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# Exposure of elderly people to *Legionella* isolated in shower hot-water aerosols in nursing homes : first results from the French LEGION'AIR multicentric study.

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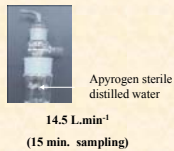
## INTRODUCTION

The effect of airborne *Legionella* on human health has recently increased in importance. Increased outbreak of *Legionella* has raised an interest in reliable methods for the collection and determination of airborne *Legionella*. Detection and enumeration of water *Legionella* is well established in routine examinations for several years and has been standardized even today. *Legionella pneumophila* and other species of *Legionella* are often found in water systems in large establishment such as hospitals and hotels, but relatively few sites are associated with clinical disease. Even if the main mode of transmission of *Legionella* is inhalation, there is an absence of a standard protocol for bioaerosols sampling.

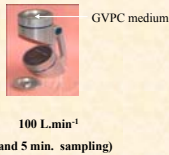
The epidemiological LEGION'AIR project aims at characterizing exposure of elderly people to *Legionella* while showering, and at studying the relationship between concentrations of *Legionella* in water and/or air and health (clinical and biological signals). It focuses on the mild pathology caused by *Legionella* : the Pontiac Fever. The first phase of this research deals with metrological measurements of *Legionella* in water and in aerosol to characterize the exposure level of elderly. From October 2003 to September 2004, we carried out environmental studies about shower hot-water aerosols in 19 nursing homes from Lorraine region (France). 412 water samples and 102 aerosol samples were collected at 103 showers. Each sampling point was chosen so as to represent shower water quality for one or a group of elderly people based upon thorough diagnostic of the water system in each nursing home.

## MICROBIAL AEROSOL IMPACTORS

### Impinger SKC BioSampler

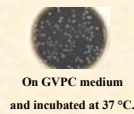


### MAS100®

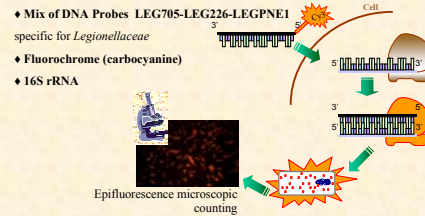


## Legionella DETECTION METHODS

### CULTURE :

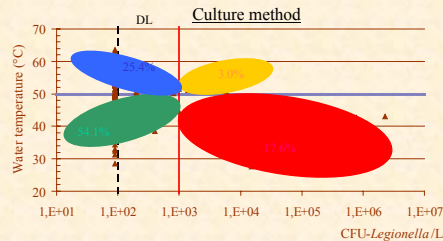


### FISH: Fluorescence In Situ Hybridisation



## Legionella WATER CONTAMINATION

In our study, 68% of the nursing homes are contaminated by cultivable *Legionella* : mainly *Legionella pneumophila* is isolated (66%). With culture method, 32% of the water samples contained *Legionellae*, ranging from 100 CFU.L<sup>-1</sup> (detection limit) to 2.0x10<sup>7</sup> CFU.L<sup>-1</sup>. Moreover, with FISH method, 68% of the water samples contained *Legionellaceae*, ranging from 5.0x10<sup>3</sup> FISH.L<sup>-1</sup> (detection limit) to 1.6.10<sup>8</sup> FISH.L<sup>-1</sup>.



FISH

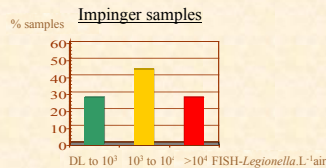
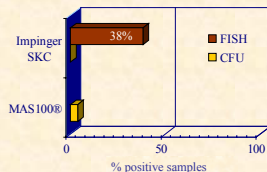
Positive	27.7% (114/412)	39.6% (163/412)
Negative <sup>1</sup>	2.4% (10/412)	27.4% (113/412)
	Positive	Negative <sup>2</sup>

Culture

<sup>1</sup> < DL = 100 CFU.L<sup>-1</sup>  
<sup>2</sup> < DL = 5.0x10<sup>3</sup> FISH.L<sup>-1</sup>

In 39.6% of the water samples, cultivable *Legionella* aren't detected whereas *Legionellaceae* are detected with *in situ* hybridisation method. The risk of contamination with *Legionella* >10<sup>3</sup> CFU.L<sup>-1</sup> (french recommendations) is 7 times greater if water temperatures are <50°C. For water temperatures >50°C, the presence of cultivable *Legionella* (3.0%) can be explained by the thorough diagnostic water system in each nursing home : maintenance problems for the hot-water production and for the points-of-use (cleaning, descaling, ...).

## AIRBORNE Legionella



### In situ hybridisation

Positive water samples (%)	38.2% (39/102)	52.9% (54/102)
Negative water samples (%)	0% (0/102)	8.8% (9/102)
Positive aerosol samples (%)		Negative aerosol samples (%)

There is an improved detection of aerosolized *Legionella* with FISH method and impingement technique (38%) compared to culture and MAS100®. Aerosolized *Legionella* concentrations are ranging from 1.5x10<sup>2</sup> FISH.L<sup>-1</sup>air (detection limit) to 3.2x10<sup>4</sup> FISH.L<sup>-1</sup>air. In 28% aerosol samples, *Legionella* contamination is >10<sup>4</sup> FISH.L<sup>-1</sup>air.

For 38% of the hot-water sampling points, *Legionella* is detected in shower aerosols. However, even if the water samples' majority are positive (52.9%), we could not detect *Legionella* in the aerosol in our experimental conditions.

## CONCLUSIONS

More half of the studied nursing homes have water systems contaminated by *Legionella*. FISH method improves the characterization of the *Legionella* exposure of elderly while showering. Moreover, this exposure to showers aerosols is better characterized with FISH method and impingement technique. Finally, to maintain a water temperature >50°C (french recommendations) can limit the *Legionella* risk but maintenance (water systems, points-of-use) remains also important for people's exposure.

## ACKNOWLEDGMENTS

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