

Other NTM outbreaks

NTM OUTBREAKS

Hospital bronchoscopy-related **pseudo-outbreak** caused by a circulating **Mycobacterium abscessus** subsp. massiliense.

First United States **Outbreak** of **Mycobacterium abscessus** Hand and Foot **Disease** Among Children Associated With a Wading **Pool**.

Genomic **epidemiology** of a national **outbreak** of post-surgical **Mycobacterium abscessus** wound infections in **Brazil**.

Over Troubled Water: An **Outbreak** of Infection Due to a New Species of **Mycobacterium** following Implant-Based Breast Surgery.

Global outbreak of severe **Mycobacterium chimaera** disease after cardiac surgery: a molecular epidemiological study.

Investigation of a **Mycobacterium fortuitum** prosthetic joint infection **outbreak** at two ambulatory surgery centers in Tennessee.

Mycobacterium chelonae infection of a cardiovascular bioprosthesis linked to a recent **outbreak**.

Same strains, different patients; Patients not infected (false-positive cultures)

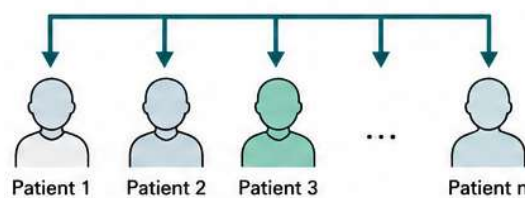
1. Contamination via bronchoscope

Contaminated bronchoscope



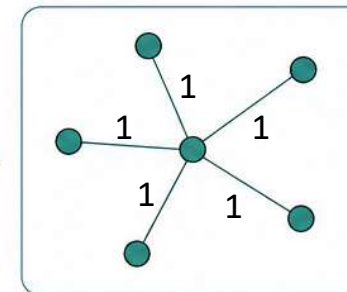
NTM persist in biofilm within the bronchoscope or its channels

How contamination occurs



The bronchoscope is used for multiple patients. Incomplete reprocessing leads to transfer of NTM to respiratory samples.

Apparent clustering (e.g. Minimum Spanning Tree)



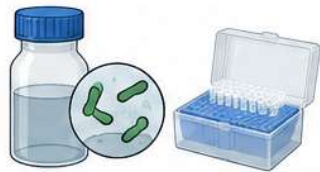
Isolates from different patients are genetically indistinguishable or very closely related.

Looks like an outbreak, but source is a contaminated bronchoscope.

● Sample from different patients

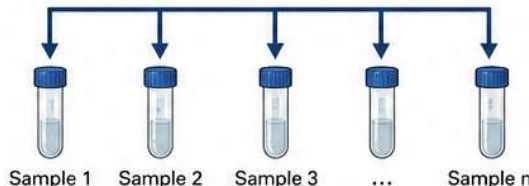
2. Contamination in the laboratory

Contaminated reagent or material



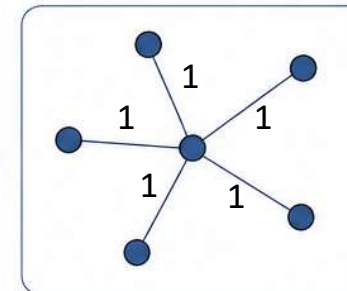
NTM present in reagent, water, ect. or laboratory environment

How contamination occurs



Contaminated reagent, labware, or environment introduces NTM into multiple specimens during processing.

Apparent clustering (e.g. Minimum Spanning Tree)

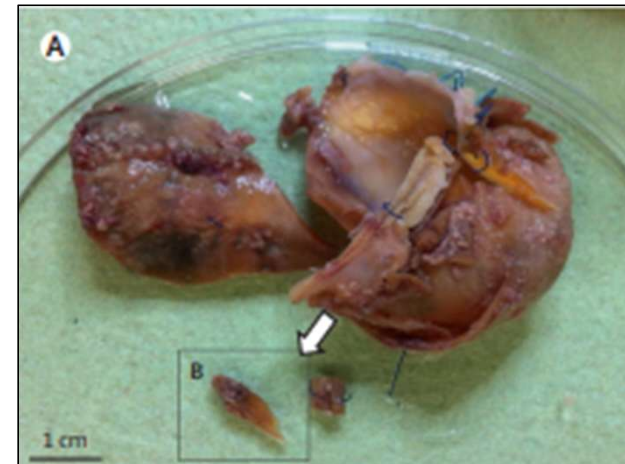
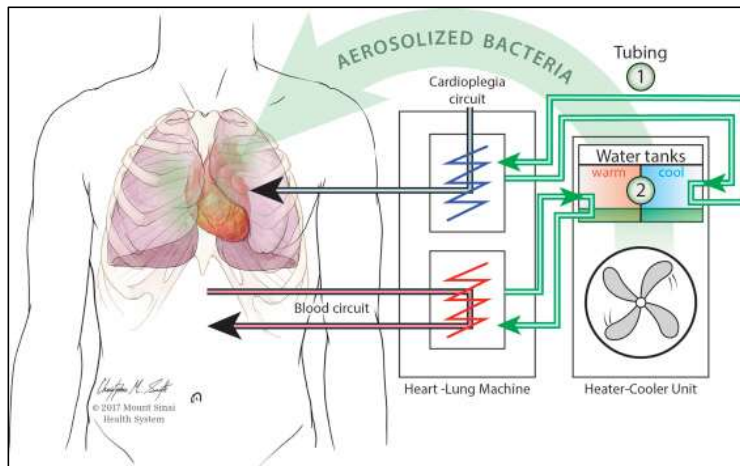


Isolates from different patients cluster together.

Looks like an outbreak, but source is laboratory contamination.

● Sample from different patients

- Case study 1: Heater-cooler unit (HCU) outbreak – *M. chimaera*
- Case study 2: BioIntegral hearth valve outbreak – *M. chelonae*



M. CHIMAERA HCU OUTBREAK

Prolonged Outbreak of **Mycobacterium chimaera** Infection After Open-Chest Heart Surgery.

Sax H, Bloemberg G, Hasse B, Sommerstein R, Kohler P, Achermann Y, Rössle M, Falk V, Kuster SP, Böttger EC, Weber R.

Clin Infect Dis. 2015 Jul 1;61(1):67-75. doi: 10.1093/cid/civ198. Epub 2015 Mar 11.

PMID: 25761866 [Free article.](#)

Global outbreak of severe **Mycobacterium chimaera** disease after cardiac surgery: a molecular epidemiological study.

van Ingen J, Kohl TA, Kranzer K, Hasse B, Keller PM, Katarzyna Szafrńska A, Hillemann D, Chand M, Schreiber PW, Sommerstein R, Berger C, Genoni M, Rüegg C, Troillet N, Widmer AF, Becker SL, Herrmann M, Eckmanns T, Haller S, Höller C, Debast SB, Wolfhagen MJ, Hopman J, Kluytmans J, Langelaar M, Notermans DW, Ten Oever J, van den Barselaar P, Vonk ABA, Vos MC, Ahmed N, Brown T, Crook D, Lamagni T, Phin N, Smith EG, Zambon M, Serr A, Götting T, Ebner W, Thürmer A, Utpatel C, Spröer C, Bunk B, Nübel U, Bloemberg GV, Böttger EC, Niemann S, Wagner D, Sax H.

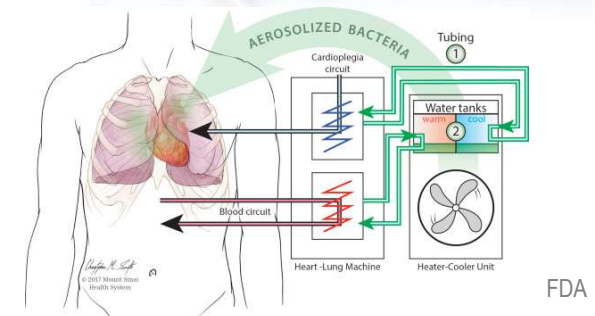
Lancet Infect Dis. 2017 Oct;17(10):1033-1041. doi: 10.1016/S1473-3099(17)30324-9. Epub 2017 Jul 12.

PMID: 28711585

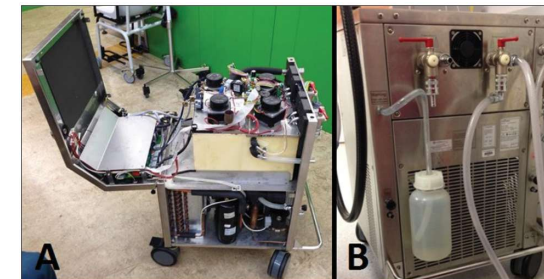
M. CHIMAERA HCU OUTBREAK - FACTSHEET

- Linked to heater cooler units (HCU) – specifically from LivaNova
- Over 180 cases of *M. chimaera* infections in cardiac surgery patients in US/EU since 2013
- Median time between surgery and first symptoms: 17 months (IQR 13-26 months)
- Resected material (e.g. valve prosthesis) positive in 94% of cases
- All patients showed EP signs of NTM, 41% signs of endocarditis, 14.6% pulmonary infection, 67% disseminated disease (eyes, kidney, bone, or brain)
- Overall case fatality rate was 45.5% (80/176), with a median survival of 24 months after the initiation of antimycobacterial therapy or diagnosis

Aerztezeitung.de



Van Ingen et al – LID 2017



M. CHIMAERA HCU OUTBREAK

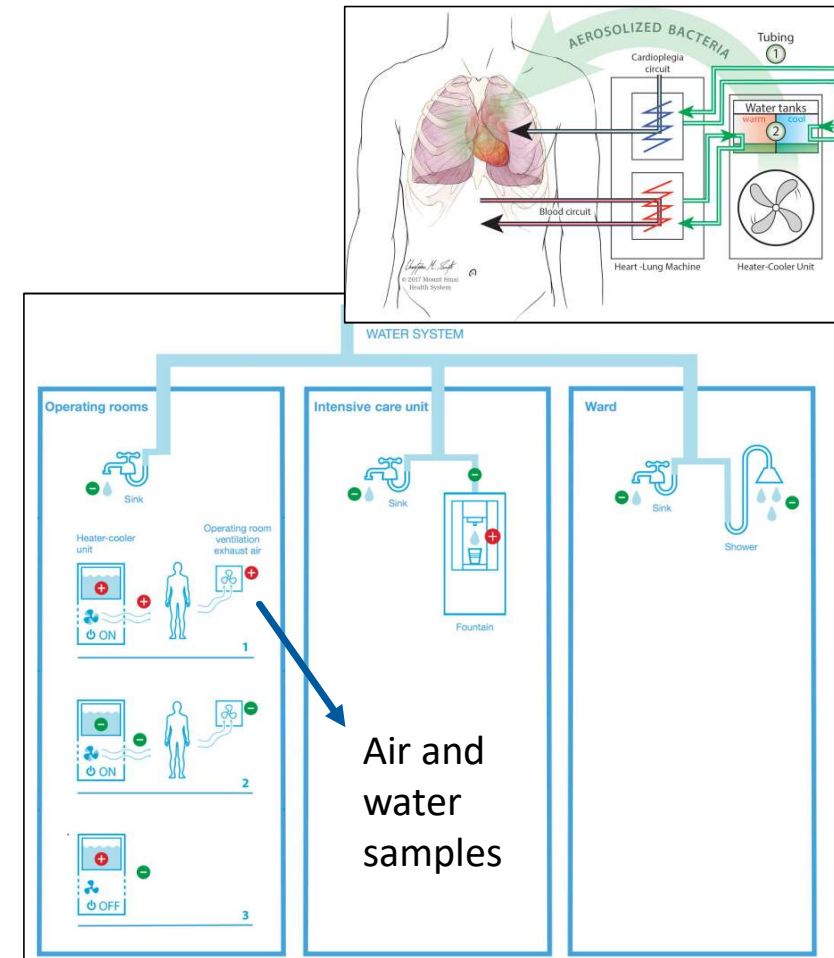
Prolonged Outbreak of *Mycobacterium chimaera* Infection After Open-Chest Heart Surgery.

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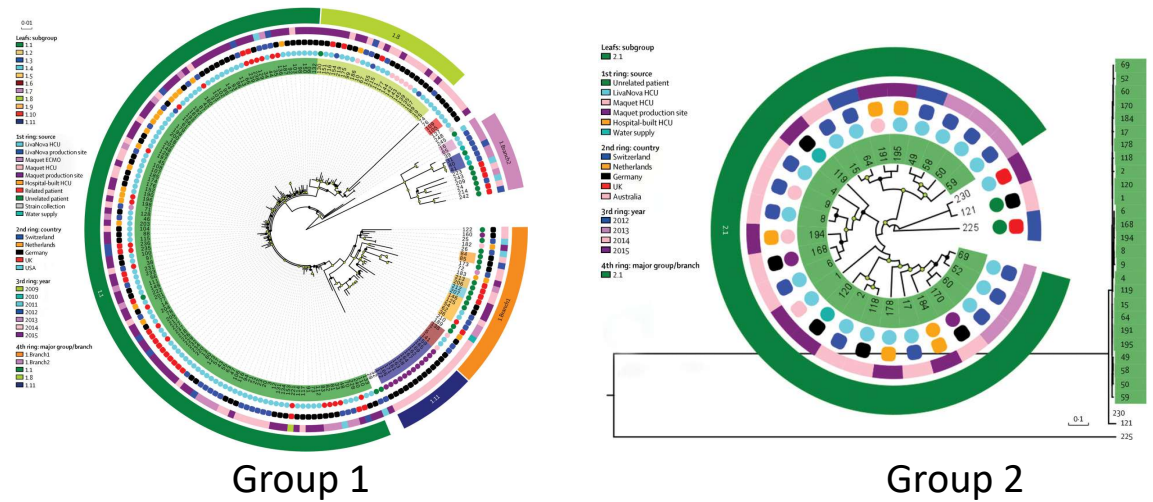
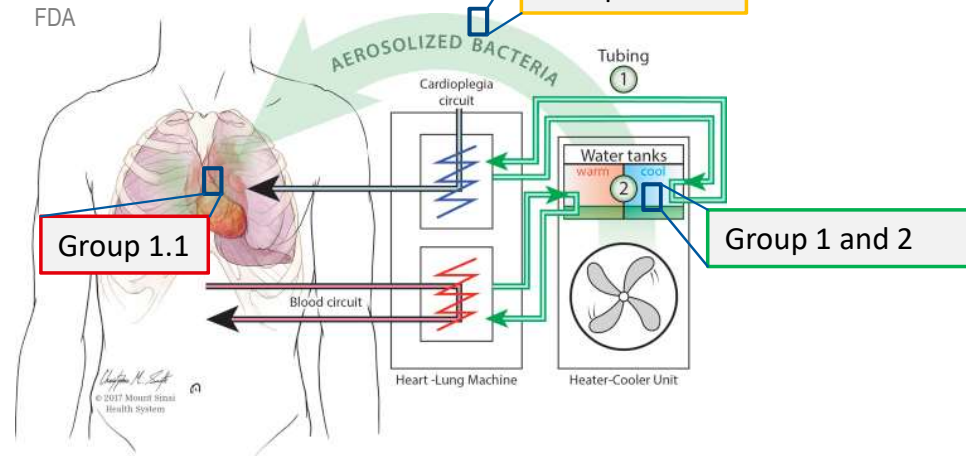
- In 2012: 2 cases of *M. chimaera* invasive disease in Zürich after cardiac surgery; same RAPD-PCR pattern
- Environmental investigation
- Over 180 cases of *M. chimaera* infections in cardiac surgery patients in US/EU since 2013
- Median time between surgery and first symptoms: 17 months (IQR 13-26 months)
- Overall case fatality rate was 45.5% (80/176)



M. CHIMAERA HCU OUTBREAK

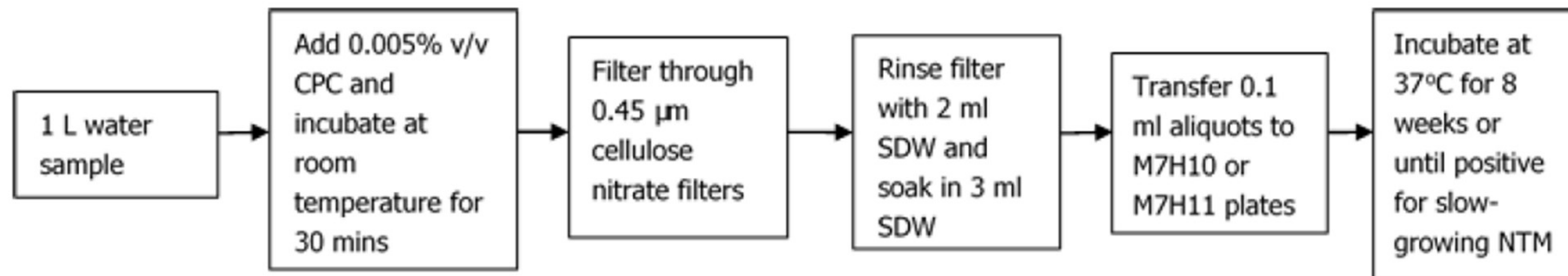


Van Ingen et al – LID 2017 **WGS analysis of 250 isolates**



ECDC TECHNICAL DOCUMENT

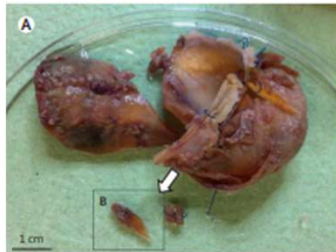
EU protocol for case detection, laboratory diagnosis and environmental testing of *Mycobacterium chimaera* infections potentially associated with heater-cooler units: case definition and environmental testing methodology
August 2015



M. CHELONAE HEARTH VALVE OUTBREAK

BIOMITRAL™

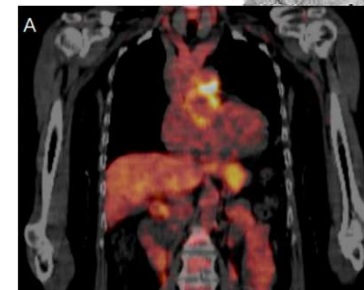
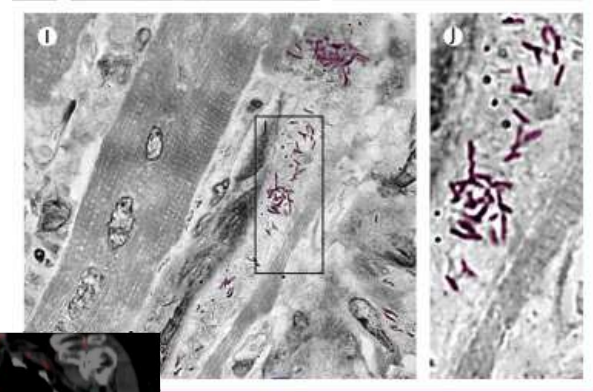
STENTED PORCINE AORTIC AND MITRAL BIOPROSTHESIS



Endocarditis associated with contamination of cardiovascular bioprostheses with *Mycobacterium chelonae*: a collaborative microbiological study

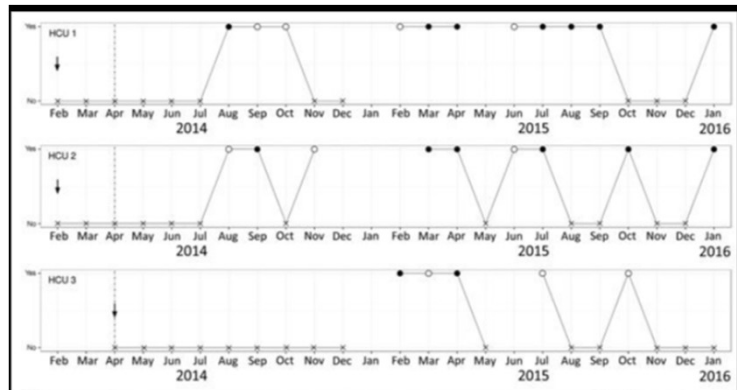
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- *M. chelonae* detected in several cardiac surgery patients (molecular methods, not culturable)
- All patients had a bioprosthesis from BioIntegral
- Potential sources and transmission routes remain unknown
- Hold on sales in Europe



- Difficult to detect
 - Slow growing or non-culturable
 - Delayed diagnosis due to long latency after exposure (1-3 years) and non-specific symptoms
- Prevention
 - Continuous environmental monitoring and surveillance
 - Avoid use of tap water for rinsing or processing medical equipment
 - Strict cleaning, disinfection, and maintenance protocols (problem: mycobacteria are highly resistant!)
- Outbreak control
 - Identification of the contamination source (extensive environmental sampling + epidemiological analysis + high-resolution genomic analysis)
 - Removal, replacement, or disinfection of contaminated equipment or water systems

- Intensified cleaning and disinfection protocol → failed to prevent growth of NTM entirely but succeeded in preventing detectable aerosolization of *M. chimaera*
- Custom-made stainless steel housing → strict air separation between the exhaust air of the HCUs and the operating room air
- Putting HCU outside of the OP
- Continuous microbiological monitoring



> *Emerg Infect Dis.* 2016 Oct;22(10):1830-3. doi: 10.3201/eid2210.160925.

Reemergence of *Mycobacterium chimaera* in Heater-Cooler Units despite Intensified Cleaning and Disinfection Protocol



Schreiber et al. 2016