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医療環境委員会主催オンラインセミナー  
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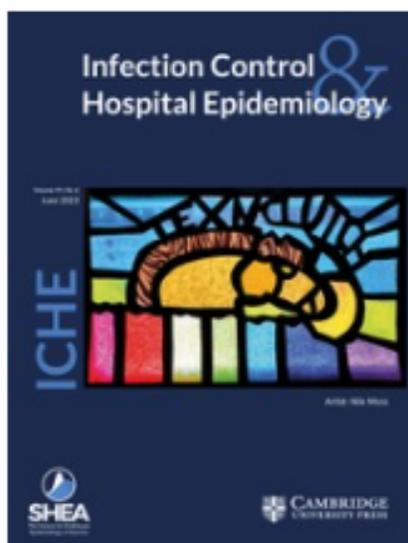
# 医療環境における水質検査の意義

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# 薬剤耐性菌が十分に減らない

- 手を介した伝播の継続  
適切な**手指衛生**の実施
- 環境による伝播の継続  
適切な**環境の清掃・消毒**  
適切な**水回り環境**の整備
- 適正な抗菌薬使用



Infection Control &  
Hospital Epidemiology

# SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update

Part of: **ICHE Compendium 2022**

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Janet B. Glowicz , Emily Landon, Emily E. Sickbert-Bennett, Allison E. Aiello , Karen deKay,  M. Salzman  and Polly A. Trexler

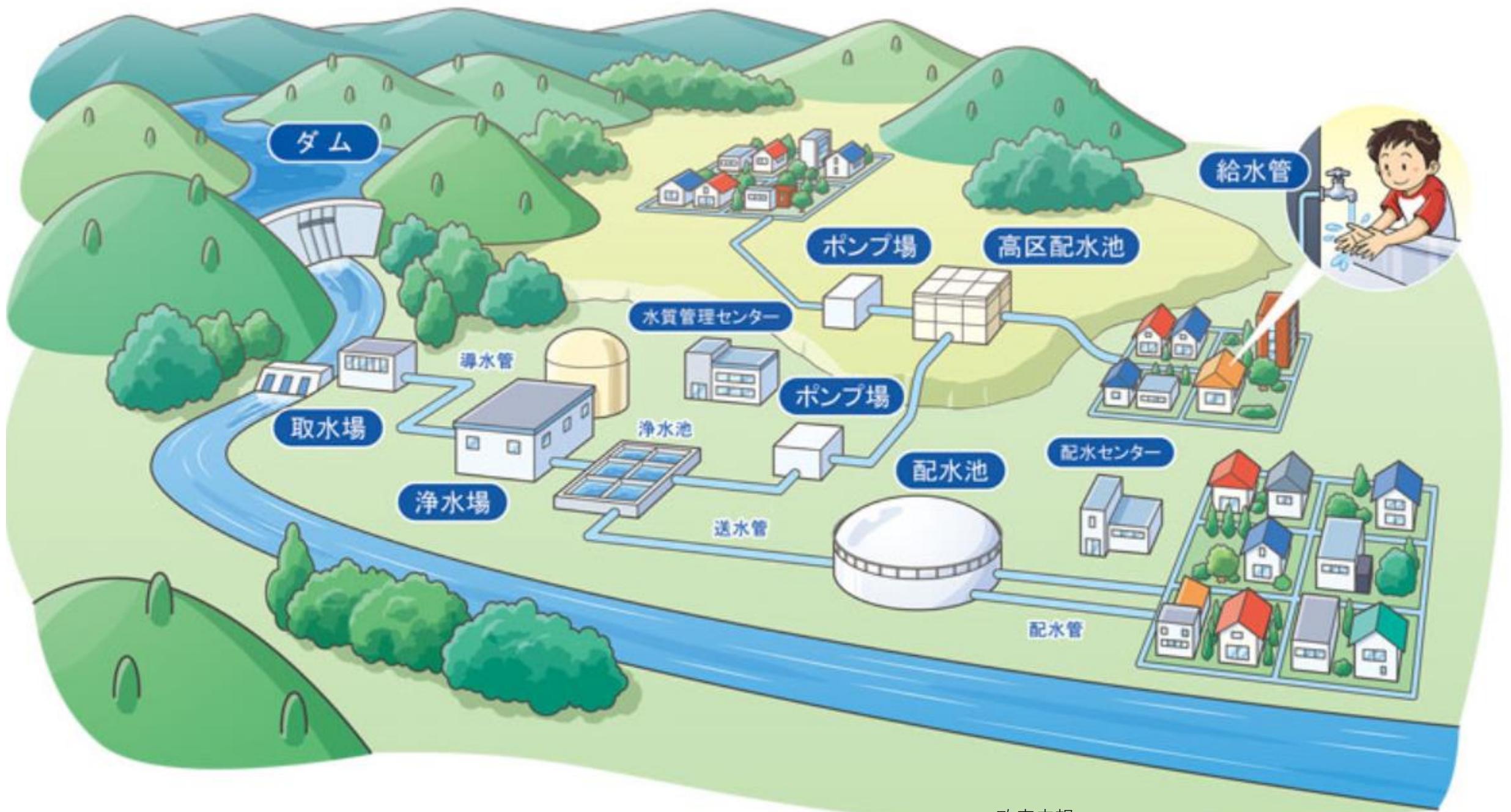
# Essential Practice : 必ずやること

1. 手の皮膚や爪を健康に保つ
2. 適切な製品を選択する
3. 手指衛生剤をアクセスしやすい場所に設置する
4. 手や環境汚染を減らすために適切に手袋を使用する
5. **シンクや排水口に関連した汚染に対し対策を講じる**
6. 手指衛生の遵守を観察する
7. 安全文化が高まる適時で意味のあるフィードバックを行う

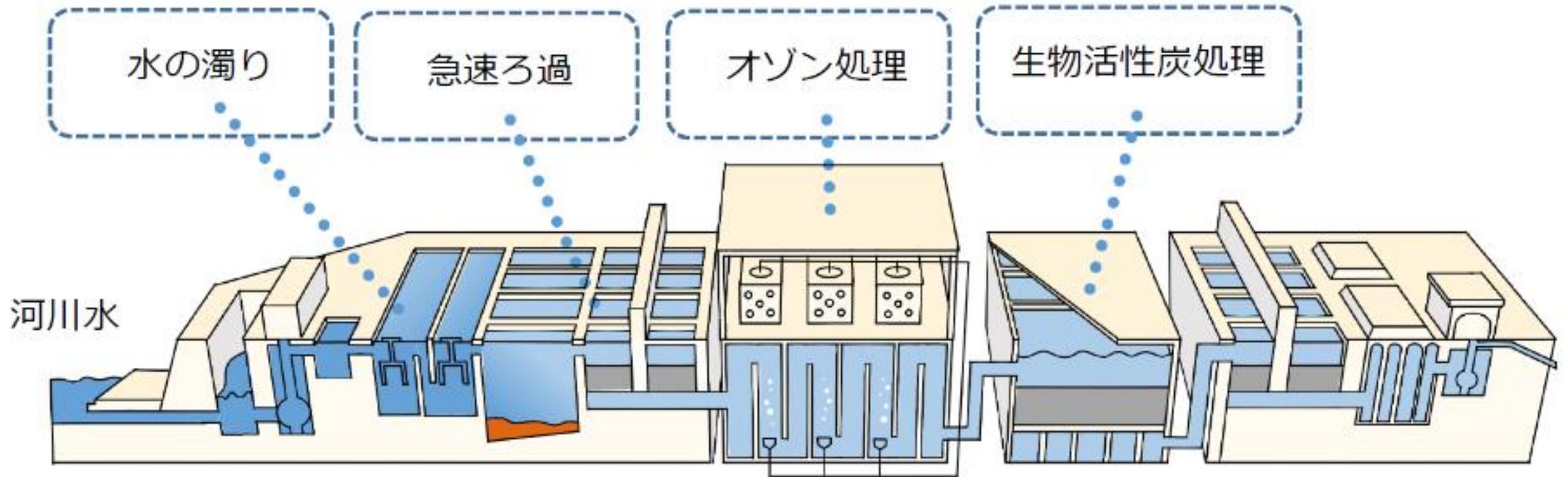
# 認識すべき事項と難解な要因

- 微生物伝播に水環境が大きく影響している
- Underestimation / 過少評価されやすい
- 医療施設における水システムは
  - ① 多人数が使用
  - ② 広範囲で複雑
  - ③ 認識や理解に専門知識が必要

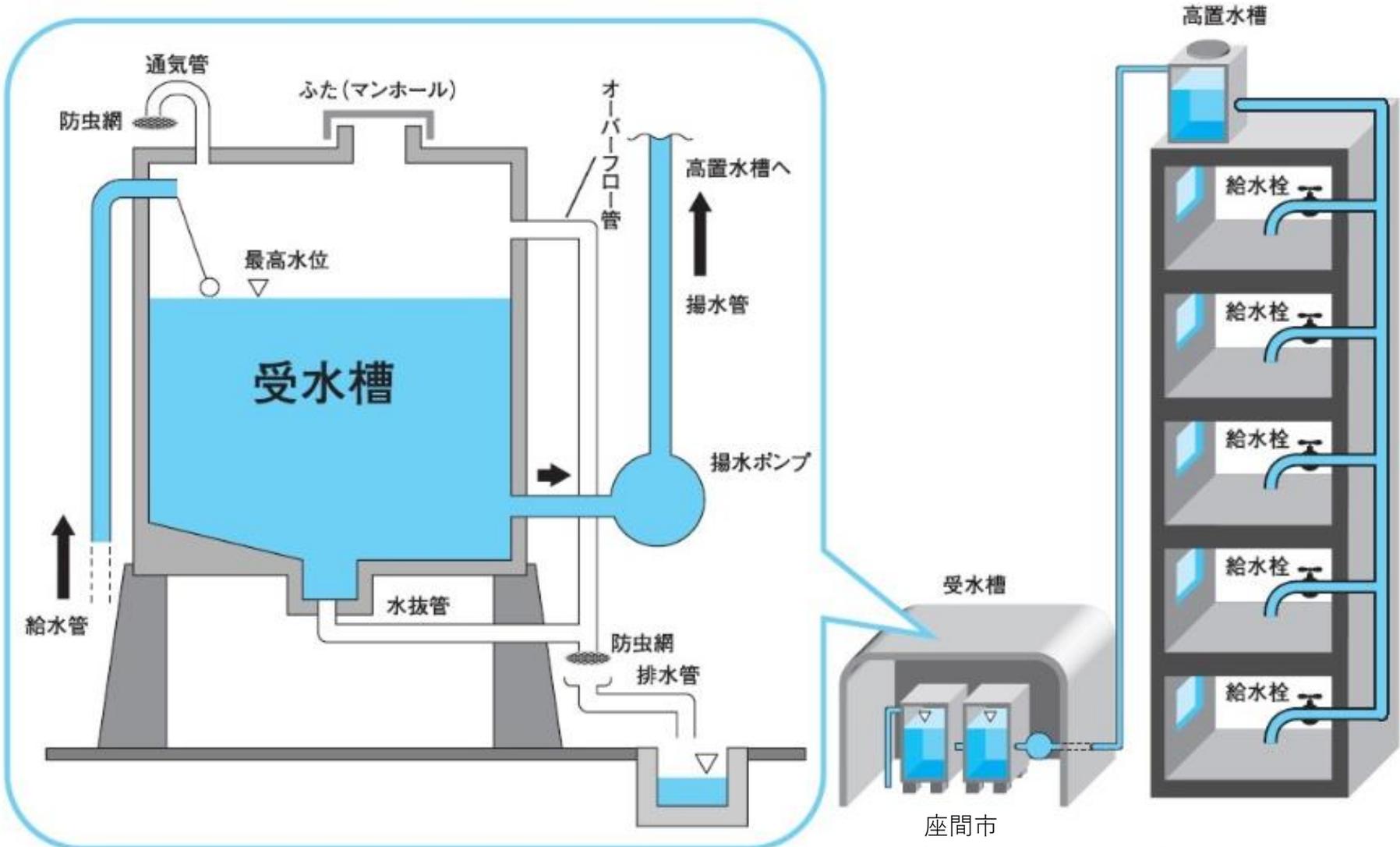
# 医療施設における水システムと微生物伝播



# 浄水場の仕組み



# 医療施設内の受水槽（貯水槽・貯湯槽）



座間市

# 上水

- 施設に供給される上水(当院は都水)はその質が担保されている
- しかし無菌ではない
- 施設内に供給された上水は、貯水槽や貯湯槽で貯留され、その後長い配管で分配、蛇口から排出される
- 水道費削減のため地下水を処理して混合使用している施設も
- この**複雑な水システム**には多くの**ピットホール**がある

# 貯水槽と貯湯槽

# 貯水槽・貯湯槽

- 最も重大なものがレジオネラ菌
- その他の病原体は稀？
- 必要な対策
  - 給湯系：十分な加熱による温度管理
  - 給水系：塩素消毒
- 温度管理や塩素管理が十分な場合、微生物の増殖が発生

# 温度管理による利点と欠点

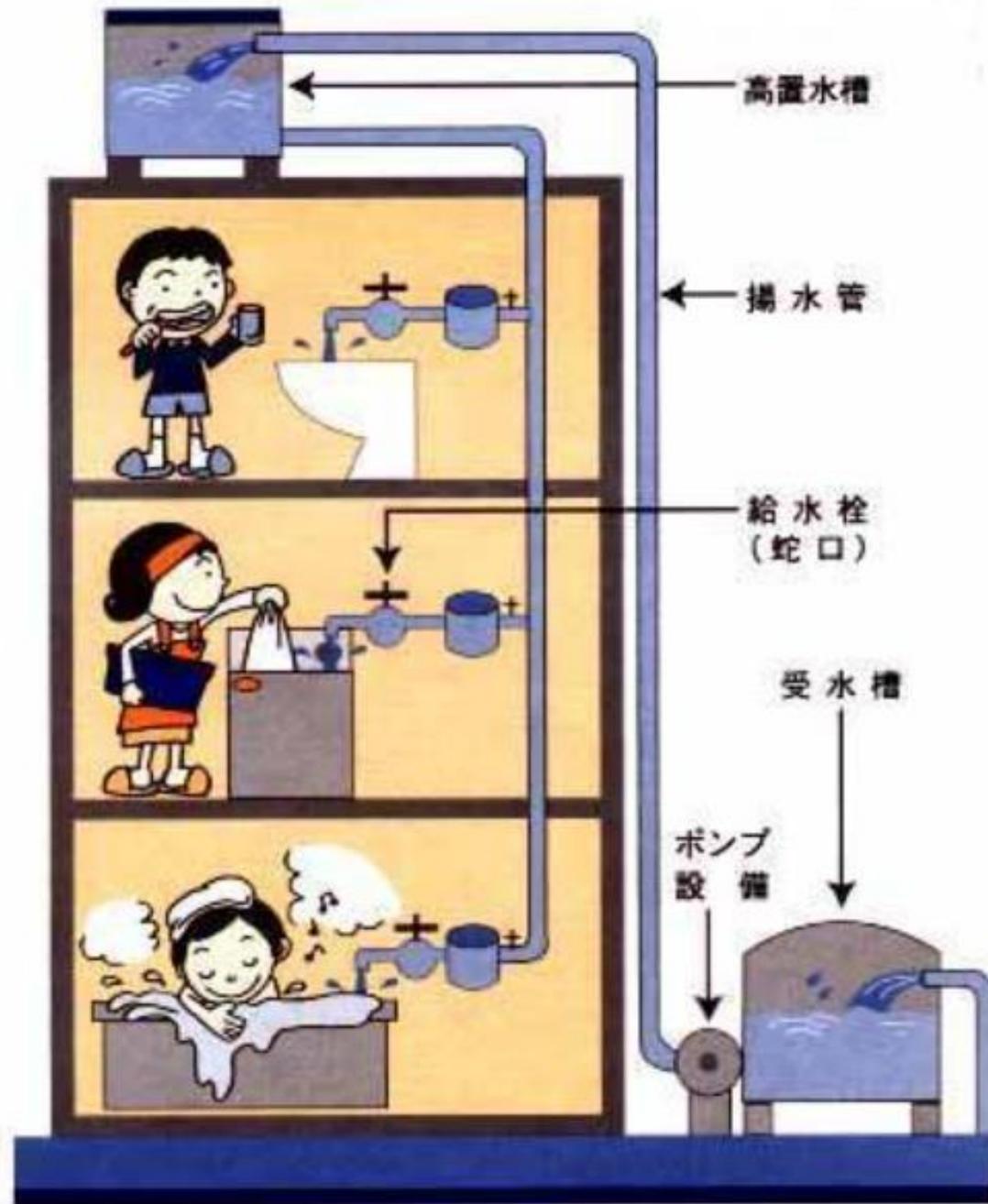
- 加熱処理は消毒の基本
- 貯湯槽だけの加熱では不十分
- 配管全ての温度管理が必要
- **高温による配管の腐食・孔食**

# 塩素系消毒の利点と欠点

- 最も一般的で簡便
- 十分な水を使い続けければ蛇口末端まで効果的な塩素濃度となる
- 使用不十分だと、滞留・うっ滞による揮発で**濃度低下**
- 加温で**濃度低下**
- 揮発や加温が予想以上に発生しやすい
- **過度な濃度上昇による腐食・孔食**

給水・給湯配管と温度調整器

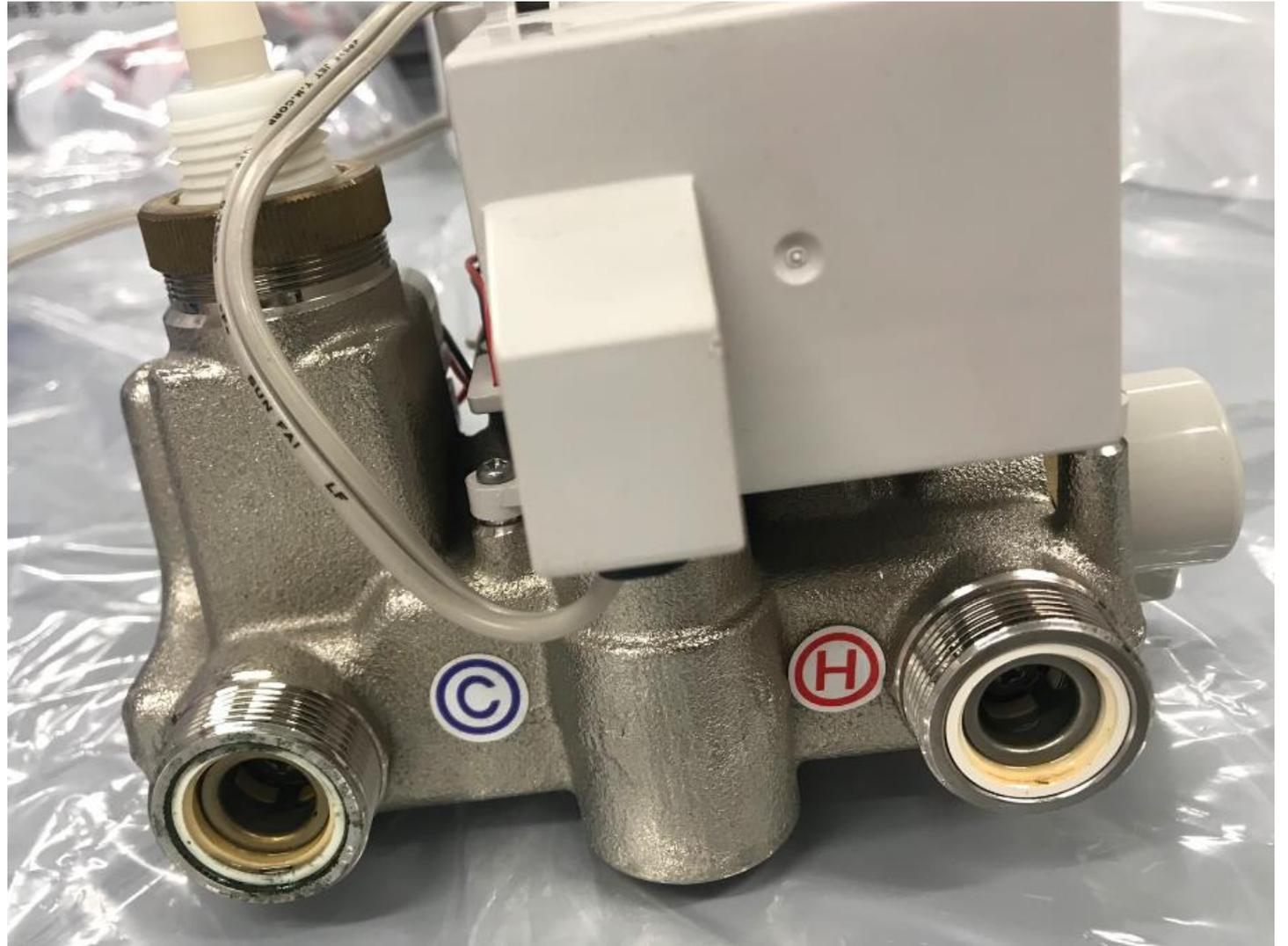
# 配管



# 配管

- 極めて長く、複雑、かつ目視できない
- 給水配管と給湯配管が近接していると両者の温度が「ぬるま湯」になり微生物増殖を促進
- 金属腐食や浸食が発生し得る

# 温度調整器(TMV: Thermostat Mixing valve)



# 蛇口と整流器

蛇口



Thanks to Dr. Michael Weinbren  
King's Mill Hospital, UK

# 本邦で普及する自動水栓の利点と欠点

## 利点

- レバーに触れずタッチレスである
- 節水が出来る

## 欠点

- **節水モードゆえに使用頻度が低い蛇口は塩素濃度が低下**  
月曜日の朝  
使用していない部屋／有料個室／休床部屋
- 手洗い時は手がセンサーに近づけやすく蛇口に触れる

蛇口に歯ブラシが近づく



# 整流器/ストレーター Straightener



名古屋掖済会病院  
横井博子看護師 提供



RESEARCH

Open Access

# Faucet aerators as a reservoir for Carbapenem-resistant *Acinetobacter baumannii*: a healthcare-associated infection outbreak in a neurosurgical intensive care unit



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Abstract

- Faucet aerators 整流器
- 中国からの報告
- CR-Acinetobacter
- 脳外科系ICU
- 食堂の蛇口（Faucet aerators整流器）から検出
- 4名の患者と遺伝子型が一致

intensive care unit, Faucet aerator.





## Pseudo-outbreak of *Mycobacterium paragordoniae* in a hospital: possible role of the aerator/rectifier connected to the faucet of the water supply system

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FOR INFECTIOUS  
DISEASES

## Persistent *Legionella* contamination of water faucets in a tertiary hospital in Japan



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### ABSTRACT

**Objective:** The feasibility of the decontamination procedure for *Legionella pneumophila* of water systems in healthcare facilities varies by water purification and disinfection methods in each country. We evaluated the efficacy of feasible decontamination strategies in Japan.

**Methods:** This study was conducted at Tokyo Medical University Hospital (1015 beds) between 2015 and 2018. Samples from the water system and cooling tower were cultured periodically. Hyper-chlorination of cool tap water (>0.2 ppm), increases in the temperature of hot water (>55 °C), and flushing were used as decontamination strategies. The case of healthcare-associated legionellosis was surveyed. Environmental and clinical isolates were genotyped.

**Results:** 1439 environmental samples were collected; 19 (1.3%) samples tested positive for *L. pneumophila* from water faucets of patient rooms, toilets, waste rooms, and water sourced from wells. Genotyping of 12 isolates confirmed that the same strains were present in eight environmental isolates and two isolates from patients over three years. Although the environmental contamination of the water system was persistent, the number of positive locations of hospital environments gradually decreased; eight in 2015, four in 2016, three in 2017, and four in 2018, respectively.

**Conclusions:** Monitoring contamination, hyper-chlorination, controlling temperature, and flushing were effective as a *Legionella* decontamination strategy.

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シャワー

# シャワー

4月 *Blastomonas* sp.  
抗酸菌  $3.5 \times 10^4$ CFU/ml

6月 *Blastomonas* sp.  
抗酸菌  $3.5 \times 10^4$ CFU/ml

8月 *Blastomonas* sp.  
抗酸菌  $3.5 \times 10^4$ CFU/ml

シャワーヘッドの汚染か  
その奥のホースの汚染か



# Biofilms on Hospital Shower Hoses: Characterization and Implications for Nosocomial Infections

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Although the source of drinking water (DW) used in hospitals is commonly disinfected, biofilms forming on water pipelines are a refuge for bacteria, including possible pathogens that survive different disinfection strategies. These biofilm communities are only beginning to be explored by culture-independent techniques that circumvent the limitations of conventional monitoring efforts. Hence, theories regarding the frequency of opportunistic pathogens in DW biofilms and how biofilm members withstand high doses of disinfectants and/or chlorine residuals in the water supply remain speculative. The aim of this study was to characterize the composition of microbial communities growing on five hospital shower hoses using both 16S rRNA gene sequencing of bacterial isolates and whole-genome shotgun metagenome sequencing. The resulting data revealed a *Mycobacterium*-like population, closely related to *Mycobacterium rhodesiae* and *Mycobacterium tusciae*, to be the predominant taxon in all five samples, and its nearly complete draft genome sequence was recovered. In contrast, the fraction recovered by culture was mostly affiliated with *Proteobacteria*, including members of the genera *Sphingomonas*, *Blastomonas*, and *Porphyrobacter*. The biofilm community harbored genes related to disinfectant tolerance (2.34% of the total annotated proteins) and a lower abundance of virulence determinants related to colonization and evasion of the host immune system. Additionally, genes potentially conferring resistance to  $\beta$ -lactam, aminoglycoside, amphenicol, and quinolone antibiotics were detected. Collectively, our results underscore the need to understand the microbiome of DW biofilms using metagenomic approaches. This information might lead to more robust management practices that minimize the risks associated with exposure to opportunistic pathogens in hospitals.

# Take Home Message

- 微生物伝播に水環境が大きく影響している
- 水システムは多人数が使用し、広範囲で複雑であるが、まずはそのリスクの認識が必要である
- 水質検査／培養による評価がリスクの認識を高める