



THE UNIVERSITY OF  
**CHICAGO**  
MEDICINE

# Swimming in the Deep End: Legionella Control in Healthcare

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Dr. Landon has disclosed that there is no actual or potential conflict of interest in regards to this presentation.

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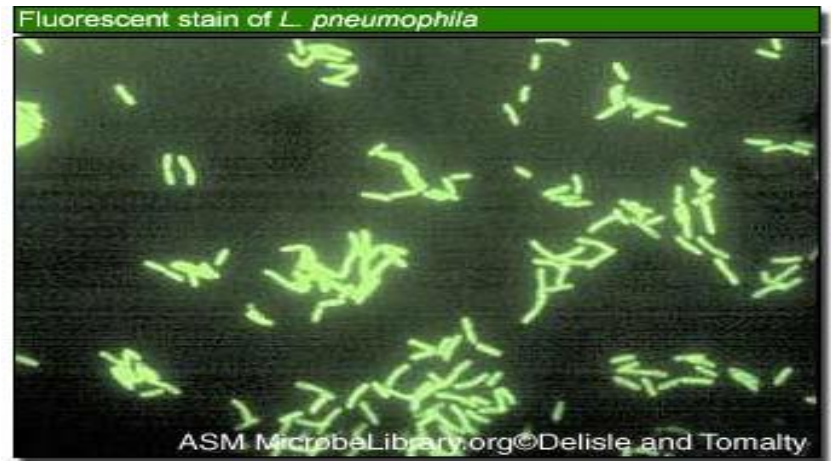
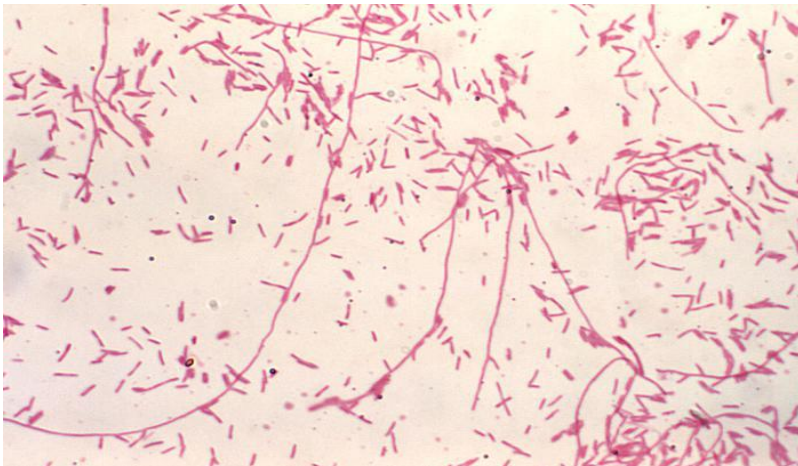
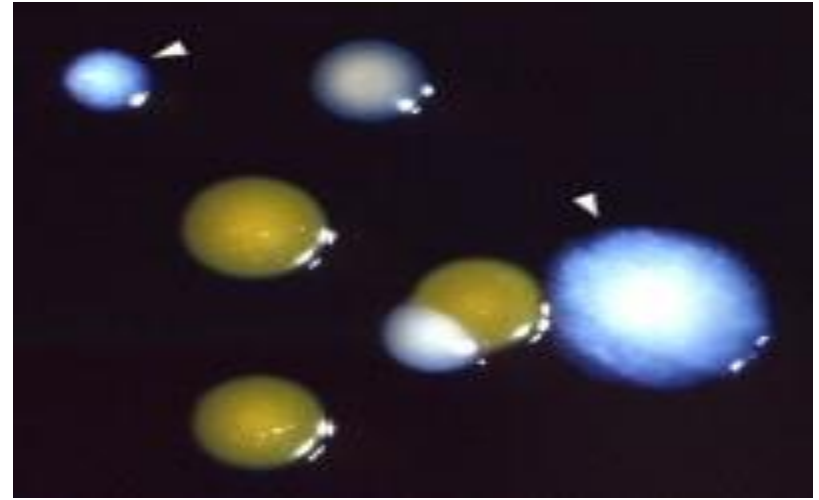
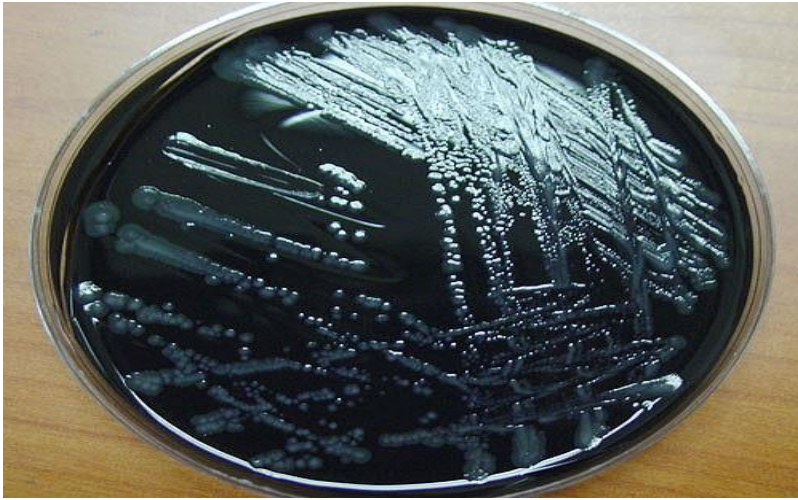
# Learning Objectives

- Understand the elements of a comprehensive water management program for healthcare
- Identify gaps in your water management program
- Describe ways you might address these gaps and streamline your own water management program.

## *Legionella pneumophila*

- Gram negative aerobic, pleomorphic, flagellated, non-spore forming bacilli
- Lives everywhere but loves fresh water
- Likes temps 20-45C
- Grows best in warm, stagnant water
- Sediment in water systems (especially water tanks and hot water cylinders) creates areas of stagnation and provides nutrients for growth.
- Symbiotic with amoeba, algae and other organic non-pathogens

# What does legionella look like?



# Legionellosis

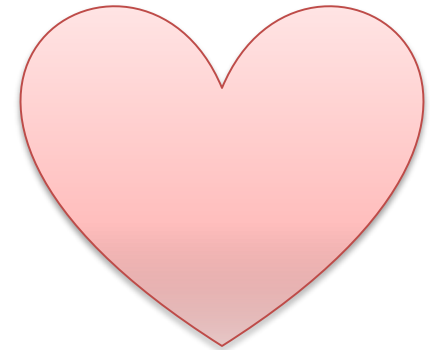
- Legionnaire's Disease
  - Acute pneumonia, sometimes fatal and often terrible
  - Incubation period 2-14 days after exposure
  - High fever, chills, headache, myalgias, cough, shortness of breath
  - Usually have an infiltrate on xray
  - Can also have diarrhea and vomiting or confusion and sepsis.
- Pontiac Fever
  - Self-limiting, febrile illness usually from ingesting legionella
  - Milder infection, no pneumonia
  - 2-14 day incubation
  - Symptoms last about 2-5 days and frequently go away on their own.
  - Difficult to suspect and diagnose.

# Who gets legionellosis?

- Older people (>50)
- Smokers (even former smokers)
- Chronic Lung disease
- Immunosuppressed
- Cancer patients
- Diabetics
- Dialysis patients
- Healthy people who have large aspiration of contaminated aerosols

## Legionella loves....

- Shower heads & those long convenient shower hoses, especially the ones the are only used some of the time.
- Whirlpools & hot tubs especially if disinfection is inadequate and filters remain unchanged.
- Humidifiers & Respiratory therapy equipment
- Faucets with aerators or electronic eyes
- Cooling towers and condensers
- Fountains and water features. Just get rid of them now. It will save you in the end.



# How to grow legionella in healthcare

- **Allow multiple locations for stagnant water.** Make sure patients are never assigned to the last room in the hall unless you are really busy. Decommission units then re-open them months later.
- **Under chlorinate and rarely clean.** If you add chlorine, only measure it right where you put it in. Let hydrotherapy do whatever they want with their hot tubs.
- **Put in a fountain.** Or two.
- **Avoid filtering out the algae and sediment in municipal water.**
- **Keep the water temperature nice and comfortable.** (77-108F is best)
- **Arrange for a pH between 5-8.** Luckily water usually has a pH of 7.
- **Occasionally create massive water pressure changes** (maybe by turning on all the faucets in one unit at the same time) so you dislodge all the sediment and biofilm you built up and deliver legionella directly to patients.



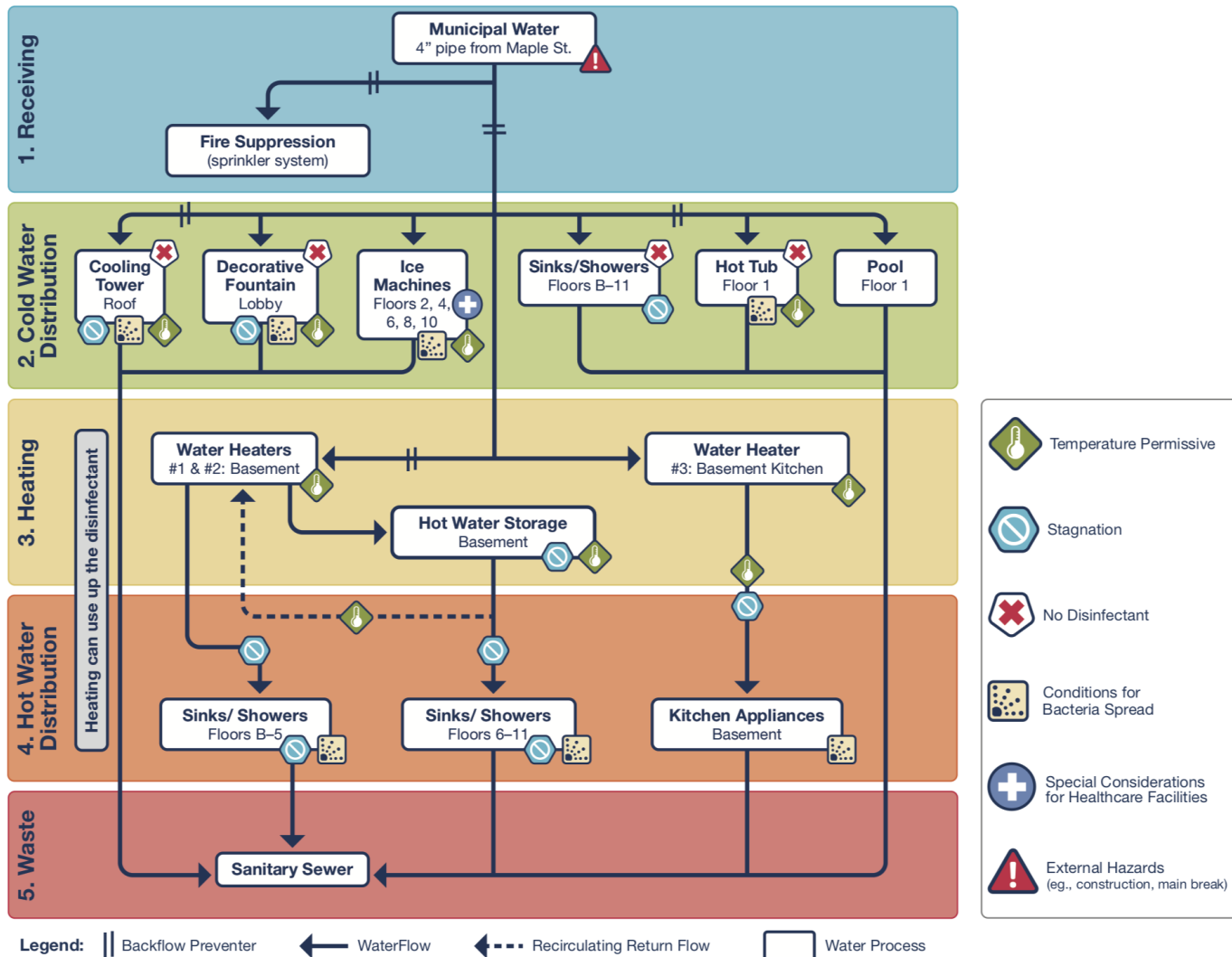
## You are expected to....

- Conduct facility-wide water safety risk assessment
- Implement a water management program based on the ASHRAE standard 188 and CDC kit
- Define and specify testing protocols, acceptable ranges for control measures, and document specific actions that will be taken when control limits are not met.

## In every day language....

- Water risk assessment:
  - What kind of patients do you serve and how do they interact with your water?
  - Where might legionella hide in your pipes?
  - Where and when might high risk patients be exposed to legionella-infested water?

# CDC Sample Diagram

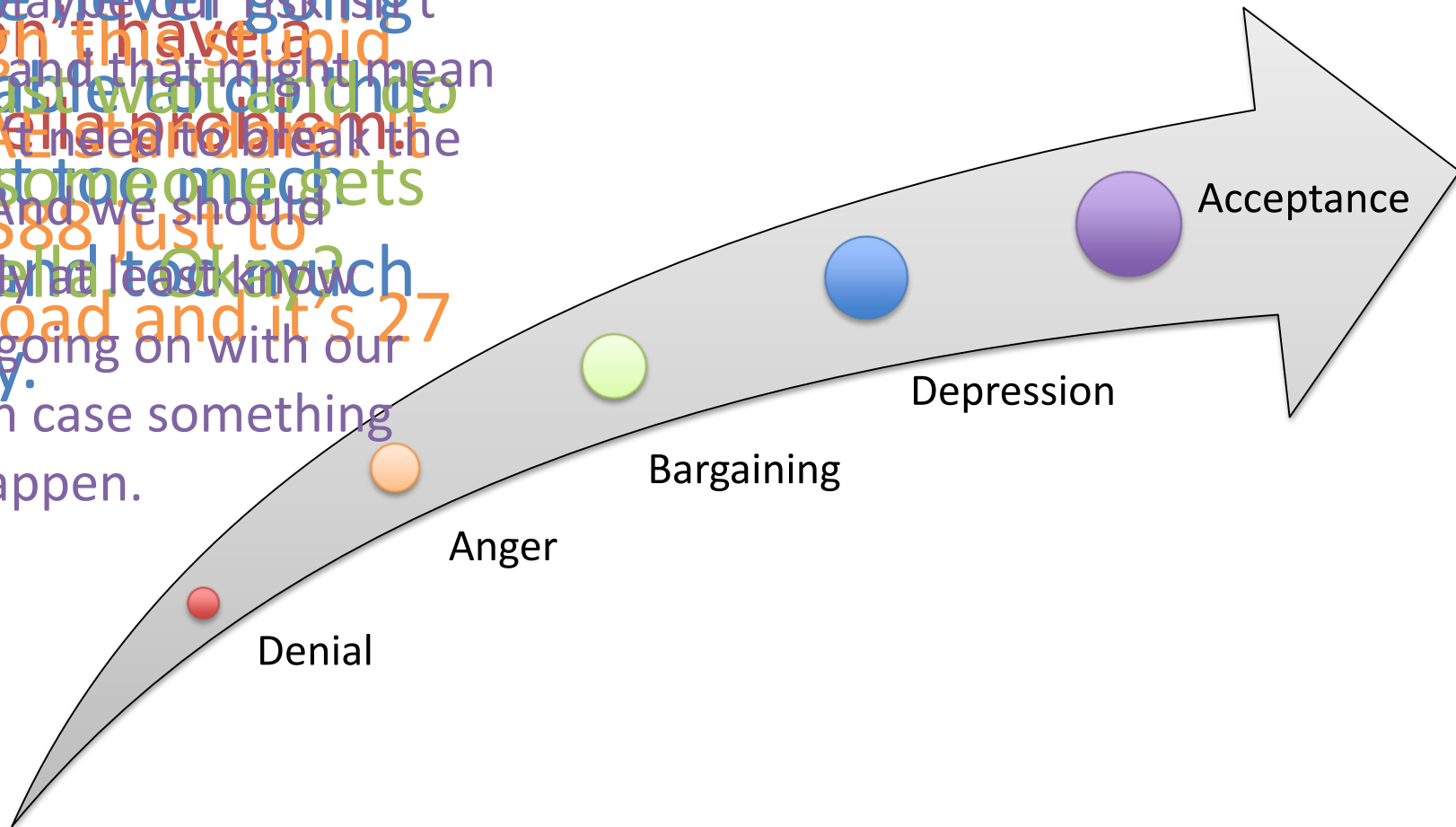


## In every day language....

- Water risk assessment:
  - What kind of patients do you serve and how do they interact with your water?
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  - Where and when might high risk patients be exposed to legionella-infested water?
- Implement a Water Management Program
  - Now this is where people get tripped up. Or should I say overwhelmed?

# Kubler-Ross Stages of Grief Change

Actually, it might not be that  
can't water going just fine.  
We are never going  
the don't have a bid  
so high and that might mean  
let's just wait and see how  
we don't need to break the  
this is for one gets  
bank. And we should  
costs \$88 just to  
probably at least know  
download and it's 27  
pages.  
what's going on with our  
water in case something  
does happen.



## What next?

- If you don't already have a team that includes people from plant/maintenance, safety, leadership, AND infection control you should get that together pronto.
- How will you prevent legionella from breeding in your highest risk areas?
  - Disinfectants? Hyperchlorination? Increased temperature? Point of use filtration? Regularly running water in low use areas?
- How will you measure whether or not these strategies are working?
  - Measure chlorination? Legionella culture? Patient testing data?
  - Who will do it? What tests will they use? When will they do it? Where will it be done? How will they report it?
- Decide what initial steps should be taken if the test is not within expected range.

## In every day language....

- Water risk assessment:
  - What kind of patients do you serve and how do they interact with your water?
  - Where might legionella hide in your pipes?
  - Where and when might high risk patients be exposed to legionella-infested water?
- Implement a Water Management Program
  - Now this is where people get tripped up. Or should I say overwhelmed?
- Define testing protocols, acceptable ranges, blah blah blah
  - This is stuff you find in manufacturer's packets and buried in the ASHRAE standard. It's as easy as contact time for bleach. You got this.
  - Now just transcribe the relevant details into your water management plan/policy.
  - Be sure to include a contingency plan for what to do if something is out of range. This way, people can act on stuff without having to call you directly. Right.

# UCM Water Management Plan

- We use hyperchlorination to manage legionella in our water. City water routinely grows legionella.
- Water is run from all spigots at least every week to ensure no stagnation.
- Cooling towers and bladders are sampled every other month when in use.
- City source water is also sampled every other month.
- We consider all of our inpatient units to be high risk so we do surveillance for legionella cases and water sampling with chlorination check at point of use and culture for legionella on a regular basis.
- Because water stacks serve many rooms, we only sample a few rooms on each stack each month but rotate the rooms so everything gets sampled at least once a year.
- Our sampling plan rotates which rooms have water sampled each month to give us a 95% confidence in finding legionella if there is contamination in oncology rooms and 90% confidence for other inpatient rooms.
- 1L samples are collected and processed in our Infection Control lab.



# What is a bladder?



# Incoming city water & cooling tower collection



# Processing Instructions

## Water Surveillance for Legionella

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4. Label 15 mL conical tube “With Acid” for each sample and a positive Legionella control sample (obtain (+) control from Microbiology lab). The “Without Acid” sample will be the 50 mL conical tube already containing the filter paper.
5. Add 1 mL of vortexed sample and positive control sample into their respective 15 mL “With Acid” conical tubes.
6. Add 1 mL of acid treatment reagent (found in flammable cabinet) to 15 mL “With Acid” conical tube and let sit for 1 minute.

### **Plating Samples for Hot/Cold Tap Water:**

1. Add 100 µL of sample on to each BYCE and BYCE w/ PAV plate.
2. Streak a lawn on the plate and wrap with parafilm.
3. Incubate at 35°C in humidified CO<sub>2</sub> for 10 days.

### **Plating Samples for Cooling Tower, Bladders, and Incoming City Water:**

1. Add 100 µL of acid-treated and non-acid-treated sample on to each BYCE and BYCE w/ PAV plate.
2. Streak a lawn on the plate and wrap with parafilm.
3. Incubate at 35°C in humidified CO<sub>2</sub> for 10 days.

There should be 3 plates in each sample set:

#### Mitchell Central, Surgery-Brain, CCD Towers

1. BCYE w/ PAV plate inoculated with acid-treated specimen
2. BCYE plate inoculated with acid-treated specimen
3. BCYE w/PAV plate inoculated with specimen

#### Legionella Positive Control

1. BCYE w/ PAV plate inoculated with acid-treated control
2. BCYE plate inoculated with acid-treated control
3. BCYE w/PAV plate inoculated with control

Negative controls are not included.

# Plates

- Water samples from various areas are processed and filtered as is a positive control obtain from micro lab. The positive control and half of the sample have acid treatment reagent added.
- The three samples are then plated on BCYE for 10 days.
- Examine plates after 24 hours (may need to dilute and re-incubate if overgrown)
- Gram stain any grey or lavender colonies
- Sub-culture to BCYE and chocolate
- Incubate another 48 hours
- If growth is only on BCYE and not on chocolate, we call presumptive legionella and send to MALDI-TOF

## What if there is a positive?

- Shock treat the affected cooling tower (bleach) and re-test 3 days later
  - If negative, back to usual surveillance
  - If positive, repeat shock and investigate further
  - Other remedies include changing shower heads and hoses with replacement of teflon lining (this makes the biggest difference), terminal filters
  - Consider changing to bottled water & bed baths if very high levels or persistent problem.
- If a patient develops HAI legionella
  - Report to CDPH
  - Sample water from the patient's room (both faucet and shower) and disallow use until results are negative.
  - Check for symptoms of legionella in other patients on the unit/in the water line.
  - Consider testing others for legionella as well.
  - Sample adjacent rooms, water and ice machines from the unit, other rooms from the same plumbing stack and control rooms from elsewhere in the institution
  - If samples from the room or adjacent rooms are positive, change to bottled water and bed baths for the whole plumbing stack/unit until problem is found and solved.
  - Consider temporary terminal filters if you can't solve the problem.