Switzerland, France - Water–Vapor treatment of Shower Systems in healthcare facilities: An effective protocol to contain the risk of exposure to Legionella of at-risk patients

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Identification

SURVEY ID NUMBER
10.16909-dataset-62

TITLE
Water–Vapor treatment of Shower Systems in healthcare facilities: An effective protocol to contain the risk of exposure to Legionella of at-risk patients

TRANSLATED TITLE
Évaluation d'un dispositif de mélange vapeur-eau pour éliminer et contrôler les biofilms et le tartre dans les systèmes de douche

COUNTRY

Name	Country code
Switzerland	CHE
France	FR

ABSTRACT
Legionnaires' disease (LD) causes severe pneumonia with 5-15 percent (%) fatality rates in hospitalized patients, with rising incidence across Europe, North America and Japan. While established disinfection protocols exist for building pipes, no large-scale solution addresses shower systems themselves, where point-of-use filters remain impractical for widespread implementation. We assessed an effective protocol to contain Legionella proliferation from terminal water outlets in healthcare facilities, nursing homes, and high-risk residences.
We evaluated an innovative water-vapor protocol consisting of sequential water flushing followed by high-pressure vapor at 120°C. Biofilms were grown under controlled conditions across five settings—one healthcare facility, one nursing home, and three private residences—targeting biofilms aged 5-104 weeks during peak LD season. Efficacy was assessed through scanning electron microscopy, flow cytometry, 16S rRNA sequencing, and functional pathway analysis (PICRUSt2), comparing results with conventional thermal disinfection (65°C, 10 minutes) and untreated controls.

KIND OF DATA
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Version

VERSION DATE
2026-01-01

Scope

KEYWORDS

Keyword
Legionella
Legionnaires' disease
healthcare facilities
shower systems
built-environment microbiome

Coverage

GEOGRAPHIC COVERAGE

Lausanne, Nods, Nidau and Prêles (Switzerland)
St-Etienne (France)

UNIVERSE

healthcare facilities, nursing homes, and residences of patients at high-risk of contracting Legionellosis

Producers and sponsors

PRIMARY INVESTIGATORS

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PRODUCERS

Name	Affiliation
Alexis Marette	Gjosa

FUNDING AGENCY/SPONSOR

Name
Innosuisse

Sampling

SAMPLING PROCEDURE

Shower systems were installed in replicate across 5 different settings—In the healthcare facility in Lausanne (University hospital of Lausanne, Switzerland) and in the nursing home in St-Etienne (France) shower units were installed in triplicate for each treatment condition (no treatment, water-vapor treatment, or conventional thermal disinfection) and for each biofilm age targeted for sampling. In the domestic settings, three residential setting located in Nods, Nidau and Prêles (Switzerland) were selected based on the presence of at least two independent shower cabins per building, allowing for paired comparisons between treated and untreated conditions. The frequency of use was controlled to ensure biofilm grow. At 5 weeks, 32 weeks, 52 weeks and 104 weeks, paired biofilms were either directly extracted or subjected to a single treatment either water-vapor treatment or thermal disinfection (10 min at 65℃) prior to extraction. To assess the effects of repeated weakly water-vapor treatments, biofilms aged 32 weeks were treated once per week for four consecutive weeks, one sample was extracted after each treatment,
The efficacy of the treatment in removing biofilm from hoses was visualized by scanning electron microscopy on 1 cm sections cut from both extremities and the center of each hose. These pieces were fixed in 2.5% Glutaraldehyde / Cacodylate buffer (0.1 M, pH 7.2), dehydrated with increasing concentration of ethanol and carbon-coated by thermal evaporation. Biofilms from the remaining hose sections were extracted following previously validated protocol. Total cell counts were determined by flow cytometry using SYBR green and PicoGreen-stained aliquots, and metal concentration by inductively coupled plasma mass spectrometry (ICP-MS Thermo iCAP TQ) following previously published protocol.
Microbiome community composition was assessed by 16S rRNA gene amplicon sequencing targeting the V3-V4 regions, using the Illumina MiSeq plateform, when sufficient DNA was available. SEM and ICP-MS analysis were performed by the Forensic Toxicology and Chemistry Unit (UTCF) at CHUV, and sequencing by Microsynth (Switzerland).

Data collection

DATES OF DATA COLLECTION

Start	End
2022/06/21	2022/09/21

DATA COLLECTION MODE

Other [oth]

DATA COLLECTION NOTES

Study design
Shower systems were installed in replicate across 5 different settings. In the healthcare facility Lausanne (University hospital of Lausanne, Switzerland) and in the nursing home in St-Etienne (France) shower units were installed in triplicate for each treatment condition (no treatment, water-vapor treatment, or conventional thermal disinfection) and for each biofilm age targeted for sampling. In the domestic settings, three residential setting located in Nods, Nidau and Prêles (Switzerland) were selected based on the presence of at least two independent shower cabins per setting, allowing for paired comparisons between treated and untreated conditions. The frequency of use was controlled to ensure biofilm grow. At 5 weeks, 32 weeks, 52 weeks and 104 weeks, paired biofilms were either directly extracted or subjected to a single treatment either water-vapor treatment or thermal disinfection prior to extraction. To assess the effects of repeated weakly water-vapor treatments, biofilms aged 32 weeks were treated once per week for four consecutive weeks, one sample was extracted after each treatment.
The efficacy of the treatment in removing biofilm from hoses was visualized by scanning electron microscopy on 1x1 cm2 sections cut from both extremities and the center of each hose. These pieces were fixed in 2.5% Glutaraldehyde / 0.1 M Cacodylate buffer pH 7.2, dehydrated with increasing concentration of ethanol and carbon-coated by thermal evaporation. Biofilms from the remaining hose sections were extracted following previously validated protocol11. Total and viable cell counts were determined by flow cytometry passing SYBR green and PicoGreen-stained aliquots on a CYTOFLEX S2 (Beckman Coulter, US), and metal concentration by inductively coupled plasma mass spectrometry (ICP-MS Thermo iCAP TQ) following previously published protocol11,12. Microbiome community composition was assessed by 16S rRNA gene amplicon sequencing targeting the V3-V4 regions, using the Illumina MiSeq plateform, when sufficient DNA was available. ICP-MS analysis was performed by the Forensic Toxicology and Chemistry Unit (UTCF) at CHUV, and sequencing by Microsynth (Switzerland). Detailed protocol is provided in Annex 1.

DATA COLLECTORS

Name
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Access policy

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CITATION REQUIREMENTS

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ACCESS AUTHORITY

Name	Affiliation	Email	URL
Documentation and data unit (UDD)	Unisanté, University Center for Primary Care and Public Health & University of Lausanne, Lausanne, Switzerland	udd.data@unisante.ch	Link

LOCATION OF DATA COLLECTION

Unisanté Data repository

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Data Dictionary

Data file	Cases	Variables