What does a DIPC/ICO want from a water safety committee?
Do they want a compliant water system

Or

A safe water system?
Timeline: Pseudomonas outbreak in Londonderry and Belfast

Four babies have died from an outbreak of pseudomonas aeruginosa in Northern Ireland.

One died at a Londonderry hospital, three others in Belfast.

Here is a chronology of events, according to the Regulation and Quality Improvement Authority which has carried out a review.

Water sources and potential *Pseudomonas aeruginosa* contamination of taps and water systems

*Advice for augmented care units*
This brings me to the role of the drainage and plumbing system—that is, sinks, wash-basins, and traps. Your leading article is perhaps too cautious in saying that the evidence of infection from sinks and drains, etc., is not clearly established. In fact traps and wash-basins undoubtedly are a reservoir and can and do become a source of cross-infection. On a number of occasions patients’ raw areas were colonized or infected by strains isolated from the traps of the wash-basins previous to the patient’s admission.

I am, etc.,
Queen Mary’s Hospital,
Rochamptown,
London S.W.15.

J. Kohn.
Pseudomonas aeruginosa: a formidable and ever-present adversary

K.G. Kerr a,*, A.M. Snelling b

* Department of Microbiology, Harrogate District Hospital, Harrogate, North Yorkshire, UK
b Division of Biomedical Sciences & Bradford Infection Group, University of Bradford, Bradford, West Yorkshire, UK

Available online 21 August 2009

Summary Pseudomonas aeruginosa is a versatile pathogen associated with a broad spectrum of infections in humans. In healthcare settings the bacterium is an important cause of infection in vulnerable individuals including those with burns or neutropaenia or receiving intensive care. In these groups morbidity and mortality attributable to P. aeruginosa infection can be high. Management of infections is difficult as P. aeruginosa is inherently resistant to many antimicrobials. Furthermore, treatment is being rendered increasingly problematic due to the emergence and spread of resistance to the few agents that remain as therapeutic options. A notable recent development in the acquisition of carbapenemases by some strains of P. aeruginosa. Given these challenges, it would seem reasonable to identify strategies that would prevent acquisition of the bacterium by hospitalised patients. Environmental reservoirs of P. aeruginosa are readily identifiable, and there are numerous reports of outbreaks that have been attributed to an environmental source; however, the role of such sources in sporadic pseudomonal infection is less well understood. Nevertheless, there is emerging evidence from prospective studies to suggest that environmental sources, especially water, may have significance in the epidemiology of sporadic P. aeruginosa infections in hospital settings, including intensive care units. A better understanding of the role of environmental reservoirs in pseudomonal infection will permit the development of new strategies and refinement of existing approaches to interrupt transmission from these sources to patients.

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Where is the evidence?
How is it possible for organisms to go from the sink to the patient?
How can you say this?
The Semmelweis reflex is a metaphor for the reflex-like tendency to reject new evidence or new knowledge because it contradicts established norms, beliefs or paradigms.

Philosopher F.C.S. Schiller holds that belief perseverance "deserves to rank among the fundamental 'laws' of nature." [4]
Health Technical Memorandum 04-01: Safe water in healthcare premises

Part C: Pseudomonas aeruginosa – advice for augmented care units

Legionnaires’ disease
The control of legionella bacteria in water systems

Approved Code of Practice and guidance on regulations

L8 (Fourth edition) Published 2013
Baby dies in hospital pseudomonas outbreak

Legionnaires contracted in hospital

Test results show that a patient diagnosed with Legionnaires’ disease is likely to have contracted it while at Cheltenham General Hospital.

A spokesman for Gloucestershire Hospital NHS Foundation Trust said there was a small amount of legionella bacteria in a water system.

The system supplies four wards in the hospital and has since been cleaned.

Water samples taken since the cleaning process have confirmed the system is now safe.

Table 4: Number of confirmed Legionnaires’ disease cases by category of exposure and year of onset, 2012 to 2014

<table>
<thead>
<tr>
<th>Category</th>
<th>Community* (%)</th>
<th>Nosocomial (%)</th>
<th>Travel abroad (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>168 (54.9)</td>
<td>11 (3.6)</td>
<td>127 (41.5)</td>
</tr>
<tr>
<td>2013</td>
<td>192 (67.4)</td>
<td>5 (1.8)</td>
<td>88 (30.9)</td>
</tr>
<tr>
<td>2014</td>
<td>186 (56.2)</td>
<td>6 (1.8)</td>
<td>139 (42.0)</td>
</tr>
</tbody>
</table>

* Includes cases who travelled within the UK
FAILURE TO MANAGE THE WATER SYSTEM
1. Define areas of responsibility
The Health and Safety Executive (HSE) consider Legionnaires’ Disease to be a ‘preventable disease’. Duty Holders and Responsible Persons (RPs) have legal responsibility and accountability. However, if individuals contract Legionnaires Disease from a poorly managed water system, then the Organisations or those in charge of these systems, may receive a financial penalty or even imprisonment.
3. Membership of water safety group

- Landlord / representative
- Estates- responsible person
- Infection control
- Water treatment company
- Approved Engineer Water (AEW)
- Domestic services
- Multi-occupancy- representative from each tenant group
- Local health protection Unit

Financial decisions made outside of the group

Reporting structure
The infection control committee
Hospital integrated Governance Committee
Hospital management board / Medical advisory committee
The water management group should be part of the governance structure being expected to report risk onto the register.
1. Live document
2. Update with any changes
3. Risk assessor will require
4. Needed for incidents
5. Legionella Risk Assessment

• A good risk assessment is CRUCIAL

L8- The dutyholder must ensure that the person who carries out the risk assessment and provides advice on prevention and control of exposure must be competent to do so.

It is the responsibility of the water management committee;
1. To read the report
2. to ensure that an action plan with timescales is produced
3. monitor compliance with the action plan that the water management group

(a) changes to the water system or its use;
(b) changes to the use of the building in which the water system is installed;
(c) the availability of new information about risks or control measures;
(d) the results of checks indicating that control measures are no longer effective;
(e) changes to key personnel;
(f) a case of legionnaires’ disease/legionellosis associated with the system.
Documentation of management procedures

Description of water system

System assessment
- Identify hazards
- Determine existing control measures
- Assess and prioritise risks
- Identify additional or improved control measures

Controlling risks
- Implement and maintain control measures
- Establish operational monitoring programs
- Define corrective actions

Verification and auditing

Periodic review
WATER SAFETY GROUP
1. Aberrant temperatures
2. Flushing records

FLUSHING POLICY
1. Risk assessment
2. Identify poorly used outlets
3. Vacated areas
4. Change of use
• Poor condition of patient has perversely increased risk from environment
• Not just a theoretical risk
• Testing for legionella has to take into account non-serogroup 1 strains
WATER TURNOVER / FLUSHING
Water system components

Catalogue of all devices connected to distributed water system or filled with water.
## Certificate of Testing

### Microbiological Quality of Water

<table>
<thead>
<tr>
<th>Sample Ref.</th>
<th>Sample Source</th>
<th><em>Pseudomonas aeruginosa</em> (cfu/100ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>s1097968070139-34109-Post</td>
<td></td>
<td>&lt;1</td>
</tr>
<tr>
<td>s1097969070118-34125-Post</td>
<td></td>
<td>&lt;1</td>
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<td>&lt;1</td>
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<td>&lt;1</td>
</tr>
<tr>
<td>s1097977022024-04657-Post</td>
<td></td>
<td>&lt;1</td>
</tr>
</tbody>
</table>

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**Training**

When and where to sample
BIOFILM AT THE PERIPHERY

PRE FLUSH

RUN TO WASTE

POST FLUSH
WATER SAMPLING

Collection

Training
When and where to sample

Processing
Transportation
Which laboratory
Communication of results

Results

Water sample Room 101
Legionella pneumophila
serogroup 1 detected
15,000 cfu/L

Who do results go to?
Who has responsibility for taking action?

Process for managing abnormal results

Incident meeting (minutes)

DEFINE HIGH RISK GROUPS

Water Safety Group
Requires notification in change of location or new patient group
SOLE PURPOSE – DECONTAMINATION OF HANDS

TRAINING
Estates staff
Infection control
Ward staff
Domestic staff
Contractors
Hand hygiene and transmission of *Pseudomonas aeruginosa* on hands in a hospital environment

Susan Jones

Health Protection Agency – Microbiology Services, Food Water and Environmental Microbiology Laboratory, Southampton, Hampshire. SO16 6YD. UK. Email: sue.e.jones@hpa.org.uk

<table>
<thead>
<tr>
<th>Method</th>
<th>Mean level of contamination cfu</th>
<th>Range cfu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry unwashed hands</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Wet hand swabs</td>
<td>400</td>
<td>10-2000</td>
</tr>
<tr>
<td>Wash soap no drying</td>
<td>97</td>
<td>11-100</td>
</tr>
<tr>
<td>Wash soap dry- lab staff</td>
<td>3.7</td>
<td>0-14</td>
</tr>
<tr>
<td>Wash soap dry -inf control</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

‘washing and drying hands according to standard hospital policy is effective in preventing transfer of organisms from contaminated water’
98% staff used hands to turn on outlets

57% staff used hands to turn off outlets

Sensor or elbow operated?

TMVs placed everywhere. One sided risk assessment.
ATTENTION

HELP US TO PREVENT THE SPREAD OF INFECTIONS.

PLEASE WASH YOUR HANDS

Wet hands with luke warm water before applying soap.
Apply 1-2 pumps of soap.
Use steps below to rub product thoroughly around hands and wrists.

Rinse for a minimum of 5 seconds ensuring all areas are free from residue.
Dry hands thoroughly using 1-2 paper towels.

Thank You

Hand in hand
sharing infection together
Outbreak of multi-drug resistant *Pseudomonas aeruginosa*
FARWELL REPORT 1995
PAEDIATRIC DEATHS LINKED TO CONTAMINATED TPN WATER FROM SINK
£14,000
Contaminated Drugs

Review
Sewage leaks / Blockages
At Water management
Multidrug-resistant *Pseudomonas aeruginosa* outbreaks in two hospitals: association with contaminated hospital waste-water systems

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Environmental contamination
Metallo-beta-lactamase
Multidrug resistance
Nosocomial infection
Waste-water system

**SUMMARY**

**Background:** Multidrug-resistant *Pseudomonas aeruginosa* (MDR-P) expressing VIM-metallo-beta-lactamase is an emerging infection control problem. The source of many such infections is unclear, though there are reports of hospital outbreaks of *P. aeruginosa* related to environmental contamination, including tap water.

**Aim:** We describe two outbreaks of MDR-P, sensitive only to colistin, in order to highlight the potential for hospital waste-water systems to harbour this organism.

**Methods:** The outbreaks were investigated by a combination of descriptive epidemiology, inspection and microbiological sampling of the environment, and molecular strain typing.

**Findings:** The outbreaks occurred in two English hospitals; each involved a distinct genotype of MDR-P. One outbreak was hospital-wide, involving 85 patients, and the other was limited to four cases in one specialized medical unit. Extensive environmental sampling in each outbreak yielded MDR-P only from the waste-water systems. Inspection of the environment and estates records revealed many factors that may have contributed to contamination of clinical areas, including faulty sink, shower and toilet design, clean items stored near sluices, and frequent blockages and leaks from waste pipes. Blockages were due to paper towels, patient wipes, or improper use of bedpan macerators. Control measures included replacing sinks and toilets with easier-to-clean models less prone to splashback, educating staff to reduce blockages and inappropriate storage, reviewing cleaning protocols, and reducing shower flow rates to reduce flooding. These measures were followed by significant reductions in cases.

**Conclusion:** The outbreaks highlight the potential of hospital waste systems to act as a reservoir of MDR-P and other nosocomial pathogens.

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TRAIN STAFF TO REPORT

Poorly draining Sinks, Showers, Toilets

‘Drain smells’
Documentation of management procedures

Description of water system

System assessment
- Identify hazards
- Determine existing control measures
- Assess and prioritise risks
- Identify additional or improved control measures

Controlling risks
- Implement and maintain control measures
- Establish operational monitoring programs
- Define corrective actions

Verification and auditing

Supporting programs

Periodic review
Validation
To the superficial observer there are two things only apparent – the disease and the remedial treatment, medical or surgical.

It requires a considerable amount of experience, in hospitals of various constructions and varied administrations, to go beyond this, and to be able to perceive that conditions arising out of these have a very powerful effect indeed upon the ultimate issue of cases which pass through the wards.

*F. Nightingale 1858*
Organisms directly linked to water systems in our minds

Unusual organisms??

Change in occurrence?
Neonates NOT part of normal flora

No baseline as to what is an acceptable level of *P. aeruginosa* on adult units
We may be ‘sensitive’ but we cause the most damage to humans

Sensitive strains
Invisible
‘Stealth bacteria’

Two or more antibiotic resistant isolates may prompt an incident/outbreak meeting
Death's Dispensary 2017
OPEN TO THE POOR, GRATIS, BY PERMISSION OF THE PARISH.
Segmented regression analysis showed that the intervention was followed by a statistically significant immediate reduction in Gram negative bacillus colonization ‘water-free’ patient care
Vibrio cholerae
Typhoid, Legionella

ANTIBIOTIC RESISTANCE

Plasmids- end of the antibiotic era
Who can be appointed as the ‘responsible’ person?

The responsible person will take day-to-day responsibility for managing the control of any identified risk from legionella bacteria. Anyone can be appointed as the responsible person as long as they have sufficient authority, competence, skills and knowledge about the installation to ensure that all operational procedures are carried out in a timely and effective manner and implement the control measures and strategies, ie they are suitably informed, instructed, trained and assessed. They should be able to ensure that tasks are carried out in a safe, technically competent manner.

The dutyholder must ensure that the person who carries out the risk assessment and provides advice on prevention and control of exposure must be competent to do so.
The Health and Safety Executive (HSE) consider Legionnaires’ Disease to be a ‘preventable disease’
• The Health and Safety Executive (HSE) consider Legionnaires’ Disease to be a ‘preventable disease’
• Duty Holders and Responsible Persons (RP’s) have legal responsibility and accountability
• Failure to do so may be considered a breach of health and safety law
• may lead to organisations receiving formal improvement notices from the HSE
• However, if individuals contract Legionnaires Disease from a poorly managed water system, then the organisations or those in charge of these systems, may receive a financial penalty or even imprisonment
The dutyholder under paragraph 28 should, with the help of the appointed responsible person, make reasonable enquiries to ensure that organisations such as water treatment companies or consultants, and staff from the occupier’s organisation, are competent and suitably trained and have the necessary equipment to carry out their duties in the written scheme safely and adequately.

(a) changes to the water system or its use;
(b) changes to the use of the building in which the water system is installed;
(c) the availability of new information about risks or control measures;
(d) the results of checks indicating that control measures are no longer effective;
(e) changes to key personnel;
(f) a case of legionnaires’ disease/legionellosis associated with the system.
Over representation in literature of outbreaks with antibiotic resistant *P. aeruginosa* strains in adult ITUs

**Neonates** *P. aeruginosa* NOT part of normal flora
WATER TREATMENT PLANT