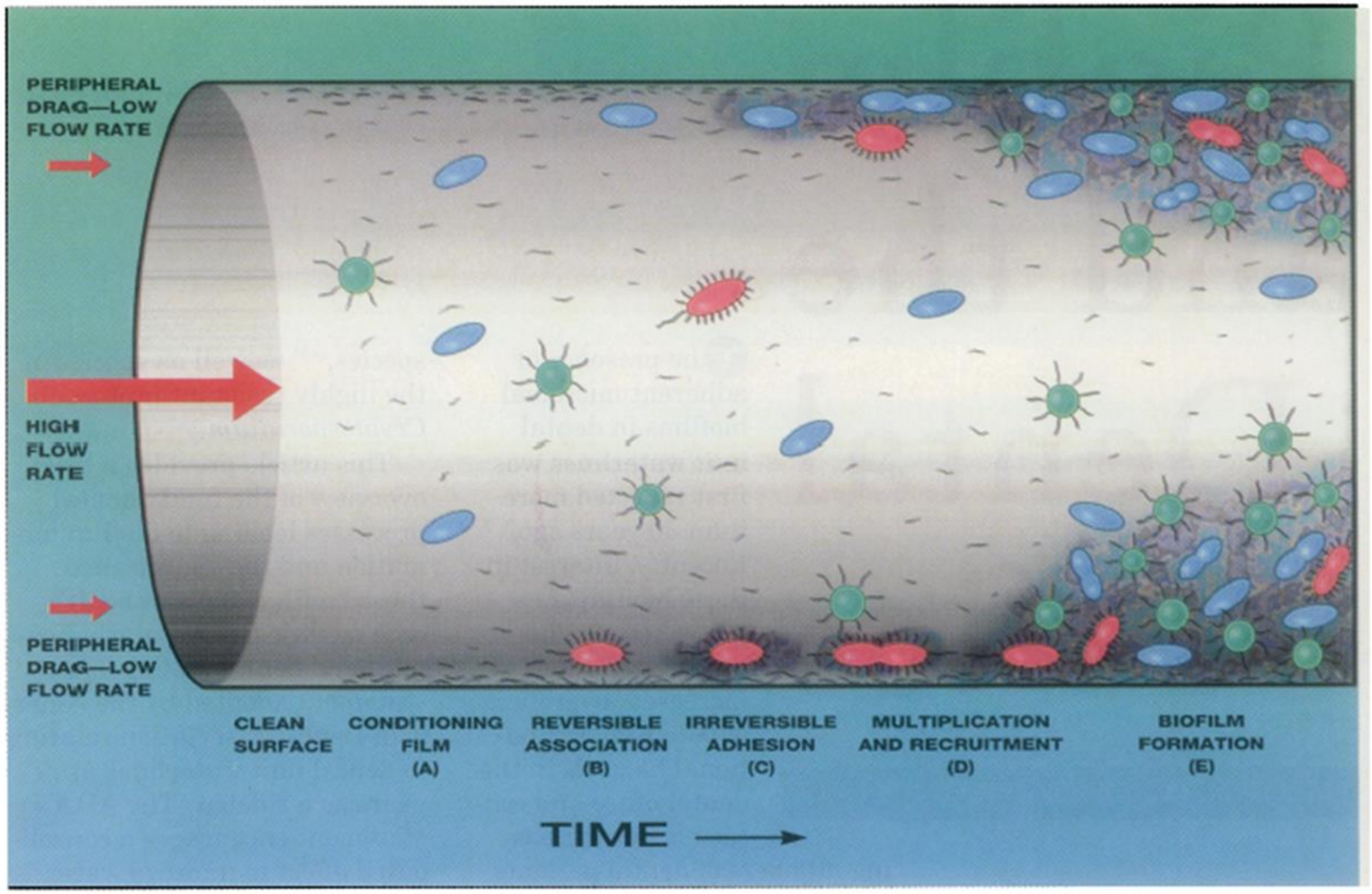


Figure 1. Biofilm formation in narrow-bore tubing. On adsorption of macromolecules from the aqueous phase and the formation of a conditioning film (A), bacteria may either associate reversibly with the surface (B) or adhere irreversibly (C). Subsequent division of adherent cells (D) and recruitment of planktonic cells from the bulk fluid phase results in biofilm formation (E).

Shearer BG. Biofilm and the dental office. The Journal of the American Dental Association. 1996; 127:181-9.

Past Outbreaks

- Lidocaine injection 1996
- Penicillin injection 2002
- Lipotourism 2008
- Acupuncture 2009
- Lung transplant patients 2015

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- **Dental clinic 2015**

Definitions

- Case definition: illness compatible with *M. abscessus* infection among children with an onset date on or after January 1st, 2014
  - Probable: physician-diagnosed illness
  - Confirmed: culture-confirmed

  - *Lymphadenopathy: swelling of the lymph nodes*
  - *Granulomatous inflammation: area of inflammation in tissue*

Case Finding

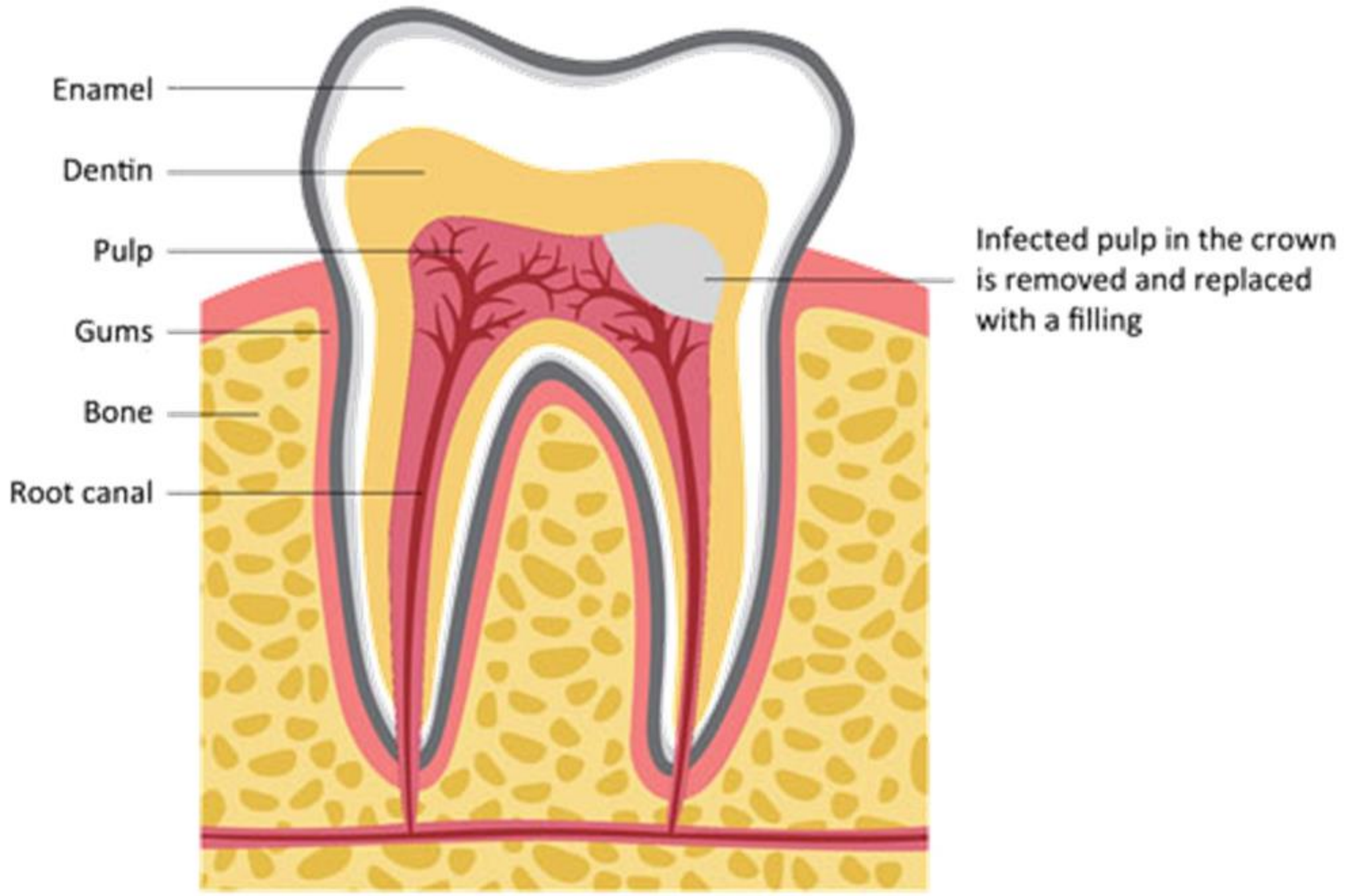
1. Patient contact
2. Notifications to providers
3. Hospital A pathology reports review
4. GA Public Health Laboratory culture review

Initial Observations

- DPH performed a walkthrough of Practice B:
  - Water from drill used during pulpotomy procedure
  - Waterlines flushed daily, no disinfectant or testing
  - No active monitoring of water quality
  - No water mixed in with any materials used during pulpotomy

Pulpotomy Procedure

- Pulpotomy is the removal of a portion of the pulp, including the diseased aspect, with the intent of maintaining the vitality of the remaining pulpal tissue



http://www.coastalkidspedo.com/assets/images/pulpotomy.jpg

Patient Information

Total (n=20*)	Number (%)
Age (range = 3-11, median = 7)	
Asthma	2 (10)
Male	11 (55)
Pain	17 (85)
Osteomyelitis	14 (70)
Facial swelling	12 (60)
Lymphadenopathy	10 (50)
Pulmonary nodules	7 (35)

*Case finding is ongoing

- *Osteomyelitis: infection of the bone*
- *Lymphadenopathy: swelling of the lymph nodes*
- *Pulmonary nodules: small, oval-shaped growth on the lung*

Patient Information

Total (n=20*)	Number (%)
Neck CT	17 (85)
Chest X-ray	11 (55)
Ultrasound	5 (25)
MRI	1 (5)
Excision and/or biopsy	17 (85)
Incision/Drainage	7 (35)
PICC/central line	10 (50)
AFB culture pos	11 (55)
AFB stain pos	7 (35)

*Case finding is ongoing
Acid-fast bacillus (AFB)

Patient Treatment and Outcomes

- Isolates resistant to multiple antimicrobials
- IV antibiotics with potential complications (i.e. Amikacin)
  - Need for central line
  - Renal failure
  - *Ototoxicity: property of being toxic to the ear*

- Surgical removal of infection
- Partial facial nerve paralysis
- Ultimate clinical outcomes unknown

http://www.medleague.com/blog/wp-content/uploads/ICU_IV_1.jpg

Trends by Provider

Assistant	# of pulpotomies
A	3
B	1
C	1
D	1
E	1
F	1
G	1
H	1
I	10

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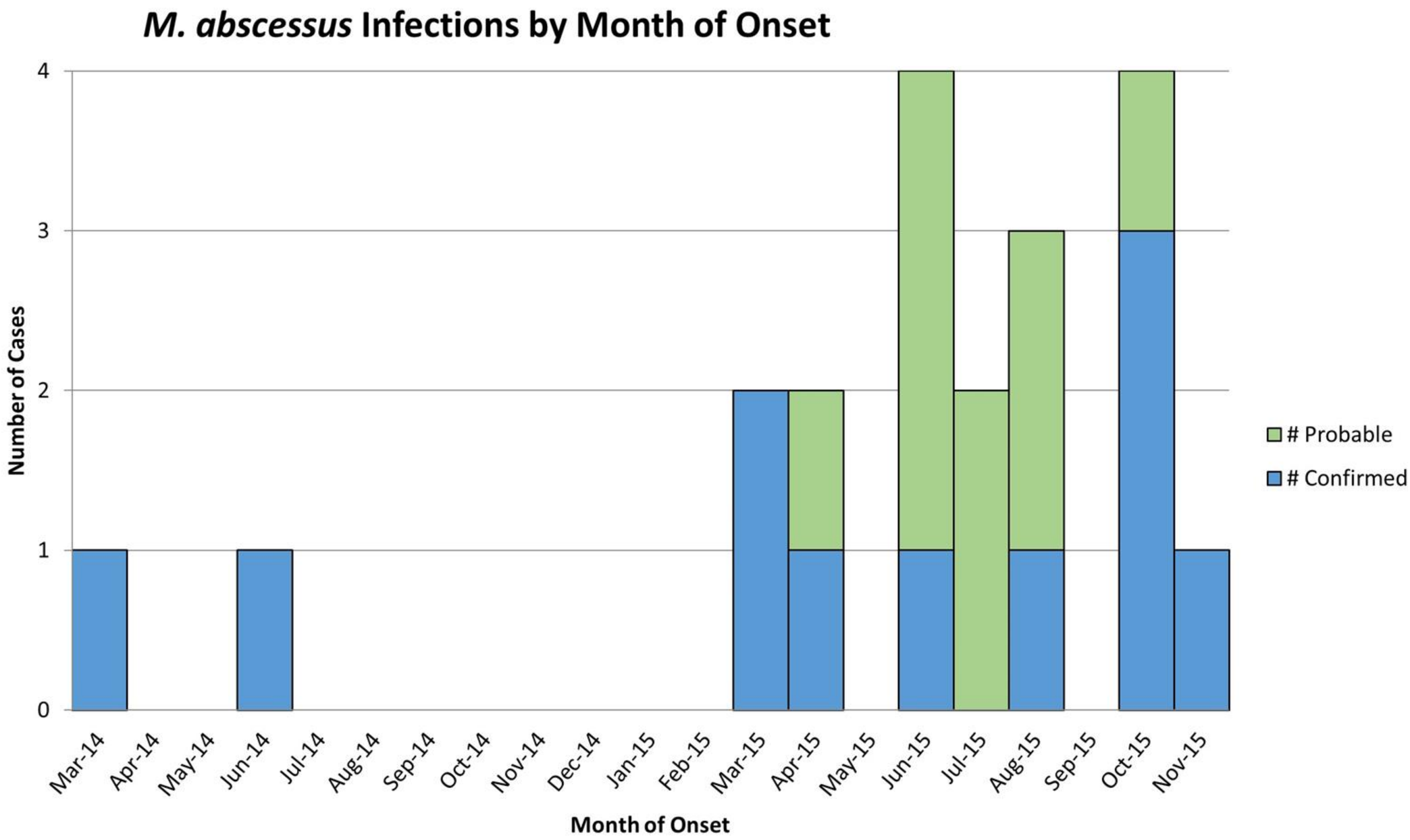
Patient Information



Confirmed (n=11)
Probable (n=9)

Attack Rate

$$\text{AR} = \frac{\#\ of\ new\ cases\ of\ disease\ in\ population\ at\ risk}{\#\ of\ persons\ in\ population\ at\ risk}$$

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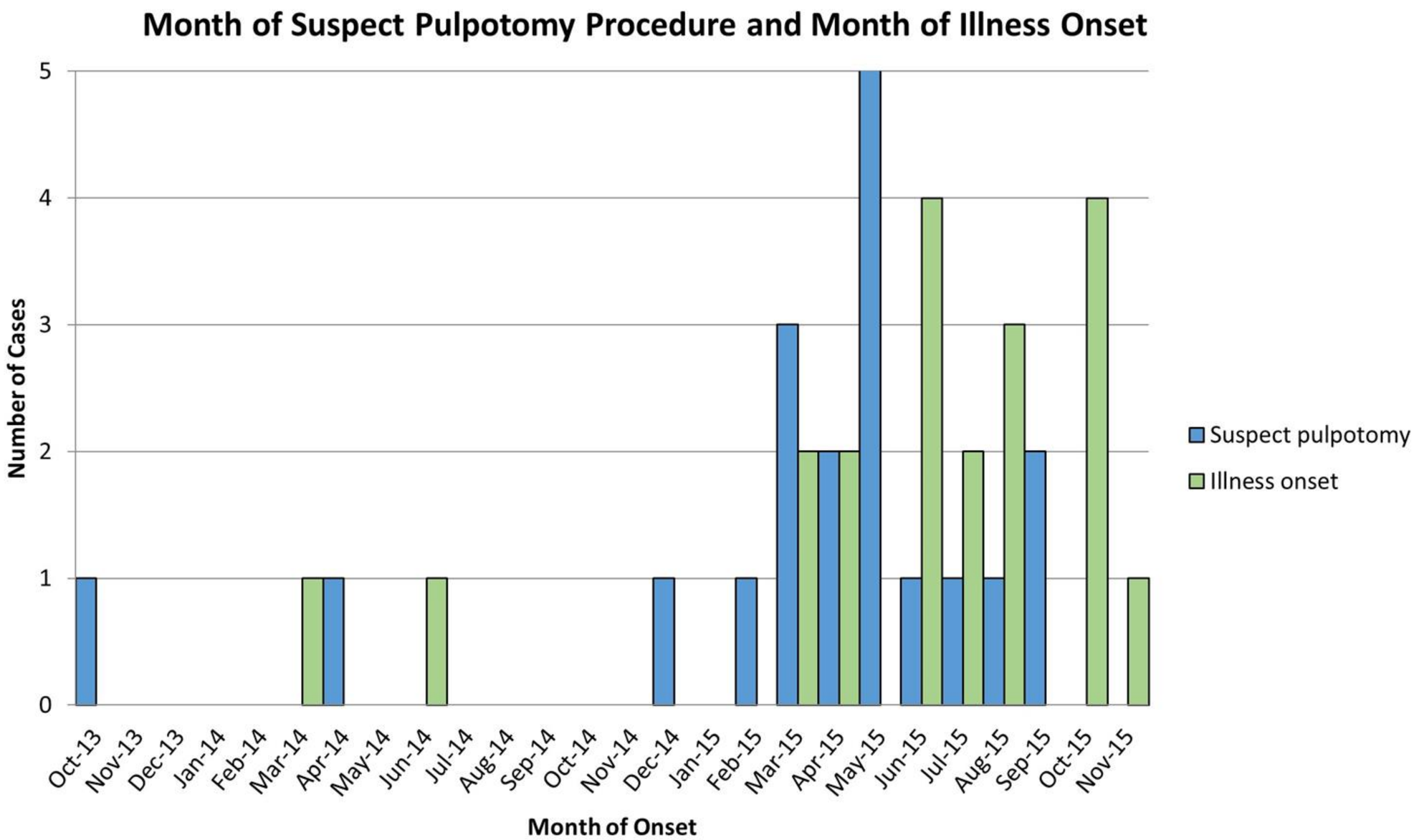
$$= \frac{20\ cases*}{1{,}386\ total\ pulpomies} = 0.014 \times 100 = \mathbf{1.4\%}$$

During the *M. abscessus outbreak, the attack rate was 1.4%*

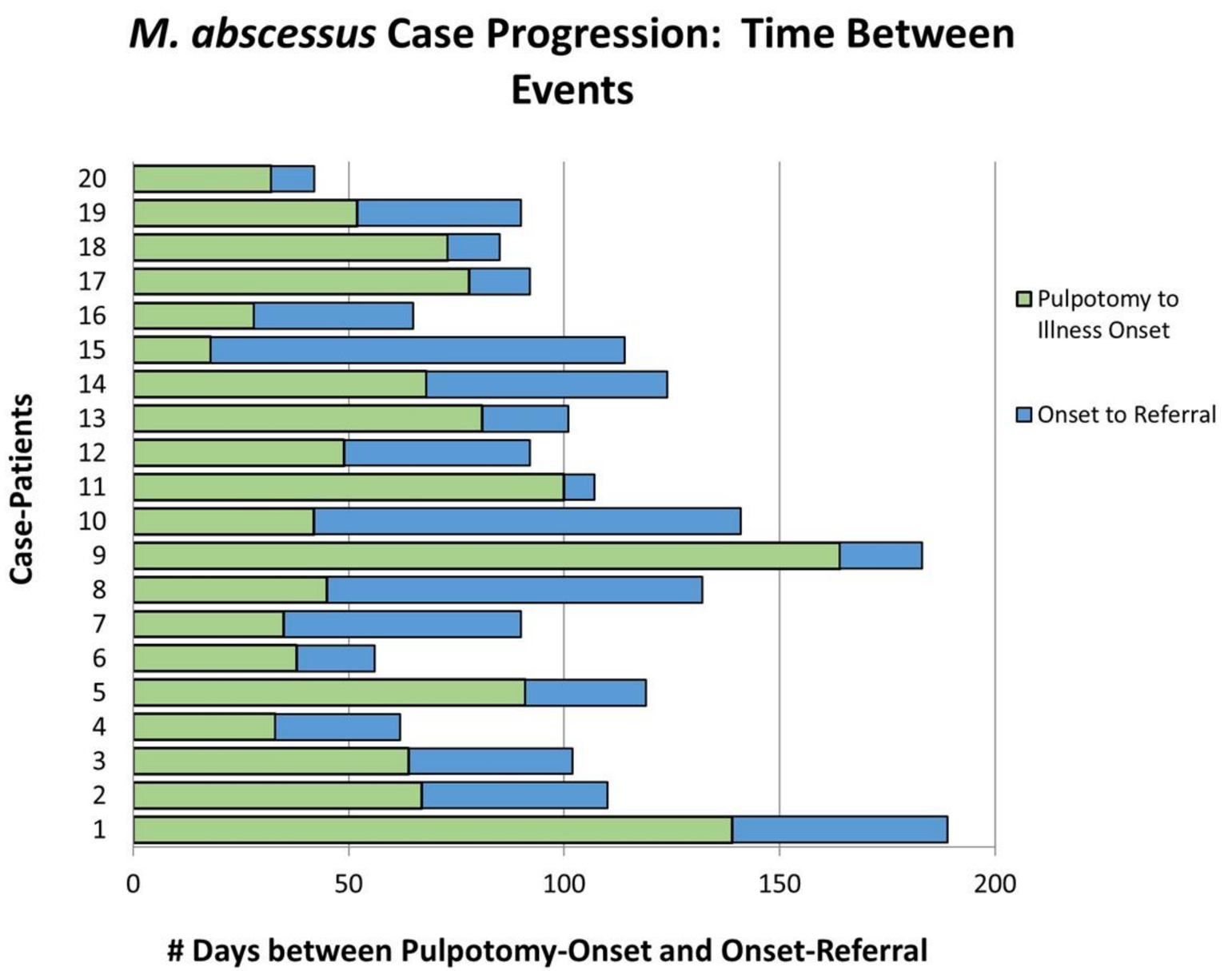
*Excludes case that was never seen at Practice B

Patient Information



- Month of suspect pulpotomy (range = October 2013-September 2015)
- Month of illness onset (range = March 2014-November 2015)

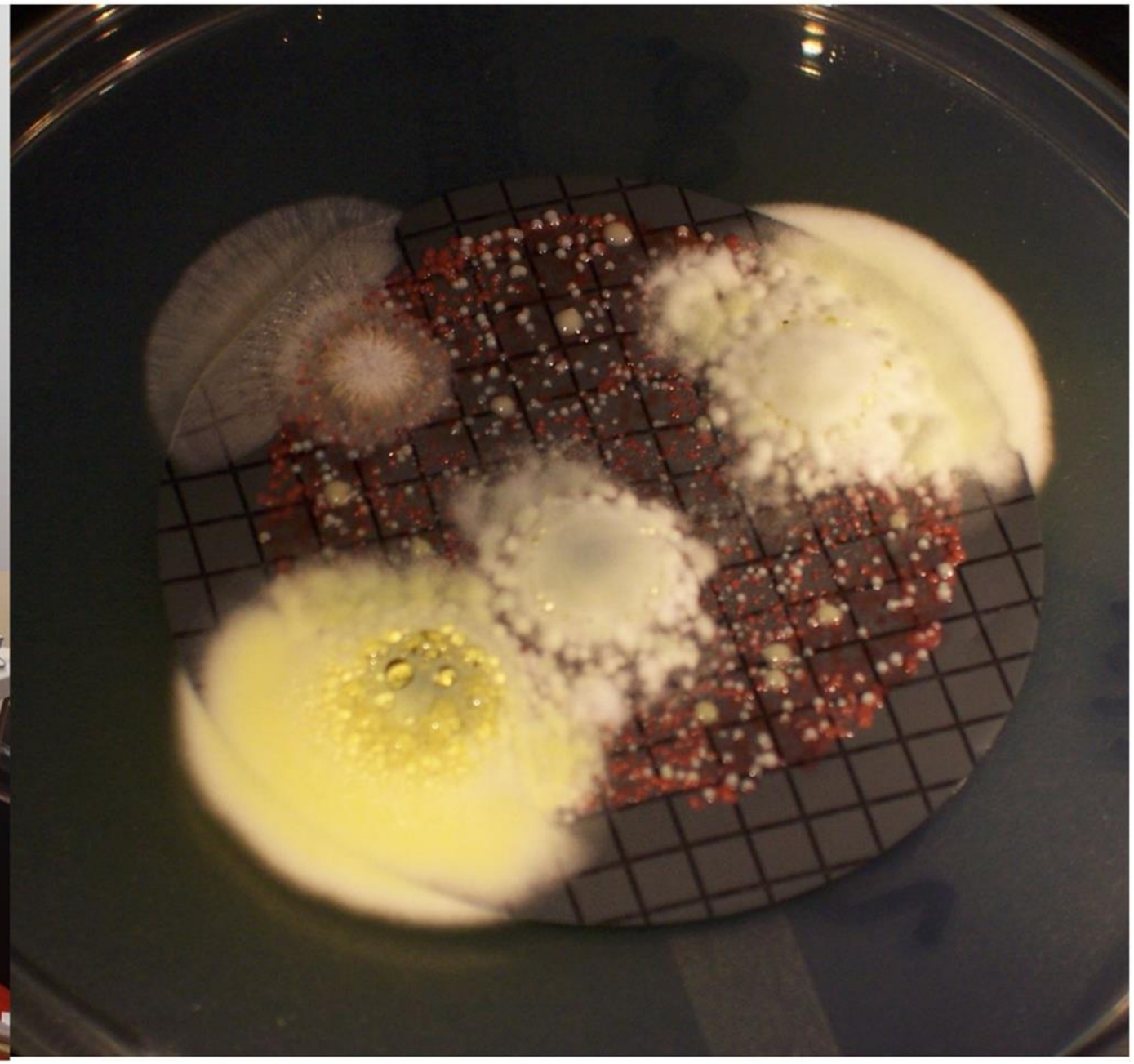
Patient Information



- Incubation period (range = 18-164 days, median = 58 days)
- Time from illness onset to referral (range = 7-99 days, median = 37.5 days)

Lab Results

Lab Results



Dental water quality

CDC recommends that water used in non-surgical dental procedures meet Environmental Protection Agency (EPA) regulatory standards for drinking water, which is **≤500 colony forming units of heterotrophic bacteria per milliliter of water (CFU/mL)**.

http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5217a1.htm

Lab Results

CDC Lab #	CSID #	Specimen Type	Specimen Description	Counts (CFU/mL)	Species/Group ID by PRA
2015-27-01	3015159882	water	chair 1 dental flush water	3.6x10^4 CFU/mL	***01-01, 01-02, 01-03*** *Mycobacterium abscessus*
2015-27-02	3015159883	water	chair 2 dental flush water	9.8x10^4 CFU/mL	***02-01, 02 02*** *M. Abscessus*
2015-27-03	3015159884	water	chair 3 dental flush water	1.2x10^5 CFU/mL	**03-*** ***01****Mycobacterium immunogenum 1,* ***03-02, 03-03*** *M. abscessus*
2015-27-04	3015159885	water	chair 4 dental flush water	7.3x10^4 CFU/mL	***04-01, 04-03*** *M. abscessus*
2015-27-05	3015159886	water	chair 5 dental flush water	1.9x10^5 CFU/mL	***05-01, 05-02*** *M. abscessus*
2015-27-06	3015159887	water	chair 6 dental flush water	3.1x10^4 CFU/mL	***06-03*** *M. abscessus*
2015-27-07	3015159888	water	chair 7 dental flush water	1.3x10^3 CFU/mL***	***07-01*** *M. abscessus*

- CDC recommends ≤500 CFU/mL!

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- All 8 patient isolates (from 7 patients) and all water samples indistinguishable by PFGE

Conclusions

- Pulpotomy using contaminated tap water led to the infections
- High counts detected by laboratory implied biofilm present

http://trustwater.com/wp-content/uploads/2012/02/Solution-Image-11.jpg

Recommendations and Next Steps

1. Point-of-use filters and replacement of pipes and tubing

2. Outreach letters to families that could not previously be reached

3. Implement a water testing plan
   - Counts ≤200 CFU/mL

4. Use of distilled water

5. Disinfection per manufacturer guidelines

Actions and Interventions

- Replaced all plumbing and tubing
- Treatment of dental unit waterlines
  - O-SO Pure water treatment system
  - Dentapure water treatment systems
- Weekly Sterilex

Dentapure

- Point-of-use

DentaPure® Position Statement

Microbial Water Quality Testing

- Provides dental water with a microbial content of less than 200 CFU/mL

- DentaPure meets the [CDC] standards without a testing requirement.

- Molinari et al. (2013)

O-SO Pure

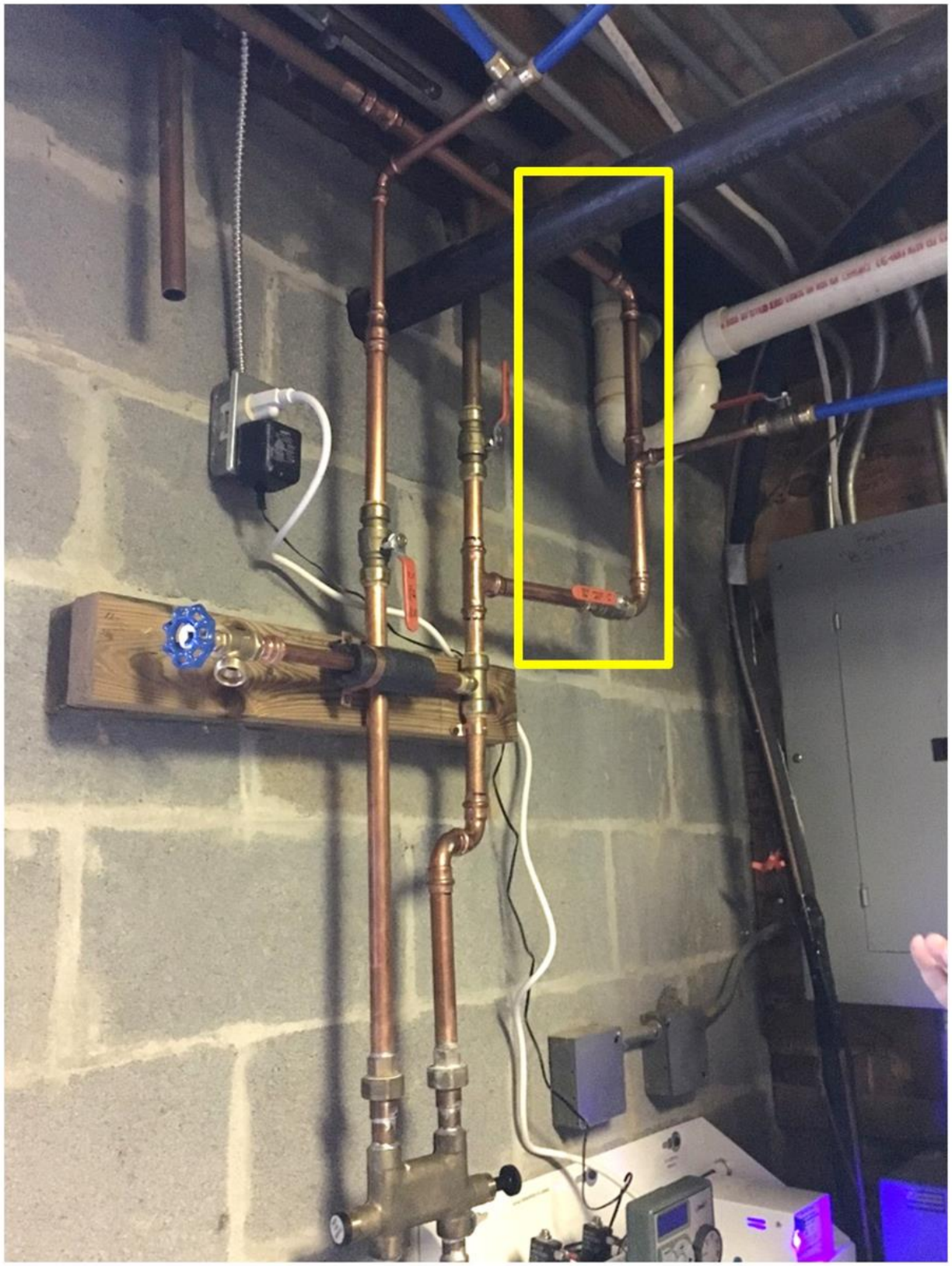
- Point-of-entry

Model DWS-POE: *THE PATHOGEN PREDATOR™*

We Protect Lives.

Surprising Setback

- Microbial counts high, despite recent interventions
- Environmental engineers hired
- Dead-leg valve
- Additional recommendations



Current Status

- Practice B closed Nov 2015-Jan 13th, 2016
- Continued water quality monitoring
- Distilled water for pulpotomies
- DPH recommends 3 sets of tests performed weekly:
  - <200 CFU/mL
  - Negative for mycobacteria

- ADA water quality goal
- Dentapure manufacturer guidelines

Unexplained Case

- Only one child was not seen by Practice B
- Meets case definition
- Culture-confirmed and PFGE match
- PFGE pattern endemic to Southeast?

Policy Considerations

1. Water monitoring: required vs. recommended

2. Pulpotomy a surgical procedure?
   - Surgical procedures require sterile water

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

ADA
American Dental Association

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Thank you!

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- DPH Oral Health Staff

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