The OPPPs: Opportunistic Premise Plumbing Pathogens

(not to be confused with)

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The Royal Melbourne Hospital

What will be covered today

- What we mean by OPPPs
- Water testing
- Clinical hand basins, sinks and drains
- Identifying possible outbreaks
- Solutions and risk mitigation
- What the literature tells us
- What you may need to think about
- Where to from here

What will be covered today

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Opportunistic Premise Plumbing Pathogens (OPPP)

Definition

*“Premise plumbing refers to the portion of **potable water distribution systems beyond the property line** and in buildings, which includes both **hot water and cold water lines and devices such as water heaters, showers, faucets and filters.***

*Premise plumbing is generally characterized as a **wet, warm, periodically stagnant environment** with l**ow disinfectant residual** and high surface area, which creates ideal conditions for microbial growth. Accordingly, opportunistic pathogens can **become established in premise plumbing** as part of the native microbiota.”*

Methodological Approaches for Monitoring Opportunistic Pathogens in Premise Plumbing: A Review Personal Author(s) : Wang, Hong;Bedard, Emilie;Prevost, Michele;Camper, Anne K.;Hill, Vincent R.;Pruden, Amy; Published Date : 6 15 2017;6-15-; Source : Water Res. 117:68-86 URL : https://stacks.cdc.gov/view/cdc/49921

OPPP

- Opportunistic premise plumbing pathogens cause infections in individuals with predisposing conditions, such as advanced age (>70 years), cancer, or immunodeficiency.
- Some recognised pathogens include:
  - *Legionella pneumophila*
  - *Mycobacterium avium* and other nontuberculous mycobacteria (NTM)
  - *Pseudomonas aeruginosa*
  - *Burkholderia species*
- They are native to the premise plumbing environment and ideally **adapted to survival, growth, and persistence in drinking water distribution systems and premise plumbing**.
- Changes in building plumbing practices and disinfection emphasizing water conservation might also be increasing the likelihood of the occurrence of these waterborne pathogens and disease.

Falkinham JO, Pruden A, Edwards M. Opportunistic Premise Plumbing Pathogens: Increasingly Important Pathogens in Drinking Water. Pathogens. 2015 Jun 9;4(2):373-86. doi: 10.3390/pathogens4020373. PMID: 26066311; PMCID: PMC4493479

OPPP Characteristics

- **Disinfectant resistance**
  - Standard disinfectant doses for potable water are insufficient to kill these and they can grow and consume the organic carbon without competition
- **Biofilm formation**
- **Survival and growth in phagocytic free-living amoebae**
  - Make them more virulent
- **Growth at low oxygen concentrations**
  - Stagnant water is therefore a risk
- **Ability to grow at low levels of organic carbon.**

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Opportunistic Premise Plumbing Pathogens (OPPP)

In a nutshell – my definition

The potable/drinking water we use for patient care, hand washing and drinking has pathogens in it that low dose chlorine does not kill because it gets used up in the biofilm and this water causes infections in patients.

The CDC estimates more than 7 million waterborne infections occur annually in the US

7 Collier SA, Deng L, Adam EA, et al. Estimate of burden and direct healthcare cost of infectious waterborne disease in the United States. *Emerg Infect Dis*. 2021;27(1):140-149. doi:10.3201/eid2701.190676

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Water testing
What does your hospital do? Reflection.

Need a good understanding of what your hospital does

- Internal or external performed?
- What water systems are tested?
  - Warm water – TMV or tepid water systems
  - Cooling towers
  - Hydrotherapy pool
  - Endoscopy and CSSD
  - Ice machines and water fountains
- How frequently are these performed? Risk based?
  - Monthly
  - Quarterly
  - Annually

- What is actually tested?
  - Legionella – mandatory/legislated
  - Endotoxins
  - HCC
  - ?Pseudomonas ?others - unlikely
- Do you have a risk management plan with an escalation pathway?
- Do you have a procedure or a policy?
- Risk register?
- Are you getting the reports?
- Do you meet with Engineering?

MELBOURNE HEALTH

LEGIONELLA CONTROL

in the operation and maintenance
of the water distribution systems of

Royal Melbourne Hospital

AquaKlar

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August 2021

A risk assessment was undertaken based on the methodology outlined in the **document enHealth (2015). Guidelines for Legionella control in the operation and maintenance of water distribution systems in health and aged care facilities. Australian Government, Canberra.**

11. Verification Monitoring and Responses

Verification monitoring involves the taking of samples for analysis of a particular parameter. The results of the samples confirm that control measures are effective and water quality risk is being managed.

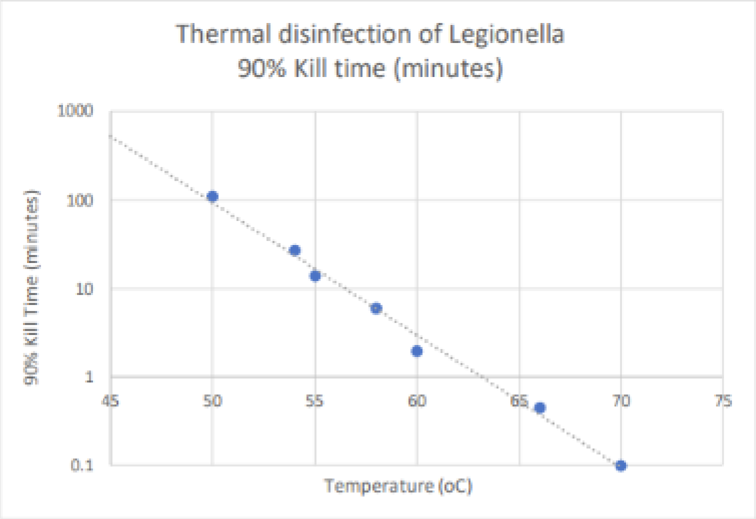
All verification monitoring results that are outside quality standards or critical limits, and confirmed cases of Legionellosis, require responses.

11.1. Warm Water System - Tepid

Parameter	Frequency	Location	Limit	Reported to	Operational response to exceedance of critical limit	Clinical response to exceedance of limit
Heterotrophic Colony Count	Risk Based. Quarterly: 2 samples from each warm water systems	Note (1)	Greater than 500cfu/mL	• Engineering manager • Infection Prevention	• Check operational measurements (temperature trend, pH, turbidity), maintenance schedules (including flushing regimes) and structural integrity • Resample after responses are completed • If results recur, implement a disinfection process and repeat.	None
Legionella	Risk Based. Quarterly: 2 samples from each warm water systems	Note (1)	Greater than 10cfu/mL	• Engineering manager • Infection Prevention	• Check operational measurements, maintenance schedules and structural integrity of system • Sanitise the system either thermally or chemically. • If resample positive, move to next row	Isolate taps Instruct patents and staff not to use the effected outlets until all clear is announced.
			Greater than 100 cfu/mL or Recurring detection	• Engineering manager • Infection Prevention	• Clean accessible pipework • Super Chlorinate system	Isolate taps Instruct patents and staff not to use the effected outlets until all clear is announced.

21. Appendix 9: Sample Thermal Disinfection Procedure

Thermal disinfection will require the appropriate temperature for the appropriate contact time.
The following data provides guidance on the contact time required for 90% reduction in Legionella:



Temperature (°C)	Minutes	Seconds
50.0	100	
52.5	40	
55.0	15	
57.5	10	
60.0	3	
62.5		75
65.0		30
67.5		10
70.0		5
72.5		2
75.0		1

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Clinical hand basin vs sink
My bug bear

Clinical hand basin

- Hand washing only

Sink

- Not for hand washing
- Disposal of fluids etc
- Wash dishes
- Do not need hand soap
- Detergent only
- Dirty utility rooms

Clinical hand basin

Sink

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Splash zone

Clinical hand basin

- 2 meters
- Think about what equipment/fixtures are within that zone
- Invasive access equipment was within the splash zone of 65% of basins

Garvey MI, Williams N, Gardiner A, Ruston C, Wilkinson MAC, Kiernan M, Walker JT, Holden E. The sink splash zone. J Hosp Infect. 2023 May;135:154-156. doi: 10.1016/j.jhin.2023.01.020. Epub 2023 Mar 3. PMID: 36870392.

Modes of transmission

Inhalation of droplets/aerosols

- Primary transmission of Legionella
- Showering
- Ingestion of tap water or aerosols

Indirect contact/environmental contact

- Splash from basin to surfaces and environment, medical devices and equipment or cleaning using tap water
- Hands from hand washing

Clinical hand basin use in an ICU in USA – motion video recording 60 days

Of the 2973 videos with 5614 observed behaviours:

- 37.4% medical care
- 29.2% additional behaviours like personal items placed
- 17.0% hand hygiene (included hand wash, paper towel use and soap use)
- 7.2% patient nutrition
- 5.0% environmental care
- 4.2% non-medical care
- **Handwashing was only 4% (224 out of 5614) of total behaviours.**

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevier.com/locate/jhin

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Characterizations of handwashing sink activities in a single hospital medical intensive care unit

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Journal of Hospital Infection, Volume 100, Issue 3, 2018, Pages e115-e122, ISSN 0195-6701, https://doi.org/10.1016/j.jhin.2018.04.025.

Group	Action name	Action count	Count per room per day	Percent group	Percent total
Medical patient care	Fill syringe or medication cup[a,b]	590	9.83	32.92	13.24
	Empty syringe or medication cup[b]	337	5.62	18.81	7.56
	Drain IV bag[b]	112	1.87	6.25	2.51
	Medical item cleaned	53	0.88	2.96	1.19
	Medical item placed	297	4.95	16.57	6.66
	Medical item removed	331	5.52	18.47	7.43
	Medical packaging placed	24	0.40	1.34	0.54
	Medical packaging removed	16	0.27	0.89	0.36
	Non-categorized medical liquid emptied	21	0.35	1.17	0.47
	Non-categorized medical behaviour	11	0.18	0.61	0.25
	Total	1792	29.87	100	40.21
Non-medical patient care	Patient care item placed	41	0.68	19.81	0.92
	Patient care item removed	40	0.67	19.32	0.90
	Wetted/wrung patient rag[a,b]	126	2.10	60.87	2.83
	Total	207	3.45	100	4.64
Patient nutrition	Food/beverage placed	68	1.13	19.94	1.53
	Food/beverage removed	61	1.02	17.89	1.37
	Non-water beverage emptied	46	0.77	13.49	1.03
	Tube feed bag filled	23	0.38	6.74	0.52
	Tube feed bag emptied	4	0.07	1.17	0.09
	Water glass filled[a]	37	0.62	10.85	0.83
	Water glass emptied[b]	102	1.70	29.91	2.29
	Total	341	5.68	100	7.65
Hand hygiene	Soap use	194	3.23	23.29	4.35
	Paper towel	444	7.40	53.30	9.96
	Handwash	195	3.25	23.41	4.38
	Total	833	13.88	100	18.69
Environmental care	EVS staff wiped sink	40	0.67	23.39	0.90
	Non-EVS wiped sink	24	0.40	14.04	0.54
	Cleaning supplies placed	43	0.72	25.15	0.96
	Cleaning supplies removed	48	0.80	28.07	1.08
	Wetted/wrung cleaning rag	16	0.27	9.36	0.36
	Total	171	2.85	100	3.84
Additional behaviours	Personal item placed	78	1.30	7.01	1.75
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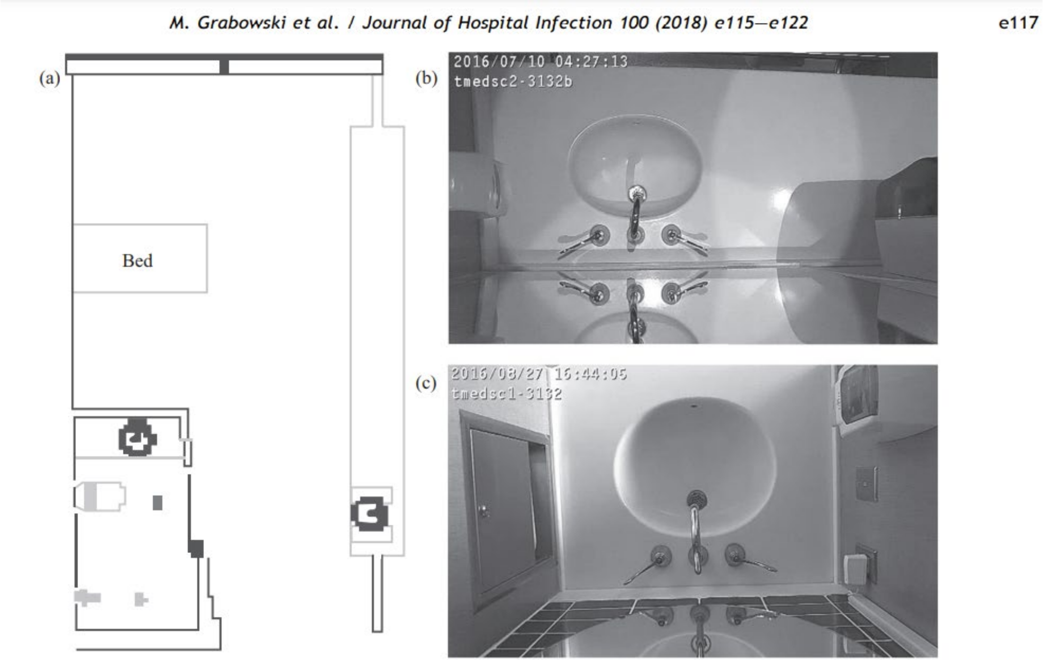
Clinical hand basin use in an ICU in USA – motion video recording 60 days

- Sub-analysis of 2748 of the later videos further categorized:
- 56 activities where a variety of nutrients, which could promote microbial growth, were disposed of in the hand basin.



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Identifying possible outbreaks

- How do you know you may have an outbreak? What are you looking for? Cluster on a ward/procedure group?
  - Clinical isolates or water samples? If collecting water samples – WGS MDU
  - May be a cluster over time as intermittently released from biofilm so difficult to detect
- Think about how you may use the EMR to identify possible clusters – AI??
- We use ICNet to identify 2 or more MRO of interest in a ward with epidemiology
- ICNet alert for Burkholderia species in clinical isolates in ICU
  - Notify ICU leadership team
  - Advise to stop using the clinical hand basin until remedial work completed
  - Speak with Engineering to organise a thermal disinfection of the affected basin via the TMV
  - Report to Infection Prevention Committee and Engineering Committee
  - If we see a cluster – consider testing the water and aerator of affected rooms or wider (Burkholderia species only)

Pseudomonas in CABG SSI group

- Early 2017, cluster of 4 deep/organ space sternal SSIs following CABG identified with *Pseudomonas aeruginosa* isolated
- Multi-disciplinary team set up including
  - Infection prevention, CTS, microbiology, executive, facilities management, anaesthetics, ICU, CSSD and theatre, CTS ward, antimicrobial stewardship
- Review of patient details and isolates
- Walk through CTS theatre and TOE processing areas
- Environmental swabbing of theatre and CTS ward

CTS ward environmental swabbing

- 20 sites screened including
  - Basins, taps, shower heads, drains
  - 6 samples positive in drains and several shower heads
  - Shower heads all replaced
  - No legionella found
- Hyperchlorination of warm water system x3
  - Elements re-swabbed after each hyperchlorination
  - Shower head replacement program instituted
- Chlorinated drip system introduced to the affected block to mitigate/reduce the risk

Burkholderia in ICU

- In 2018 – cluster of *B. cepacia* in ICU from clinical isolates
- Water sampling and aerator swabbing
  - Grew *B. cepacia*
  - WGS same as patient isolates
- Thermal disinfection of each hand basin and aerator
- Retested water and aerators
  - Not detected
- Ongoing cases over several years
- Added low dose chlorine to B block (in addition to South block)
- Due to low water use we introduced monthly flushing

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Solutions and risk mitigation - Addition of chlorine

- On-site chlorine disinfection can be used routinely to increase the level of free chlorine residual circulating in the water system
- Chlorine disinfection may be applied to dose incoming water as it enters a building, or it can be applied to only the warm water systems
- Alternatively, shock hyperchlorination is when 20–50 mg/L of free chlorine is applied in situations requiring emergency disinfection; whereas continuous hyperchlorination is performed as post-emergency disinfection to control Legionella and biofilm

Solutions and risk mitigation – Copper Silver Ionisation

- Effective but expensive and not widely used
- Possibly considered the most effective method for controlling Legionella, Pseudomonas, Stenotrophomonas, Acinetobacter and mycobacterial species
- Main advantages are its consistent effectiveness, ease of installation and maintenance
- Prolonged effectiveness
- Unlike chlorine and chlorine dioxide, the biocidal activity is not reduced by high temperatures
- The positively charged copper and silver ions form bonds with negatively charged ions on the bacteria cell wall, resulting in lysis and bacterial cell death

What will be covered today

- What we mean by OPPPs
- Water testing
- Clinical hand basins, sinks and drains
- Identifying possible outbreaks
- Solutions and risk mitigation
- What the literature tells us – more nerdy bits
- What you may need to think about
- Where to from here

What the literature tells us

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Check for updates

Spread from the Sink to the Patient: *In Situ* Study Using Green Fluorescent Protein (GFP)-Expressing *Escherichia coli* To Model Bacterial Dispersion from Hand-Washing Sink-Trap Reservoirs

Shireen Kotay,[a] Weidong Chai,[a] William Guilford,[b] Katie Barry,[a] Amy J. Mathers[a,c]

Division of Infectious Diseases and International Health, Department of Medicine, University of Virginia Health System, Charlottesville, Virginia, USA[a]; Department of Biomedical Engineering, University of Virginia, Charlottesville, Virginia, USA[b]; Clinical Microbiology, Department of Pathology, University of Virginia Health System, Charlottesville, Virginia, USA[c]

Journal of Hospital Infection 135 (2023)

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Journal of Hospital Infec

journal homepage: www.elsevier.com/

Practice Points

The sink splash zone

M.I. Garvey[a,b,c,*], N. Williams[a], A. Gardiner[a], C. Ruston[a], M.A.C. Wilkinson[a,b], M. Kiernan[d], J.T. Walker[e], E. Holden[a]

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[d] University of West London, Richard Wells Research Centre, London, UK
[e] Walker on Water, Salisbury, UK

Abstract highlights - simplified

- Gallery of hand basins
- Used a fluorescent gel marker expressing E coli in the wastewater drain
- **We found no dispersion of E. coli gel directly from the P-trap to the basin or surrounding countertop with coincident water flow from a faucet**
- **However when left to mature over 7 days – biofilm extended upwards to reach the strainer**
- **This subsequently resulted in droplet dispersion to the surrounding areas (30 in.) during faucet operation.**

Kotay et al.

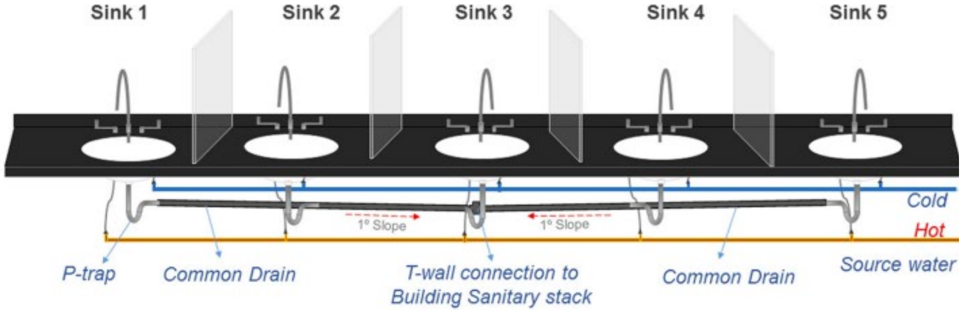

FIG 4 Layout of the sink gallery comprising the 5 sink modules and the associated plumbing.

Kotay et al.

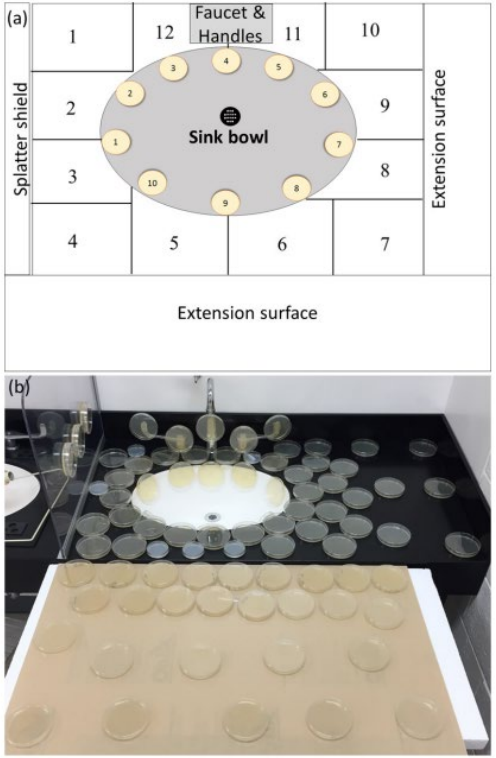

FIG 6 (a) Layout of the zones of the sink counter, bowl, and extension surface designated to monitor droplet dispersion and (b) layout of the TSA plates used for GFP-expressing *E. coli* droplet dispersion on the surfaces surrounding the sink.

- Impact of water disinfection on *Pseudomonas aeruginosa* pre and post disinfection over a 2-year period
- Introduced hydrogen peroxide and silver and replaced tap filters
- Patients with *P. aeruginosa* fell from 2.6% pre disinfection to 1% post disinfection suggesting potential correlation between environmental sources and patient colonization/infection
- Pre disinfection 29.3% of water samples were positive compared with 10.9% post disinfection

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Effectiveness of water system chemical disinfection against *Pseudomonas aeruginosa* infections, despite a not-so-obvious connection

Adrien Turban PharmD[a,c], Amélie Morin-Le Bihan PharmD[a], Lucille Derbier[a], Caroline Piau-Couapel PharmD[a], Nicolas Nesseler MD, PhD[b], Vincent Cattoir PharmD, PhD[a,c], Pierre-Yves Donnio PharmD, PhD[a,c], Guillaume Ménard PharmD, PhD[a,c,*]

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Effectiveness of water system chemical disinfection against Pseudomonas aeruginosa infections, despite a not-so-obvious connection, American Journal of Infection Control, Volume 52, Issue 12, 2024, Pages 1432-1437, ISSN 0196-6553, https://doi.org/10.1016/j.ajic.2024.08.028.

- Introduction of UV-LED incorporated shower heads would allow water to be disinfected immediately prior to release, reducing exposure to OPPP-laden aerosols and water
- The coliphage T1 challenge test results suggested that current was more influential than flowrate on disinfection performance
- Overall, without any specific optimizations, the single UV-LED achieved 0.80 and 1.4 log reduction of coliphage T1 and HPC, respectively, operating at 4.5 L/min and 700 mA.

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Check for updates

UV-LED-incorporated showerhead for point-of-use disinfection of drinking water

Jack Jia Xin Song [1,2,3], Kumiko Oguma *
Department of Urban Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8654, Japan

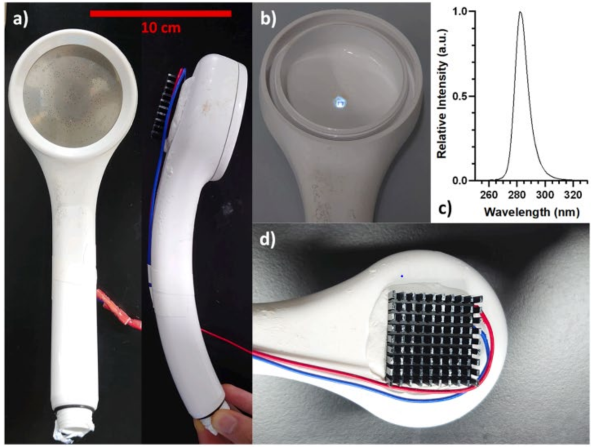


Fig. 1. (a) Front and side views of the UV-LED-incorporated showerhead. (b) Showerhead cavity with UV-LED in the center. (c) Emission spectrum of the UV-LED at 350 mA drive current and 23°C ambient temperature, measured using a spectroradiometer (USR-45DA, Ushio Inc., Tokyo, Japan). (d) Back of the showerhead, showing the heatsink and wiring behind the UV-LED.

Jack Jia Xin Song, Kumiko Oguma, UV-LED-incorporated showerhead for point-of-use disinfection of drinking water, Journal of Environmental Chemical Engineering, Volume 12, Issue 6, 2024, 114573, ISSN 2213-3437, https://doi.org/10.1016/j.jece.2024.114573.


Water Research 259 (2024) 121794

Contents lists available at ScienceDirect

Water Research

journal homepage: www.elsevier.com/locate/watres

Efficacy of chlorine-based disinfectants to control *Legionella* within premise plumbing systems

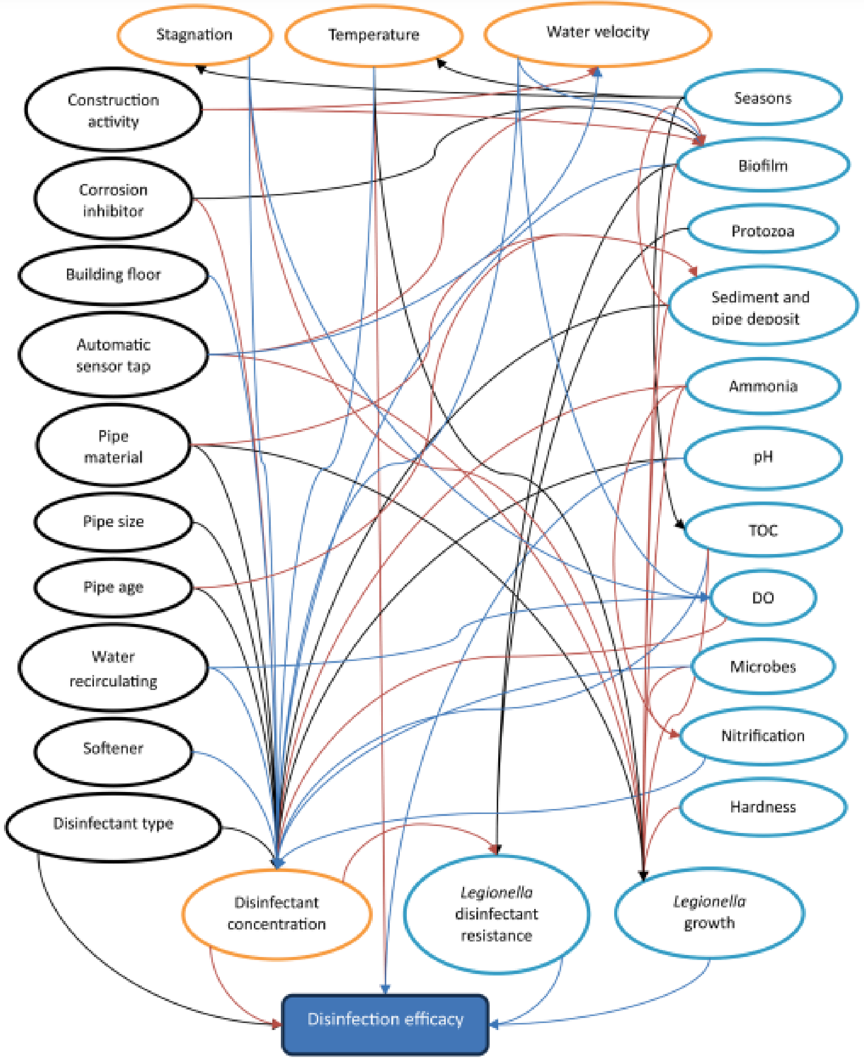
Hao Xi[a,c,*], Kirstin E. Ross[a], Jason Hinds[c,b], Paul J. Molino[d], Harriet Whiley[a,b]

[a] College of Science and Engineering, Flinders University, Bedford Park, SA, Australia
[b] ARC Training Centre for Biofilm Research and Innovation, Flinders University, Bedford Park, SA, Australia
[c] Enware Pty Ltd, Caringbah, NSW, Australia
[d] Molino, Zhang & Associates PTY LTD, Vic, Australia

- A total of 20 studies directly compared the effectiveness of the different chlorine-based disinfectants.
- The findings from these studies ranked the typical effectiveness as follows: chloramine > chlorine dioxide > chlorine. **A total of 26 factors were identified as influencing the efficacy and decay of disinfectants in premise plumbing systems.**

- These factors were sorted into categories of operational factors such as **stagnation**, **temperature**, **water velocity**), evolving factors which are changed in-directly (such as **disinfectant concentration**, Legionella disinfectant resistance, Legionella growth, season, **biofilm** and microbe, protozoa, nitrification, total organic carbon, pH, dissolved oxygen, hardness, ammonia, and sediment and pipe deposit) and stable factors that are not often changed (such as disinfectant type, pipe material, pipe size, pipe age, water recirculating, softener, corrosion inhibitor, automatic sensor tap, building floor, and construction activity)

Hao Xi, Kirstin E. Ross, Jason Hinds, Paul J. Molino, Harriet Whiley, Efficacy of chlorine-based disinfectants to control Legionella within premise plumbing systems, Water Research, Volume 259, 2024, 121794, ISSN 0043-1354, https://doi.org/10.1016/j.watres.2024.121794.


Stagnation
Temperature
Water velocity
Construction activity
Corrosion inhibitor
Building floor
Automatic sensor tap
Pipe material
Pipe size
Pipe age
Water recirculating
Softener
Disinfectant type
Seasons
Biofilm
Protozoa
Sediment and pipe deposit
Ammonia
pH
TOC
DO
Microbes
Nitrification
Hardness
Disinfectant concentration
Legionella disinfectant resistance
Legionella growth
Disinfection efficacy

Their conclusion

*The management of premise plumbing systems to **control Legionella and prevent Legionnaires' disease**, is a **significant issue**, especially in high-risk settings such as hospitals and aged care facilities. Chlorine based disinfectants have been used to control Legionella and other waterborne pathogens for over one hundred years. However, **premise plumbing systems have additional complexities** that can **affect the efficacy and the rate of decay of disinfection residual.***

Hopman *et al. Antimicrobial Resistance and Infection Control* (2017) 6:59
DOI 10.1186/s13756-017-0213-0

Antimicrobial Resistance and Infection Control

RESEARCH Open Access

Reduced rate of intensive care unit acquired gram-negative bacilli after removal of sinks and introduction of 'water-free' patient care

Joost Hopman[1*†], Alma Tostmann[1†], Heiman Wertheim[1], Maria Bos[1], Eva Kolwijck[1], Reinier Akkermans[3], Patrick Sturm[1,4], Andreas Voss[1,2], Peter Pickkers[5] and Hans vd Hoeven[5]

- Aim to evaluate the effect of removal of hand basins from ICU rooms on GNB colonisation rates
- 2-year pre/post quasi-experimental study that compared monthly gram-negative bacilli colonization rates pre- and post-intervention using segmented regression analysis of interrupted time series data
- The intervention was followed by a statistically significant immediate reduction in GNB colonisation. The overall GNB colonization rate dropped from 26.3 to 21.6 GNB/1000 ICU admission days (colonization rate ratio 0.82; 95%CI 0.67–0.99; *P* = 0.02).

'Water-free' patient care activities

Patient care-related action	New method with 'water-free' working
Gloves and gowns	Universal gloving and gowning (pre- and post-intervention period)
Hand washing after visual contamination	'Quick & Clean', (Alpheios B.V., Heerlen, The Netherlands) wipes to remove extensive contamination from hands. Followed by disinfection with alcohol-based hand rub
Medication preparation	Dissolving of medication in bottled water (SPA reine, Spa, Belgium)
Drinks	Bottled water (SPA reine, Spa, Belgium)
Canula care	Disposable materials
Hair washing	Rinse-free shampoo cap (Comfort Personal cleansing products, USA)
Washing	Moistened disposable wash gloves, (D-care,Houten, The Netherlands)
Dental care	Bottled (SPA reine, Spa, Belgium)
Shaving	Electric shaving, or with warm bottled water (SPA reine, Spa, Belgium)

Journal of Hospital Infection
Volume 139, September 2023, Pages 99-105

Sinks in patient rooms in ICUs are associated with higher rates of hospital-acquired infection: a retrospective analysis of 552 ICUs

G-B. Fucini [a, b], C. Geffers [a, b], F. Schwab [a, b], M. Behnke [a, b], W. Sunder [c], J. Moellmann [c], P. Gastmeier [a, b]

- Investigated if hand basins in ICU are associated with higher incidence of HAI using surveillance data from 2017 to 2020
- 552 ICUs provided data
- The incidence density per 1000 patient-days of total HAIs was higher in ICUs in the hand basin group (3.97 vs 3.2)
- The incidence density of HAI-PA was also higher in the hand basin group (0.43 vs 0.34).
- The risk of HAIs associated with all pathogens [incidence rate ratio (IRR)=1.24, 95% confidence interval (CI) 1.03–1.50] and the risk of lower respiratory tract infections associated with P. aeruginosa (IRR=1.44, 95% CI 1.10–1.90) were higher in ICUs with sinks in patient rooms.
- After adjusting for confounders, sinks were found to be an independent risk factor for HAI (adjusted IRR 1.21, 95% CI 1.01–1.45).

G-B. Fucini, C. Geffers, F. Schwab, M. Behnke, W. Sunder, J. Moellmann, P. Gastmeier,
Sinks in patient rooms in ICUs are associated with higher rates of hospital-acquired infection: a retrospective analysis of 552 ICUs,
Journal of Hospital Infection, Volume 139, 2023, Pages 99-105, ISSN 0195-6701, https://doi.org/10.1016/j.jhin.2023.05.018.
(https://www.sciencedirect.com/science/article/pii/S0195670123001779)

What will be covered today

- What we mean by OPPPs
- Water testing
- Clinical hand basins, sinks and drains
- Identifying possible outbreaks
- Solutions and risk mitigation
- What the literature tells us
- What you may need to think about
- Where to from here

What you may need to think about

- Find out what water systems are being tested
- What, if any, additional disinfection processes are you doing?
  - Does it work?
  - Who monitors it?
- Renovations or new build requirements
  - Offset drains and laminar flow
  - Appropriate taps with correct positioning to avoid directly going into drain
  - Location of hand basins
    - How many hand basins are actually needed
    - The splash zone and what equipment might be within it
    - Sensor taps vs elbow taps
    - automatically flush
  - What disinfection system you want to introduce
  - TMV system and how many (basin level or ward level)

What you may need to think about

- Equipment such as ventilators, AIRVO, dental lines, HCU
- RO water
  - CSSD
  - Haemodialysis
  - Endoscopy
- Isolation valves for flushing and sampling points
- Ice machines – plumbed
- Water stations/drink bottle stations
- Water disruptions - flushing
- Important to collaborate with Engineering

- What are your risks? If so say none, then you need to do some investigating…
- The keys to prevention of water related infections in healthcare is **knowledge, awareness, thoughtful design, proactive risk assessment and routine preventative maintenance**

What will be covered today

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Where to from here – What I would like to see

- More research on OPPP and other risk mitigation ideas
  - Limitations with chemical and heat treatments
- Improved plumbing plastics and metals that can withstand chemicals and heat
- Ongoing commitment by relevant building authorities to enable evidence based practice to be funded

Thank you

The Royal Melbourne Hospital

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