Timeline of incidents in the Queen Elizabeth University Hospital and Royal Hospital for Children for the period 2015 to 2019

Section 1
Introduction

Introduction and Summary of the Timeline

Introduction

In 2018 Ward 2A and 2B of the Royal Hospital for Children (RHC) experienced a number of "incidents" where a Gram Negative Bacteria (GNB) (or other environmental bacteria) or fungal organism were identified as being present. Wards 2A and 2B of the RHC treat paediatric haemato-oncology and Bone Marrow Transplant (BMT) patients.

An "incident" is defined as an occurrence where a patient or patients are identified as having one of these bacterial and/or fungal infections. Such patients were identified through a number of sources. Although the source was not always identified in the information used to construct the timeline, it did include blood and line cultures and bronchoalveolar lavage (BAL) procedures (where a bronchoscope is used to squirt water into the lungs and then collect it for examination).

A number of hypotheses were explored to determine the cause of the presence of the bacteria and fungi; however, the main hypothesis investigated was in relation to contamination of the water system. This hypothesis came to the fore during 2018 when, following one incident, water sampling identified contamination of water outlets and drains. However, there were diverse views on the source of the contamination and in September 2018 both wards were closed as a definitive source of the bacteria could not be determined. The closure was also to allow a full investigation of the issues identified in relation to water outlets, drains and ventilation to be carried out and to conduct remedial action in the wards to address these issues. Patients in Ward 2A were transferred to Ward 6A of the Queen Elizabeth University Hospital (QEUH) with BMT patients transferred to Ward 4B of the QEUH.

The slides in this report set out a timeline of the incidents where a GNB or a fungal organism were identified and which occurred in Wards 2A and 2B of the RHC and latterly the QEUH (in Wards 4B and 6A only). The timeline has been created to assist in the understanding of the sequence of incidents that occurred, the control measures put in place and the various hypotheses investigated to identify the source of the incidents.

The timeline covers the period from when the hospitals were first opened in 2015 through to 2019. It also considers incidents which occurred in other wards of the RHC (as patients could be temporarily accommodated in other parts of the RHC due to the severity of their illness) but also to demonstrate exactly where all of the incidents reported actually occurred. The objective of the timeline is purely to set out the sequence of events as evidenced by the documentation provided by NHS Greater Glasgow and Clyde (GGC) and does not express an opinion on the actions taken or activities performed.

The timeline does not cover any such incidents reported in the QEUH hospital other than following the transfer of patients to Wards 6A and 4B.

Investigation of Incidents

A set procedure is followed when an incident occurs. A Problem Assessment Group (PAG) is set up when certain infection/colonisation triggers (which NHS GGC advised are agreed locally) are breached. The trigger is normally based on a certain level of an organism in a specified time period. The level and period are dependent on which organism is being considered. Microbiologists (MBs) and Infection Control Doctors (ICDs) advise that PAGs may also be set up where triggers have not been activated but, in the MB/ICD professional judgement, one is warranted.

The trigger will be reviewed by the PAG and, if infections or colonisations are found to be linked or are a Hospital Acquired Infection (HAI) or a Healthcare Associated Infection (HCAI), then an Incident Management Team (IMT) may be convened to investigate the incident more fully. Where the PAG finds that the trigger was activated by two community acquired infections then no further action will be taken with regards to the source but control measures would be put in place to contain any spread of the infection. It should be noted that the process for reporting and investigating any infection/colonisation is the same for both the RHC and the QEUH.

Interaction with Facilities and Estates Team

The timeline looks at both the activities of the Infection Prevention and Control Team (IPCT) and also the Facilities and Estates (F&E) team, who are normally both involved with the IMT, to show the interaction between these two teams. In respect of the F&E team, the timeline incorporates activities performed by the team in responding to issues with the RHC/QEUH following them being handed over by the main contractor who built the hospitals. The timeline also considers the development of the F&E team over that period in respect of its levels of compliance and also the handling of two reports prepared by a company called DMA Canyon Ltd (DMA) which highlighted concerns with the water system at the time the hospitals were handed over.

Involvement of Other Parties

The timeline also includes details of other parties who were involved with the IMT, especially from 2018 onwards. Other parties include Health Protection Scotland (HPS) and Health Facilities Scotland (HFS) who provided NHS GGC with guidance and support in managing the incidents from 2018 onwards. Advice, guidance and other expertise was also sought from, for example, Public Health England, other Health Boards and experts in water and ventilation systems.

Summary of Timeline

Haemato-oncology and BMT patients were originally accommodated in Ward 2A and day patients were seen in Ward 2B of the RHC. Patients could also be accommodated in or transferred to and from the Paediatric Intensive Care Unit (PICU) depending on the severity of their condition. The timeline shows that an increasing number of incidents were recorded in Ward 2A from 2017 onwards – NHS GGC advise that this was a direct result of the update to the National Infection Prevention Control Manual (NIPCM) which occurred in June 2017 and included environmental organisms (such as GNB and fungi) as alerts. NHS GGC further advise that this resulted in processes being put in place to capture these organisms even though there was no guidance as to what to do with them or how to implement surveillance.

In 2018 the level of incidents resulted in Wards 2A and 2B being closed and BMT patients being moved to Ward 4B of the QEUH with the remainder of patients moved to Ward 6A of the QEUH. This relocation occurred at the end of September 2018 but was intended only to be for a short time.

Prior to the closure of Wards 2A and 2B a number of hypotheses were investigated to determine the source of the infections and colonisations. The investigations included research and work to reduce line infections, review of hand hygiene, ward cleanliness and operating practices, and issues with the water and ventilation systems. NHS GGC advise that a definitive source of the infections/colonisations was never conclusively determined as the source of such incidents can be difficult to establish.

One of the hypotheses explored was the potential contamination of the water system (due to a build up of

Introduction and Summary of Timeline

biofilm in taps and drains which certain MBs/ICDs note were confirmed from the results of water sampling) as some forms of GNB can originate in water. MBs/ICDs have advised that GNB can be either endogenous bacteria, meaning they originate from patient's own flora (body), or they can be exogenous bacteria, meaning they are acquired from the environment. Such infections can therefore originate from organisms in the patient's own body or from an external source.

Patients such as haemato-oncology patients are at greater risk of both types of GNB as their immune system is compromised making them more susceptible to infections. NHS GGC have advised that endogenous infections, i.e. from the patient's own flora, are a very common source of infections in patients whose immune system is compromised. MBs/ICDs advise that strategies exist to minimise the risk of endogenous bacteria, such as through line care, screening for the bacteria and skin hygiene. They also advise that while the strategies to target endogenous and exogenous bacteria differ, there is overlap with hand hygiene and environmental cleanliness strategies being employed for both as they are critical to stop the spread of the bacteria.

Certain MBs/ICDs have advised that initially there were concerns about endogenous infection rates but these were drastically reduced by work performed by NHS GGC to improve the quality of line care (referred to as the CLABSI work in the timeline) and improvements in cleaning and hand hygiene. Certain MBs/ICDs advise that, following these improvements, it was predominantly exogenous infections rates which became of concern and led to the development of the hypothesis that the water system or at least the water outlets and drains were contaminated and were the source of the infections.

The timeline shows that the hypothesis around the water system started to be formerly investigated by NHS GGC in 2018 when the first incidents started to occur in March of that year. A Technical Water Group (TWG) was set up in April 2018 to investigate this hypothesis further and to consider and come up with both short and long term solutions to the problem. The timeline, however, also notes that certain MBs/ICDs have raised their concerns over the water system before the hospital opened and formerly registered their concerns in an SBAR in October 2017. Certain MBs/ICDs advise that concerns were reported to tier consultant colleagues in relation to the number of infections, including unusual ones at RHC, not all of which related to a possible water source.

Investigation of the other hypotheses noted above were also being progressed at this time or had already started to be investigated prior to 2018 (such as the work to reduce line infections).

The decant of patients from Ward 2A and 2B was in order to allow a thorough investigation of the wards to understand what the cause of the infections/colonisations was and where the contamination of water outlets and drains had originated from - was this from the water itself or simply contained to the water outlets and drains? It was also to allow replacement taps, showers and drains to be fitted.

As work begun, further issues in relation to the ventilation of the wards became apparent and following receipt of a report on the ventilation system the decision was made that the extent of the work required was much more extensive and the decant would not be for the short term. It should be noted that the report on the ventilation system was not reviewed when preparing this timeline.

As the work progressed other problems were discovered, such as mould in shower rooms due to faulty floor sealings. At the time of writing the work on the wards is still progressing having been delayed by Covid-19.

Following the move to Ward 6A incidents continued to occur during 2019 and led to a more detailed analysis of patient pathways and their access to other sources of water and locations outside of the ward. New admissions to the ward were restricted until no further cases were reported for a period of time. Ward 4B continues to accommodate BMT patients to the present day.

It should be noted that the timeline also includes infections in other areas of the RHC, such as PICU, Wards 1E, 3A and Theatre 6. The level of incidents in these wards was much less, with the exception of PICU which also saw more incidents in 2019. All these wards remained open and preventative measures were taken to control the spread of the organisms.

Water Groups

The TWG continues to meet since it was first convened in April 2018 but now meets on a quarterly basis. There is a section in the timeline (pages 28 to 39) dedicated to the TWG that summarises the minutes of the group from when it was first instigated in April 2018 to December 2019. This section details the actions of the group to investigate the hypothesis around potential water contamination and the matters taken into consideration when deciding on both short and long term solutions to rectify the problem, if the water system was proven to be contaminated.

Initially the TWG conducted a large number of water tests across both the RHC and the QEUH to ascertain whether the issues with the water supply were confined to just Ward 2A or beyond. The results of these tests revealed that the problem was widespread, and a solution to address it would have to cover both the RHC and the QEUH. This was a key milestone moment in that it confirmed that the contamination was system wide and that biofilm existed. Following discussion with third parties and water experts, the long term solution agreed was the installation of a chlorine dioxide (CD) plant and continual dosing of the water supply in both the RHC and the QEUH. The CD plant was installed and the RHC has received dosing of the water supply since November 2019 and the QEUH since January 2020. Weekly water tests of 142 water outlets are conducted with the results producing a large number of negative results, indicating that the CD is having a positive effect.

The water testing undertaken by the TWG was in addition to that normally conducted by the F&E team (with water samples being collected by outside contractors and analysis of samples performed by either the NHS GGC's own laboratory or an external laboratory). Water testing conducted by the F&E team tests for Legionella, E.Coli and Pseudomonas, as well a total number of viable microorganisms present. Testing for other organisms, such as GNB, would normally be done at the request of the IPCT or individual IMTs as part of their investigations. However, as noted above, the weekly water tests currently being conducted now also cover GNB as part of the 142 water outlet tests.

In addition to the TWG, NHS GGC has a number of water groups which were in existence prior to the opening of the RHC and the QEUH. There is a water safety group for each of the NHS GGC sectors and these will deal with local related water matters within the hospitals in that sector. The RHC and the QEUH come under the remit of the South Clyde Water Safety Group (SCWSG).

The local sector water groups report up to the Board Water Safety Group (BWSG). The BWSG's responsibilities include the development of a water safety policy and plan, identifying and monitoring appropriate control measures for water safety in high risk clinical areas, coordinating and monitoring the

Introduction and Summary of Timeline

work of the sector water safety groups, and effective planning and management of any clinical incidents where the water supply is implicated. The BWSG used to report directly to the Board Infection Control Committee (BICC) but in late 2019 a new group, the Infection Control Built Environment Group (ICBEG), was set up to review and agree policies and the BWSG now reports to this group. The ICBEG now reports to the BICC who in turn report to the NHS GGC Board.

Both the BSWG and SCWSG were kept informed of the work of the TWG, as were the BICC and other NHS GGC sub-committees. A summary of the relevant minutes for each group/sub-committee is also included in the TWG timeline.

Structure of Timeline

There are a number of sections contained in this timeline as follows

- **Timeline for the period from 2015 to 2019 (section 3 to 7)** – these sections set out the investigations made by the IMTs and the control measures put in place to prevent the spread and transmission of the infections/colonisations. The type of GNB or fungus is noted together with the ward/location where the infection/colonisation occurred and also the number of patients that were affected.

- **Timeline of Technical Water Group (section 8) –** this section looks at the work of the TWG and the decisions taken in relation to the instalment of the chemical dosing (CD) plant from April 2018 (when the TWG was first convened) up to December 2019. The TWG continues to meet but now on a quarterly basis. The timeline also details the issues identified with Wards 2A and 2B as work progressed and details the reasons for the delay in being able to return patients to these wards.

- **Summary Table of Incidents (section 9)** – this section brings together in one table all the incidents that occurred during the period from 2015 to 2019. The table shows where the incidents occurred, which month they occurred in, the organisms involved and the number of patients that were identified with that organism at the time. The table highlights the increase in incidents in years 2018 and 2019.

Information Source

The information contained in this timeline has been taken from a number of sources as detailed below:

- Minutes of meetings of IMTs and/or PAGs set up to investigate each incident;
- Minutes of meetings and associated papers of the NHS GGC Board, Acute Infection Control Committee (AICC), BICC, Board Clinical Governance Forum (BCGF), Clinical and Care Governance Committee (CCGC), the Acute Clinical and Governance Committee (ACGC) and associated Committee and Board papers;
- Interviews with members of the NHS GGC IPCT to understand how incidents associated with GNB and fungi were reported up through NHS GGC's governance structure to the Board, HPS and Scottish Government;
- Interviews with members of the F&E team to understand the procedures around water risk assessments, audit and compliance of water systems and water testing;
- Papers provided by F&E team in relation to water risk assessments, audit and compliance documents;
- IPC Summary documents attached to papers of the AICC;
- Minutes of meetings of the TWG, BWSG and SCWSG;
- Copy of the HPS Report entitled "Technical Review Water Management Issues NHS GGC QEUH and RHC";
- Copy of HPS reported entitled "Summary and Incident Finding of NHS GGC QEUH/RHC";
- Copy of HPS report entitled "Review of NHS GG&C haemato-oncology data";
- Copy of DMA report "Legionella L8 Risk Assessment 2015 (pre-occupancy)"; and
- Copy of DMA report "Legionella L8 Risk Assessment 2017".

This timeline also reflects comments made by NHS GGC and a number of MBs/ICDs on the content of the timeline.

Limitations

The timeline has been completed for the period from 2015 to 2019 and has not taken into account, unless specifically stated otherwise, the events that have occurred after that period. The minutes of the NHS GGC Board and its various committees have not been reviewed for 2020.

The timeline does not include any information in relation to infections and colonisations that occurred during the period from 2015 to 2019 in the adult hospital or within the adult patient population. The exception to this is when the paediatric haemato-oncology patient group moved to Wards 6A and 4B in the adult hospital. The absence of any such similar incidents relating to the adult population from the timeline should not be taken to mean that such incidents did not occur.

The timeline was created from a paper based review of documentation supplied by NHS GGC and does not include detailed or extensive interviews with members of staff. Meetings held with staff were, as noted in the Information Source section, to clarify points within the documentation provided or to understand reporting procedures. The timeline is not the result of a forensic investigation into the events that occurred and are contained in the timeline.

The information for this timeline is based on that provided up to and including 27 March 2020.

Section 2
Key and Glossary

Glossary

- A - *Aspergillus*
- AB – *Acinetobacter baumanii*
- AC - *Achromobacter*
- AE – Authorised Engineer
- AICC – Acute Infection Control Committee
- ACGC - Acute Clinical and Governance Committee
- ACGF – Acute Clinical Governance Forum
- BCGF – Board Clinical Governance Forum
- BICC - Board Infection Control Committee
- BMT – Bone Marrow Transplant
- Board – NHS Greater Glasgow and Clyde Board
- BWSG – Board Water Safety Group
- CA – *Cryptococcus albidus*
- CCGC - Clinical and Care Governance Committee
- CD – Chlorine Dioxide
- CH - *Chryseomonas*
- CEO – Chief Executive Officer
- CN – Cryptococcus Neoformans
- CRO – Chief Risk Officer
- CRR – Corporate Risk Register
- CU – *Cupriavidus*
- DA – *Delftia acidovorans*
- DSR – Domestic Services Room
- EA – *Enterobacter aeromonas*
- EC – *Enterobacter cloaecae*
- EM – *Elizabethkingia miricola*
- E.coli - *Escherichia coli*
- F&E – Facilities and Estates
- FG – Fungal Growth
- GNB – Gram Negative Bacteria
- GPB – Gram Positive Bacteria
- HAIRT – Healthcare Associated Infection Reporting Template
- HaN – Hospital at Night
- HEPA - High-efficiency particulate air filter
- HH – Hand Hygiene
- HIIAT – Healthcare Infection Incident Assessment Tool
- HIIORT – Healthcare Incident Infection and Outbreak and Incident Reporting Template (predecessor of HIIAT)
- HFS – Health Facilities Scotland
- HIS – Health Improvement Scotland
- HPS – Health Protection Scotland
- IMT – Incident Management Team
- ICD – Infection Control Doctor
- ICM – Infection Control Manager
- ICN – Infection Control Nurse
- ID – Infectious Diseases
- IPCT – Infection Prevention and Control Team
- LICD – Lead Infection Control Doctor
- MB – Microbiologists
- MC – *Mycobacteria chelonae*
- MD – Medical Director
- NHS GGC – NHS Greater Glasgow and Clyde
- OPD – Out Patient Department
- Pan - *Pantoea*
- PAG – Problem Assessment Group
- PanS – *Pantoae septica*
- POUF – Point of Use Filters
- PICU – Paediatric Intensive Care Unit
- Ps - *Pseudomonas*
- PsA – *Pseudomonas aeruginosa*
- PsP – *Pseudomonas putida*
- QEUH – Queen Elizabeth University Hospital, Glasgow
- RCA - Root Cause Analysis
- RHC – Royal Hospital for Children, Glasgow
- SCN – Senior Charge Nurse
- SCSWG – South and Clyde Sector Water Group
- SG – Scottish Government
- SICP – Standard Infection Control Precautions
- SM - *Serratia marcescens*
- SPC – Statistical Process Charts
- STM – *Stenotrophomonas maltophilia*
- TBP – Transmission Based Precautions
- TCV – Temperature Control Value
- TVC – total viable count (total number of viable individual microorganisms present)
- ToR - Terms of Reference
- TWG – Technical Water Group
- VGNB – Variety of Gram Negative Bacteria
- VHF – Viral Haemorrhagic Fever

Key

Gram Negative Bacteria

- AB - *Acinetobacter baumanii*
- AC - *Achromobacter*
- CH - *Chryseomonas*
- CU - *Cupriavidus*
- DA - *Delftia acidovorans*
- EA - *Enterobacter aeromonas*
- EC - *Enterobacter cloaecae*
- EM - *Elizabethkingia miricola*
- Pan - *Pantoea*
- PanS - *Pantoae septica*
- Ps - *Pseudomonas*
- PsA - *Pseudomonas aeruginosa*
- PsP - *Pseudomonas putida*
- SM - *Serratia marcescens*
- STM - *Stenotrophomonas matophilia*
- GNB - *Gram Negative Bacterial not yet identified*
- NUO - *Numerous unidentified organisms*

Fungal Infections

- A - *Aspergillus*
- CN - *Cryptococcus neoformans*
- FG - Fungal Growth

Gram Positive Bacteria

- MA - *Mycobacteria abscessus*
- MC - *Mycobacteria chelonae*

Locations

- 1E - Ward 1E, RHC
- 2A - Ward 2A, RHC
- 2B - Ward 2B, RHC
- 3A - Ward 3A, RHC
- 4B - Ward 4B, QEUH
- 6A - Ward 6A, QEUH
- PICU - Paediatric Intensive Care Unit (PICU), RHC
- ??? - Unidentified ward
- T6 - Theatre 6, RHC

Other Symbols

- → - activity continues into future
- ← - activity continues from the past
- ↔ - activity continues from the past and continues into the future

Section 3
Timeline for 2015

Timeline for 2015 (January to June)

- Hospital campus handed over.
- Contractor tests water in Dec 2014, Jan 2015 results show high TVC and E.coli.
- Outlets with high TVC counts are disinfected, but still fail test. No further evidence that further action taken.
- Initial water results and water testing methodology reviewed by the lead ICD. No evidence that final water testing results were presented to or reviewed by the lead ICD.

26 Jan

- DMA Legionella L8 Risk Assessment 2015 (pre-occupancy) is received.
- Recommendations refer to adjustments to water temperature, removal of dead legs and debris in water tanks. No evidence has been seen which demonstrates that the DMA report was actioned prior to 2018 or that there was widespread knowledge that it had been received, i.e. there is no evidence to show that it was shared with the senior management or F&E team or with IPCT.
- Noted that sampling programme (for TVC, E.coli, coliforms and Legionella) was being conducted and daily flushing and local disinfections were underway where positive results were found. Method of sampling was acceptable to microbiologists. The DMA reports notes that DMA were not given the sample results and disinfection process to review.

Early May

Facilities and Estates (F&E)

1 Jan 2015

End Jan to June?

- Flushing regime is instigated to ensure turnover of water prior to occupation.
- This is performed by estates staff and also agency staff.

2 Feb

- 200 contractors appear on campus to finish work on hospital systems and address issues being found. These contractors had been working with the main contractor to deal with snagging issues.

Apr

- NHS GGC conducts testing of water outlets from April to December. Testing is for Legionella only which was in line with National Requirements. There was no requirement to test for any other organisms.
- April results show positive results for Legionella species in certain areas.
- Sampling is performed by 2 estates managers with no training in taking samples which are taken from 500-600 sentinel points throughout the campus.
- Where positive samples were found, the area/outlet was disinfected until 3 consecutive samples were negative.

18 May

BICC Meeting

- Noted that there is a concern with treating immunocompromised patients at the new hospital due to the ongoing building work there. Minutes note that dust control people have been asked for method statement and list of demolition work planned together with the timescale.

14 June

- Completion of the move by all units and hospitals to the new campus.

23 June

NHS GGC Board Meeting

- Paper presented to Board details the move to the new campus. Noted some initial operational difficulties but these were quickly and effectively resolved by staff.
- Other operational issues which have emerged include ongoing issues with the pneumatic tube system. No mention of any water issues either in this paper or the Board minutes.

30 June 2015

Infection Prevention and Control (IPC)

1 Jan 2015

26 Jan

BICC Meeting

- While discussing the new hospital, Infectious Disease (ID) physicians commented that if there was a VHF (viral hemorrhagic fever) patient the ante room should be adequately sized to deal with this eventuality and requires to be assessed. ID physicians wish to see the beds and ante room used for these types of patients.
- MD stresses that keys for new hospital are being handed over the next day and would need to discuss urgently with F&E team to see if ID physicians can look at the area that day.
- ID physicians note that ID Unit has only two beds for VHF patients and the rest of the unit is for managing all other patients.
- Noted by Public Health consultant that a sub group is commencing to look at VHF type of patient.

27 Apr

- Southern General Out Patient move to new campus.
- Commencement of adult patient move from Western Infirmary, Victoria Infirmary and Mansion House Unit, Gartnavel General Hospital.

1 May

- Southern General In Patient Department moves to new campus.

10 June

- The Royal Hospital for Sick Children at Yorkhill moves Into the new RHC on the campus.

30 June 2015

Timeline for 2015 (July to December)

Work continues at the hospital to address issues being identified.

July to Dec (F&E)

1 July 2015

27 July

BICC Meeting

- Noted at BICC meeting that the patients in the Bone Marrow Transplant (BMT) Unit have been transferred to the Beatson as the unit was not built to the correct specification and the main contractor has agreed to fund the rebuild for this area. Timeframe is 12 weeks.
- Concerns again raised around treatment of immunocompromised patients due to demolition of surgical block in September. Alternative route will be identified for these patients so that they enter the hospital at the further point away from the demolition work.

5 Oct

BICC Meeting

- BICC noted that rooms in the adult Tower are now completed except for two rooms (assumed to be reference to the BMT Unit previously vacated).
- Meeting arranged to discuss dust particles from demolition of surgical block. Alternative routes are being found for immunocompromised patients.
- Noted that after a significant flood in neuro theatre, they were closed for approximately 6 weeks but are now in use after air monitoring was deemed satisfactory.

31 Dec 2015

Psuedomonas aeruginosa (PsA)

- Isolated in 2 patients from respiratory specimens taken on 17/12/15. Two different strains identified.

Investigation performed

- Water safety checklist done. SBAR on these cases issued to SCN.

Control measures put in place

- Cases reviewed and an action plan agreed in respect of these cases. .

1 July 2015

27 July

6 July

AICC Meeting

- The draft minutes record that there is discussion of theatre maintenance and validation. One MB advises there are issues with ventilation in QEUH in a couple of areas and one room in particular.
- The minutes note discussion around HEPA filters and the need to ensure air pressures are correct as the MB had reported there were some issues around slightly positive air pressures.
- The MB and Lead ICD are to meet with the Director of Regional Services to discuss these issues.
- The AICC minutes of 7 September note a correction to the draft minutes by the MB in relation to the above discussion. The correction was to include wording to reflect the issues that were raised around the design of the room. The minute does not give any further details as to what specific concerns were raised.
- The MB/ICDs have advised that at the meeting of 6th July 2015 a number of concerns were raised about the new build and claim the wording was not recorded correctly. A correction was requested at the meeting of 7 Sep. The MB/ICDs do not consider that this change reflects the issues raised.
- The minutes also record that there was some discussion about the implication of the 1100 single rooms in the QEUH on the Infection Control Implementation Plan. The minutes note the IPCT and Lead ICM were cognisant of the concerns raised and agreement to review the implementation plan was captured. The exact implications for the plan are not noted in the minutes.

5 Oct

30 Nov

BICC Meeting

- Minutes note that Co-ordinating ICD ("CICD") advises adult BMT services are due to transfer to the new QEUH. MD asks if testing had been done in the new unit and if the timeframe for the transfer on 19 Dec is still on track.
- CICD advises there is no national standard for testing BMT rooms. MD asks for some members, including IPCT and CICD, to discuss this further after the meeting.

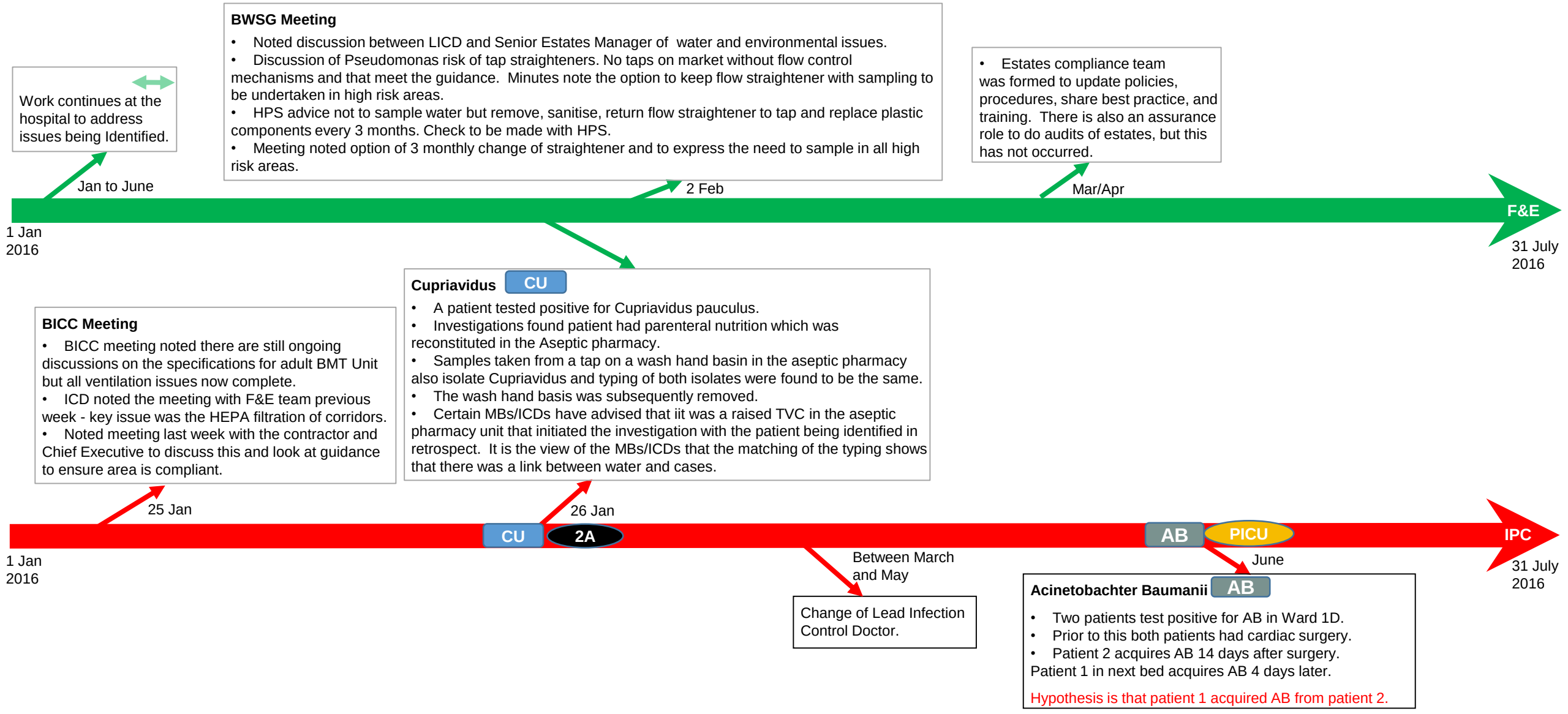
IMT 24 Dec – HIIAT **GREEN**

PsA PICU IPC

31 Dec 2015

Section 4
Timeline for 2016

Timeline for 2016 (January to July)



Timeline for 2016 (August to December)

Work continues at the hospital to address issues being identified.

Original structure included estates officers on day, back and night shifts. Due to the activities that were ongoing at the hospital and requirement to "fire fight" issues, it was decided to change those officers on back and night shifts to day shifts to assist with the volume of work being undertaken. Year on year cost savings also required this to be done as resource was being cut. Once work completed (circa end of 2017/beginning of 2018) these individuals were moved to the compliance team.

1 Aug 2016

July to Dec

Between Aug and Dec (exact date not known)

31 Dec 2016

F&E

PAG on 4 Aug followed by IMT on 5 Aug

Aspergillus A

- 2 cases in Ward 2A – 1 definite and 1 probable case.
- Subsequently confirmed as not Aspergillus - Medical Director notified.

Contributing factors considered

- Tears identified in ventilation ductwork now repaired.
- Condensation from chilled beams creating damp conditions and dust had been cleaned and disinfected. Noted that condensation issue had been raised with main contractor as this should not occur.
- Construction/demolition work on site.

Investigations performed

- Air samples of chill beams were taken and were negative. Samples from air handing unit showed fungus.
- Ceiling area of previous water leak inspected and no fungus found.

Control measures put in place included

1) Increased cleaning and cleaning of chilled beams.
2) Proplyaxis given to high risk patients with Ambisome.
3) Portable HEPA filter units to be placed in unit – noted all rooms filtered but not HEPA filtered due to design of air handling units and chilled beams.

Incident closed by ICD on 16 August and HIIORT updated.

Serratia Marcescens (SM) SM

- 6 patients reported with SM in PICU.
- HIIAT Green at IMT on 04/10/2016.
- Typing confirmed all cases were different types.
- BICC meeting of 3 Oct noted that 1 patient in PICU was identified with SM and had transferred from Neonatal Intensive Care Unit.
- IMT held on 27 Sep recommended carrying out standard infection control precautions.
- LICD asked for review of when the patient came into the room and when water and environment were sampled. Environment screened negative for SM and Pseudomonas and ICPT advised water sampling results are awaited.
- MD asked if this related to hand hygiene and it was noted that this could be a possibility.
- LICD noted there are practice issues with washing equipment in sinks which could potentially be contaminating the environment.

Reported to:

- **3 Oct – BIICC**
- **20 Dec – Board**
- **9 Jan** 2017 - **AICC**
- **6 Feb** 2017 - **BCGF**
- **December HAIRT**

AICC Meeting

- The minutes note that the Adult and Paediatric BMT rooms fall below standards implemented in other units. Risks to adult patients and corrective action were considered. Work is ongoing in Paediatric BMT Unit to achieve required specification.
- IPCT involved in design/functionality of 4 new neurological theatres to meet building standards.
- Guidance awaited from HPS/HFS on suitability of QEUH for infectious disease patients.

5 Sep

Sep/Oct

A 2A

SM PICU

IPC

1 Aug 2016

5 Aug

16 Aug

31 Dec 2016

HIIAT – reported as **AMBER**

- First case on 25 July
- Second case on 4 August

HIIAT – updated to **Green**

Reported to:

- **18 Oct – Board**
- **28 Nov – BICC**
- **December HAIRT**
- **14 Nov - AICC**
- **October HAIRT**

Section 5
Timeline for 2017

Timeline for 2017 (January to May)

- Report of the audit conducted by the Authorised Engineer (AE) on 4 May is received. This audit is normally conducted annually but this is the first time since the campus was occupied. It is assumed an audit did not take place in 2015 as the Campus was in the process of being occupied. The reasons why an audit did not take place in 2016, however, is not known.
- The audit focuses on the compliance processes and documentation that is in place around the management of water quality and not of the physical system itself. So, for example, it will consider if a risk assessment process is in place and what it covers, if it is documented, whether actions identified from the risk assessment are recorded and whether there is evidence to show these have been addressed. Other areas considered, for example, will be servicing records, whether staff have requisite training and experience and if documentation of roles and responsibilities and sampling protocols is in place (including those for escalation of positive results, but this is noted only for legionella and the report does not include a review of the results).
- A review of the audit report for 2017 shows that apart from one entry, all actions have been completed. The one entry shown to be in progress is completed by the 2018 audit. The report gives a score of 99% compliance, but it is not clear whether this is before or after the actions noted were taken.

Work continues at the hospital to address issues Identified.

Reported to:
6 Mar – AICC meeting - Included in paper "IPC Summary Dec – Jan 2017"

Reported to:
8 May – AICC meeting – Included in paper "IPC Summary Feb – Mar 2017"

Jan - April

4 May

31 May 2017

F&E

1 Jan 2017

Serratia marcescens (SM) SM

- Cases of SM in PICU and Ward 1D.
- Review of domestic Cleaning, especially pendants.
- Estates review of trough sink relocation from trolley bay.
- Typing of isolates.
- Chlorine clean of bed spaces.
- Timeline created.
- Patients reported as not giving cause for concern at the time of reporting.

Elizabethkingia Miricola (EM) EM

- Three cases are isolated from patient line cultures between Sep 2016 and February 2017. All unique strains.
- Review of vent cleaning and maintenance by estates.
- Sampling of vents, chill beams and water outlets were negative.
- IPCN carried out visual inspection of environment.
- Incident closed 27/3/17.

Increased bacteraemia rates (NUO) NUO

- Increased bacteraemia rate July 2016-February 2017 amongst paediatric haematology patients.
- Gradual upward trend since July 2016. Multiple organisms.
- Review of vascular access devices to be carried out.
- Aim to reconvene SLWG for vascular devices.
- Surveillance to continue at present.

HIIAT reported as **Green**

Aspergillus A

- Three cases in Ward 2A reported to HPS.

Investigations performed

- IPCT review level of dust from ongoing works at site.
- IPCT review full ward and ceiling void after mouldy ceiling tiles noted caused by a leak into the ceiling void.
- Cleaning of ward was inadequate.
- Inspection of cooling beams which leaked periodically.
- Air and water sampling done – both were negative.
- Hand hygiene performed – score 85%.

Control measures put in place

- Removal of mouldy tiles and ceiling void repairs.
- Full terminal clean of ward.
- Anti-fungal given to all patients.
- Ongoing surveillance by clinical teams to alert IPCT as lab testing unreliable.
- ICD and Estates produce water damage policy.

- Working group to reduce CLABSI rate first meets.
- CLABSI cases reviewed from Mar 2006 to Mar 2010.
- Measures developed were: 1) Standardisation of clinical practice regarding line access, insertion and maintenance. 2) Education and awareness for both staff and families on line care and hand hygiene.
- Rate reduces from median of 6.33 in June 2017 to 1.34 in Dec 2019.

Serratia marcescens (SM) SM

- SM incident in PICU.

BICC meeting - concern about disruption in Ward 2A due to a Rotovirus/ Astrovirus outbreak. Concerns were:
- Level of cleaning/use of professional cleaners.
- Shortage nursing resource to implement IPC measures.
- Low level of HH actions taken are HH education, seeking extra nursing/domestic staff.
- BICC ask IPCT to check resource issue is being addressed.

1 Jan 2017

6 Feb

PAG 3 Mar

3 Mar

IMTs between 7 March to 28 April

10 Mar?

May

15 May

31 May 2017

SM PICU EM 2A NUO 2A A 2A SM PICU IPC

30 Jan

6 Feb

3 Mar

3 Mar

6 Mar

10 Mar ?

8 May

HIIAT reported as **Green**

HIIAT reported as **Green**

BICC meeting
- LICD submits a paper entitled "Role of Infection Control Team in New Builds".
- Notes approved by Director of F&E and states that IPCT should be involved in all stages of project from initial planning through to completion and handover. Paper submitted due to issues with new build and was an abbreviation of SHFN 30 – which covers the role of IPCT in new builds. MD questions if specialist expertise in ventilation beyond ICT is needed.

Reported to:
8 May – AICC meeting - Included in paper "IPC Summary Feb - Mar 2017"

Noted at **AICC meeting** that QEUH isolation rooms are not suitable for air borne infectious disease. Physicians will review the facilities based on HFS report. In interim, patients will be transferred to GRI or Monklands.

HIIAT initially reported as **RED** then downgraded to **AMBER** and then **Green** once ceiling repairs completed. Incident closed on 28 April.

HIIAT initially reported as **AMBER** and subsequently upgraded to **RED**. No details of when down-graded and incident closed.

- **AICC Meeting** – noted 2 isolation rooms in Ward 2A are being changed from positive to negative pressure. Patients will remain in situ while work is done.
- Certain MBs/ICDs advise above minutes are incorrect and that change was from from negative to positive.

Reported to:
8 May and **3 July** – **AICC**. Meeting on 8 May updated through "IPC Summary Feb – Mar 2017" document. **27 June** - **Board**
31 July – **BICC** **7 Aug** – **BCGF** **June 2017 HAIRT**

Timeline for 2017 (June to August)

Work continues at the hospital to address issues Identified

- The AE report for 2018 of the audit conducted on 23 July 2018 is received and actioned.
- The report gives a score of 99% compliance, but it is not clear whether this is before or after the actions noted were taken .
- A review of the report shows all actions are completed.

1 June 2017 — July - Aug — 23 July — 31 Aug 2017 — F&E

- NHS GGC advised that in June 2017 there was an update to the National Infection Prevention and Control Manual (NIPCM) to include 4 environmental organisms.
- As per the IPCM appendix 13 these organisms are PsA, AB, STM and SM.
- It is important to note that there was a change in LICD between June 2017 and Jan 2018.

AICC Meeting

- Records that some extra alert organisms have been added onto the minimum alert organisms listed in appendix 13 of the NIPCM. This includes GNB and GPB.
- Minutes note that no changes are required as IPCT already include these extra organisms in its systems.
- NHS GGC have advised that the ICD developed triggers for these organisms based on available scientific literature. NHS GGC also advised that no guidance was provided in the NIPCM on how to manage these organisms or implement surveillance.

Stenotrophomonas Maltophilia (STM) STM

- 2 cases of STM line associated bacteria in 8 days. Typing of bacteria from both patients revealed isolates were unique.
- One patient discharged home well. The other became septic when line removed and was too ill to have line reinserted. Admitted to PICU but died on 31 August. The patient had been reviewed by IPCT almost daily. STM recorded on part 1c of the death certificate.
- On 4 Sep ICD requested water sampling in Ward 2A. NHS GGC advised that during the course of 2017 118 samples were taken and all were negative for STM.
- On 4 Sep HPS were informed by email of the death of the patient and asked if any further action was required. HPS advised no further action was required.

Control measures put in place

- Many control measures were already ongoing from previous incidents on Ward 2A.
- Terminal clean of the 2 rooms occupied by the affected patients.
- Review of the environment led by Lead Nurse for IPC, SCN and Domestic Manager. This review assessed cleanliness of the ward and if staff were complying with infection control precautions, e.g. hand hygiene, use of gloves/aprons.
- Additional staff and parent education was introduced in July. Teaching provided for medical staff by IPCD on 2 Aug.
- Review of line care was already in progress (CLABSI work).
- Some MBs/ICDs have advised that they believe that STM had been isolated before or around the time the hospital opened. However, no confirmation of this has been found in the information sources reviewed. MBs/ICDs also note that SPC chart showed a marked increase in STM cases - not just the 2 noted here, but there had been 5 cases after a long period of none. MBs/ICDs also advise that the ICD asked for water samples to be taken – the Health Board advised that a test and process were set up and samples reported to the ICD.

Pseudomonas (Ps) Ps

- One patient with Pseudomonas positive blood culture and one patient with a colonisation.
- Epidemiological link between the two.
- Neither patients giving cause for concern as a result of the Ps.

Control measures put in place

- Full terminal clean of unit.
- IPCAT of unit by IPCT – 78% which is an amber marking. Action list is generated to address failings.
- Water checklist completed and practice issues identified and reported to SCN.
- Monitoring continues.

1 June 2017 — End of June — 3 July — PAG 26 July — STM — 2A — 26 July — MA — ??? — 31 July — PAG 2 Aug — Ps — PICU — 2 Aug — Aug — IPC — 31 Aug 2017

- HIIAT status **RED** due to severity of illness.
- PAG held on 26 Jul but no IMTs – reason recorded in HIIORT.
- Downgraded to **Green** on 15 Augt after discussion with HPS
- HIIORT was updated 13 times between 26 Jul and 15 Aug.

Reported to:

- **17 Oct** – **Board** **4 Sep** and **6 Nov** – **AICC** – Meeting of 4 Sep Incident noted through "IPC Summary Jun – Jul 2017" document in papers.
- **2 Oct and 4 Dec** – **BCFG** through October HAIRT **9 Oct and 27 Nov** – **BICC** (see next slide) **October HAIRT**

BICC Meeting

- Report on meeting of 16 Jun on genome sequencing of Mycobacterium Abscessus. Samples sent to Reference Lab who said some are linked.
- IPC unclear on how it transmitted and national guidance awaited.
- Lothian and Aberdeen also have cases. HPS content this is not an ongoing incident.
- Noted in the minutes that work is ongoing in Ward 2A with hand hygiene and SICPs training for medics with ward being reviewed on an ongoing basis.
- Member of BICC comments that the cubicles in Ward 2A had fungal counts in them and there were also high counts in the teenage cancer area. IPCT advise that the areas have been cleaned and re-sampled with acceptable results.

- HIIAT status is **Green**
- PAG held on 2/8/17.

SBAR issued by NHS GGC advising IPCTs of a list of alert organisms in appendix 13 of the NIPCM which may require further investigation. This list includes GNB and GPB.

Timeline for 2017 (September to October)

Work continues at the hospital to address issues Identified

- Work on September 2017 DMA report begins.

1 Sep 2017 — Sep - Oct — Sep — 31 Oct 2017 — F&E

Sep to 2020

Still ongoing in 2021

- During September three consultant microbiologists ("MBs") in the South Glasgow sector raised Step 1 of NHS GGC's whistle blowing procedures, following which they were asked by the MD to submit an SBAR. The MBs/ICDs have advised that there was some confusion if Step1 had been raised. The MBs/ICDs advised that they challenged NHS GGC's view that Step 1 had not been raised and this challenge was successfully upheld. The MBs/ICDs advise NHS GGC acknowledged there had been a misunderstanding. The matters of concern raised in the SBAR were about the facilities in the QEUH and the RHC and the structure of the IPCT Service in NHS GGC. Themes raised by the MBs were as follows:
  - Ventilation issues;
  - Protective Isolation;
  - Cleaning;
  - Water quality (with regard to taps having TCVs (temperature control values); policy for cleaning and maintenance of these taps is not reported) and concerns about delays on water testing and reporting of results, and that ICDs need to request water testing as this is key to investigating/managing outbreaks;
  - Plumbing in neurosurgical block;
  - Decontamination of respiratory equipment; and
  - Structure of IPCT.
- A meeting was held on 4 Oct with the MBs to discuss concerns. A 27 point action plan was developed to address the concerns in the SBAR. This action plan was ratified by the CCGC on 5 Dec and noted by the Board on 20 Feb 2018. Work to address the action plan is extensive and continues from this point onwards and is still ongoing in 2021. Certain MBs maintain that the action plan was never agreed with them at any point and that it contained inaccuracies and misrepresentations.
- The MBs/ICDs advise they raised concerns over the water system prior to the hospital opening. They also advise that concerns were reported to their consultant colleagues in relation to the number of infections, including unusual ones at RCH, not all of which were related to a possible water source.

Serratia marcescens (SM) SM

- One SM case attributable to Ward 1D during a period of increased burden of SM cases (3 other patients on the unit colonised with SM).

Control measures put in place

- Terminal clean of affected bay carried out.
- Hand hygiene audit carried out and training provided for staff to carry out local audits.
- No further action unless new cases identified.

BICC meeting

MD noted the receipt of a number of emails concerning the ventilation and negative pressure rooms in QEUH and RHC. The minutes note the MD had a meeting last week to progress matters on these issues. It is not clear from the minutes if this is referring to the meeting with MBs/ICDs on 4 Oct.

- Discussion on STM cases in July when 1 patient died. IPCT are monitoring the ward closely and worked with ward and facilities staff on environmental cleanliness and clinical practice.
- Questions raised on line infections - IPCT are reviewing line care. RHC Chief Nurse is supporting a quality improvement group on line care. Update on this to be given at next meeting (this relates to the work on CLABSI which reduced line infections).

Acinetobacter baumannii (AB) AB

- New case of AB on Ward 3A. Same strain as one of the two previously colonised cases on ward at the same time.
- Review of cases/patient placement shows none in the same room but 2 patients with same strain played together.
- A fourth case, colonised since 2016, returned to the unit after the new HAI. The strain matches the 2 cases above.

Control measures put in place

- IPCT have reiterated good SICP's and continue to monitor Ward 3A for any onward transmission.

Aspergillus (A) A

- One patient with A from a Bronchoscope procedure on 23 Oct 2017.
- HPS informed on 27 Oct and agreed HIIAT is green.

Control measures put in place

- On anti-fungal since 20 Oct.
- Clinical Team are risk assessing all Ward 2A patients on a case by case basis before prescribing anti-fungal prophylaxis.
- Twice weekly IPCN visits to ward to monitor environment, cleaning and practice.
- Ongoing cleaning of ward with chlorine based detergent.

Sep to 2020 — CU — 2A — SM — PAG 6 Oct — PICU — 9 Oct — AB — 3A — 11 Oct??? — A — 2A — PAG 27 Oct — 31 Oct 2017 — IPC

1 Sep 2017 — 4 Sep — Sep — 6 Oct — 11 Oct??? — 27 Oct

AICC Meeting

- Noted SBAR circulated at 3 Jul meeting is withdrawn as there is some outstanding work to be performed on environmental SPCs.

CCGC Meeting

- A paper presented at the CCGC meeting in June 2018 notes that a patient presented with Cupriavidus bacteraemia.
- The paper notes the patient received a product from the aseptic pharmacy. The date the incident occurred is not noted in the paper.

- PAG held on 06/10/17.
- HIIAT marked as N/A.

Reported to:

- **8 Jan 2018** – AICC Meeting through "IPC Summary Oct – Nov 2017" document

- Date of PAG or IMT is not noted.
- HIIAT marked as N/A.

Reported to:

- **6 Nov and 8 Jan 2018** – AICC Meeting on 8 Jan noted incident in "IPC Summary Oct – Nov 2017" document in papers

- HIIAT status **GREEN.**
- PAG held by phone 27/10/17.
- HPS informed 27/10/17.
- IMT not required unless a new case is identified.

Reported to:

- **6 Nov and 8 Jan 2018** – AICC meeting on 8 Jan noted incident in "IPC Summary Oct – Nov 2017" document in papers

Timeline for 2017 (November to December)

Work continues at the hospital to address issues identified

Nov - Dec

1 Nov 2017

31 Dec 2017

F&E

AICC Meeting

- Committee advised that in relation to Ward 2A work is ongoing as they have had a high number of outbreaks with lines associated with blood cultures (reference to CLABSI work). There have been a few issues in the ward and enhanced visits and education have been carried out.
- Compliance with the Care Plan resulted in a score of 50%.
- A single case of Aspergillus was identified in a patient (see previous slide for case in October). The patient is clinically well and there is ongoing cleaning of the ward with chlorine based detergent. Committee advised that the patient did not have anti fungal prophylaxis.
- Committee advised that Ward 2A has 8 beds that are PPL rooms and 4 of these have been converted to positive pressure rooms but there would be a significant expenditure required to change all these to positive pressure rooms.
- Committee asked whose Risk Register this would sit under and were informed that it would be Women & Children's directorate. They have been invited to the next BICC meeting to provide an update on Ward 2A.

Acinetobacter baumannii (AB) AB

- Two new cases of HAI colonisation although only 1 is an HAI from PICU (2nd is an HAI from 1E).
- There is also a third case noted, previously diagnosed in Oct 2017, currently in PICU (this seems to relate to incident in Ward 3A, see previous slide, but it is unclear from the document if that is the case).

Investigations performed

- Time and place link to one bed bay for all 3 cases above.
- Look back at 3 cases from September and October found 2 further cases associated with this bed bay.
- 2 patients remain in Ward 1D. Neither giving cause for concern.

Control measures put in place

- TBP's around bed spaces.
- Hand hygiene, audit and environmental sampling completed.
- Ongoing IPCT investigations and monitoring - date of PAG/IMT is not noted.

CCGC Meeting

- CCGC were informed of the concerns raised by MBs/ICDs in Sep and were provided with papers detailing these concerns.
- CCGC were advised that the concerns raised were in relation to the facilities in QEUH and RHC and structure of the IPCT service.
- Noted that the Chief of Medicine for Diagnostics and members of the IPCT Senior Management team met with the MBs to discuss all concerns raised.
- The consultant MBs tabled a list of concerns and it was confirmed all of the issues were reviewed and, where required, acted upon to address all concerns.
- CCGC were also advised that the infection rates on the QEUH site are some of the lowest in the health board and in line with Scottish infection rate standards.
- It was recognised that the QEUH was planned and designed in 2007/08 but a number of changes in the structure and patient case mix meant original planning assumptions needed to be updated.
- The CCGC noted that the paper was clear and gave assurances.
- Certain MBs/ICDs note that the above was presented at the meeting without any feedback from those raising concerns and that NHS GGC had not obtained any clarification from them as to whether these actions address the concerns they raised; the Health Board contests this view.

6 Nov

13 Nov

5 Dec

1 Nov 2017

AB PICU 1E

IPC

27 Nov

31 Dec 2017

Reporting to 8 Jan 2018 – AICC Meeting through document "IPC Summary Oct – Nov 2017" included in committee papers

BICC Meeting

- Minutes include an update on work being done on CLABSI which has been ongoing since the group first met in May 2017. It is noted in the minutes that the group has focused on 4 main area – service, infection control, domestics and estates.
- The minutes note the group collects data weekly on CLABSI rates within the RHC site including haemato-oncology patients cared for at home and those attending day care. Initial rates had doubled in Jun 2017. On 14 Aug the group introduced the use of a Curos port protector tip which eliminates the need for staff to disinfect the hub attached to the line as this is done by the device itself. This resulted in a reduction in the CLABSI rate. Member noted there had been a lot of changes at once regarding staff, new equipment being introduced and ensuring staff are adhering to decontamination/line care, but this had contributed to the improvements in the CLABSI rate.
- Minutes note that from December every CLABSI will be subject to a rigorous review utilising Event Cause Analysis methodology within 72 hours of a reported case.

Section 6
Timeline for 2018

Timeline for 2018 (January to April)

- DMA report for 2017 has been completed and finalised.
- A work plan is being formulated by Facilities and Estates to action recommendations.

- HFS and HPS requested in March 2018 to assist with the investigation of the water incident detailed below.
- Papers sent to HFS include a copy of the DMA report for 2015.
- NHS GGC conduct an internal investigation as to why the 2015 DMA report had not been actioned.
- The DMA 2015 report recommendations are similar to those in the 2017 DMA report and were included in the work plan created by F&E for the 2017 DMA report.

BICC Meeting

- The minutes record that when providing an update on the "water incident" the ICD advised NHS GGC water testing is fully compliant with national guidance and MBs receive both routine results and those requested during outbreaks of water borne bacteria. Certain MBs/ICDs, however, note that water results go to the ICDs and not MBs.
- The minutes also note that yearly risk assessments are done for areas not included in the guidance but which may benefit from additional water testing.
- A routine investigation into an unusual type bacteria found in a clinical case led to additional testing and positive results being found in Ward 2A in RHC and 4B in QEUH.
- MD asks if there is a clear way forward for handling this incident and to involve Public Health and IPCT. ICD and Interim Director advise they want to get a water expert on board along with HPS/HFS to look at short and long term solutions.

First meeting of the Technical Water Group (TWG). (See details on pages 28 to 39)

1 Jan 2018 — 31 Jan — Mar onwards — 28 Mar — 28 Apr — 30 Apr 2018 — **F&E**

IMTs held 2 Mar to 27 March – HIIAT RED until 27 Mar then changes to AMBER

17 April

Pseudomonas aeruginosa

PsA

- Two cases in PICU. Two cases linked in time and place with another 2 cases on the unit (long-term). Cases at the opposite ends of the ward.
- All isolates sent for tying – confirmed to be different strains so no evidence of cross-transmission.
- Water and environmental tests are both negative.
- IPC audit completed and scored 91%.
- Review of cleaning practice of sinks and drains performed..

Various Gram Negative Bacteraemia

Patient on Ward 2A has Cupriavidus at the end of January 2018.

Investigation performed

- Comparison with a Cupriavidus case in 2016 attributed to the aseptic pharmacy. Water tests from that location are negative. Comparisons made to historical cases and other hospitals to identify links. MB's epidemiological report concludes organism introduced to a particular water outlet via an unknown route followed by cross transmission via patient interaction, contaminated cleaning/clinical equipment or healthcare worker.
- MB's report confirms various gram negative organisms (different strains) and fungal growth in tap outlets (flow straighteners particularly) and shower heads in RHC/QEUH (including Wards 2A, 2B and 4B). It is noted that taps were evaluated by HPS/HFS prior to fitting in RHC/QEUH.
- Main water supply tests negative but test positive in sinks in Prep and Treatment room.
- Consultation with HPS, HFS, SG, Public Health England and water experts.
- Minutes of 6 Mar note that concerns raised by the clinical team over environmental risks (not detailed in the minutes) in Ward 2A were communicated higher and to HPS over 2 years ago.
- Members are dissatisfied that responses from senior management and outside of NHS GGC do not provide reassurance. Members are encouraged to share their concerns with senior management.

Hypothesis is outlets are source. Flow straighteners linked to other outbreaks as prone to biofilm growth.

Control measure put in place

- Water dosing performed but it only reduces organism counts, so taps are replaced, sanitised and POUFs fitted.
- Removal of sinks in Prep and Treatment room.
- Filter changed every 25 days and taps tested weekly.
- Disposable shower heads fitted and changed quarterly.
- Mobile wash hand basins and bottled/sterile water used for washing and drinking while above actions taken.
- CU and STM added to IPCT alert organism software system.
- Patients receive Ciprofloxacin prophylaxis and additional line protection measures are introduced.
- Increased hand hygiene and cleaning regime.
- Technical Water Group created to find long term solutions.

Board Meeting

- Board updated on recent identification of infections which may be linked to water and overview given of the circumstances, ongoing work to identify the cause and measures put in place to prevent further contamination.
- Advised risk rating was reduced to amber and investigations confirmed no cross-transmission had occurred.
- Board asked if source of the infections had been identified. Advised Scottish Water are regularly testing the water supply to both the hospital site and the neighbouring residential properties but state that infection is not present in water supply.
- Board told extensive work is ongoing to identify infection's origin in the water system.

Jan — Feb — 1 Mar — 15 Mar — 19 Mar — 13 Apr — 17 Apr

PsA — PICU — CU — PsA — STM — 2A — STM — FG — IPC

1 Jan 2018 — Jan — 30 Apr 2018

HIIAT status:
19 Jan – AMBER
24 Jan - GREEN

MBs/ICDs advise that two MBs raised Step 2 of GGC's whistle blowing policy due to concerns around the ongoing issues raised in Step 1 in Sep 2017. Evidence of this action has not been noted in the various committee and Board minutes reviewed.

- From 26 Jan to 1 Mar – 4 cases in Ward 2A: Cupriavidus (CU) (1 case), Pseudomonas (Ps) (1 case) and Stenotrophomonas (STM) (2 cases).

4 new cases of Stenotrophomonas:
- 1 patient in Ward 2A and 1 in PICU
- 1 discharged from Ward 2A but came into Ward 2B for line care
- 1 in Ward 3C (renal) – unsure if HAI as day care

- Two cases in Ward 2A of patients with pyrexia.
- Some patient cases in Ward 3C with possible fungal growth. IPCT to investigate.

- Full incident management report – details incident and actions taken. Final case count is 1 Cupriavidus, 5 Stenotrophomonas and 1 Pseudomonas auerginosa (later excluded following different identity of water isolate).

Reported to: 31 Jan – BICC (PsA incident only) **28 Mar - BICC** – noted discussions on the potential long term solutions and that the Executive team and Board updated on progress. **17 April – Board** **27 Apr** – AICC – update provided to Committee on incident and upgrading of Ward 2A BMT rooms. Questions on impact of chlorine dioxide on renal system. Assured this a different water supply and water expert involved Further 3 RHC rooms and 4 QEUH rooms to be converted from positive to negative pressure. **4 June** – BCGF noted April HAIRT. **12 Mar** – ACGC – reports issues with Mixer taps in ward 2A but IMT set up and equipment sanitised. **9 April –** ACGC – incident reported and situation resolved with appropriate filters fitted over all taps. **April** HAIRT

Timeline for 2018 (May to June)

During the period from May to June, members of the F&E team received formal training as an Authorised Person for water as well as other services such as Mechanical and Electrical. Certificates were obtained and signed off by the Authorised Engineer to state that the person has passed the training and is now responsible the safe operation and maintenance of the water or another relevant system.

1 May 2018 — May to June — 30 June 2018

F&E

PAG/IMTs held 11 May to 6 June. HIIAT **GREEN**

IMTs held 29 May to 21 June – HIIAT Amber changed to Red on 4 June until 18 June when Amber and Green on 21 June (Water Incident)

12 June

Acinetobacter baumannii (AB)

- Three colonisations of AB in April, then 2 in May. IMT count a further case (bringing total to 6 cases) colonised in Feb 2018 - patient remains in the unit.

Investigations performed

- Two patients in adjacent bed spaces.
- Domestic audit identifies cleaning concerns.
- IPCT raise concerns over TBP adherence.
- All isolates sent for typing.

Control measures put in place

- A list of actions relating to above is put in place including a review of TBPs in the unit.
- IPCT monitor for new cases.
- NHS GGC advised that the hypothesis was that these infections were due to direct contact between patients.

- IMT set up following PAG on 18 May which looked at the incidence of 4 EC cases from 28 April to 14 May and 3 STM cases since 4 May.

Investigation and Testing

- Drain swabs reveal a variety of GNB (different strains) including those listed below plus Sphingomnas, Klebsiella oxytoca and Elizabethakinga. Black grime was seen in the RHC and QEUH drains.
- Dissection of a sink waste pipe shows exposed metal parts with bio-film. All waste pipes are replaced in Wards 2A/4B with new plastic ones, as were sink drains, following complaints of water not draining away.
- Review of cleaning regime and additional resource allocated following issues identified. Noted that rooms are cluttered and there is a large number of visitors/medical staff in the ward. In response, numbers are restricted and parent education is provided to prevent clutter
- Analysis was being done by HPS through comparison with Yorkhill taking into account changes in the environment, patient population, and historic lookback and comparison with rest of Scotland. HPS and water experts were being consulted.
- Ongoing meetings with clinical staff to discuss their concerns that the IMT is not in control of the environment as there have been issues (not detailed in the minutes) since the ward opened. Hypothesis – drains are the source due to links in time, place and person. Belief that water is clean but bio-film can build up due to hand washing and inappropriate liquids poured down the drains e.g. coffee/tea. Research shows aerolisation of bio-film can occur when tap turned on and this spreads around the sink area.

Control measures put in place

- Drains are cleaned and then decontaminated with Hydrogen Peroxide Vapour in Wards 2A, 2B, 7A, 7D, PICU and elsewhere on site.
- Replacement of waste pipes and sink drains.
- Enhanced hand hygiene introduced – alcohol gel to be used after washing.
- Chemotherapy and BMTs are delayed/stopped, admissions restricted and patients given Ciprofloxacin while drains are decontaminated.
- IPCT to conduct peer reviews focusing on SICPs, TBPs and the environment.
- Site visited twice by water experts to advise on long term solutions including use of chlorine dioxide to dose and decontaminate the water system.
- TWG confirms chlorine dioxide dosing began in November, followed by tap replacement in January 2019.

CCGC Meeting

- CCGC updated and provided with a paper on the "water incident" in Wards 2A/2B which details all incidents in 2018, investigations performed and control measures put in place.
- CCGC told further water tests revealed evidence of a systemic problem in RHC and QEUH.
- Noted that working closely with HPS/HFS on this incident.
- Noted that a special water group was set up and UK water experts consulted to develop a long term solution, which includes chemical dosing of the water supply.
- Members noted the above and were assured by long term preventative methods and use of water experts.

12 June

Pan | 2A | AB | PICU | EC | STM | Ps | 2A | EC | STM | Ps | A | CU | 2A — IPC

1 May 2018

6 May — Case of Pantoea in Ward 2A on 6 May.

Reported to:
19 June – AICC through "IPC Summary Apr – May" included in papers.

4 June

BCGF meeting + April HAIRT

- Update provided on this incident and actions taken.
- Noted that outlets remain positive even after chemical dosing so POUFs were fitted to outlets.
- Further testing found evidence of a Systemic problem and work is ongoing to solve these problems.
- Further updates to be provided.

Forum noted update.

4 June

HIIAT reported a total of 9 cases in Ward 2A/2B with;

- Stenotrophomonas
- Pseudomonas Aeruginosa
- Enterobacter cloaecae

Patient who out on pass and was well returned peri arrest.

During this period there were 17 GNB cases with some patients displaying multiple organisms. Total of 23 organisms were identified.

- **Enterobacter** (6) **Stenotrophomonas** (9) **Pseudomonas** (4)
- **Acinetobackter** (2) **Cupriviavidus** (1)
- **Pantoea** (1) – occurred in Ward 2A on 6/5/18 and reported to HPS.

Reported to: 23 May and 25 Jul – BICC – 28 May noted chlorine dioxide system to go out to tender. **26 Jun, 21 Aug – Board 6 Aug– BCGF 11 Jun – ACGC** – Noted infection controls working, Technical Water Group set up to address wider implications. Still significant clinical concern. **19 Jun AICC** – Update provided on incident and TWG actions. **13 Aug – ACGC** – noted control measures appear to be effective. **June and August HAIRT**

26 June

Board Meeting + June HAIRT

- Update provided to Board on actions taken to address the bacteria in the water system.
- Board disappointed to note that QEUH had consistently been worst performer in NHS GGC for cleanliness over past 12 months. Comparison made with Glasgow Royal Infirmary as superior performer despite more challenges.
- Another member noted QEUH complied with national requirement of >90% compliance and methodology used at sites was different.
- Board asked for further update at October meeting.

30 June 2018

Timeline for 2018 (July to August)

- The work plan to address the recommendations of the 2 DMA Reports from 2015 and 2017 is completed. Actions are allocated to members of the F&E team and work starts from July onwards. All actions are completed by the end of 2018.
- A record is kept setting out the recommendations from the 2 DMA reports and the details of the work performed to address each recommendation plus any supporting evidence. The date the work is performed (a job ticket) and the supporting evidence is contained on the F&E's own computer systems.
- It was noted that this record was updated during Jul, Sep, Nov and Dec to reflect work completed at these points and the status of work not started or not yet completed.

5 July onwards

- HFS/HPS produce a draft report on their findings from the investigation into the suspected contamination of the water system. The report entitled "Technical Review Water Management Issues NHS GGC QEUH and RHS" is passed to NHS GGC in a final draft status for comments. The conclusion of the Report is that the system was potentially either contaminated during the construction phase and lack of proper maintenance has led to the build up of bio-film and consequently GNB, or that bio-film built up in the tap flow straighteners and regressed back into the water system. HFS recommend that NHS GGC implement the recommendations set out in the DMA reports.
- NHS GGC responded with comments and discussions took place between the Board and HFS/HPS. There is a general, broad concern about the size and technical content of this report given it is intended as briefing information.
- The recommendations in the report for NHS GGC are to address the recommendations made in the 2 DMA reports of 2015 and 2017 which (as highlighted earlier in this timeline) are already being actioned.

Aug

1 July 2018

F&E

31 Aug 2018

23 July

- The AE report for 2018 of the audit conducted on 23 Jul 2018 is received and actioned.
- The report gives a score of 99% compliance but it is not clear whether this is before or after the actions noted were taken.
- A review of the report shows all actions were completed.

21 Aug

Board Meeting + August HAIRT

- Update on water incident is provided to the Board.
- Noted that they continue to work closely with HPS/HFS.
- A report from HPS is expected and will be presented to Board in due course.
- Board noted concern regarding the water issues given this was a new hospital and query if there were issues with the building specifications.
- Chief Executive advised that work to identify problems with the initial specifications is underway so that learning can be obtained and shared.

21 Aug

1 July 2018

IPC

31 Aug 2018

Timeline for 2018 (September)

- A review of NHS GGC's Water Safety Policy by an external consultant is commenced and a first draft is produced in Sep with the final version being created in Jan 2019.
- The policy sets out the roles and responsibilities, governance structure, risk reduction strategy, operational arrangements, water testing and reporting and monitoring requirements in respect of the management of water safety.

1 Sep 2018 — Sep — 30 Sep 2018

F&E

IMTs held 5 from Sep to 28 Sep – HIIAT initially Green, RED from 13 Sep then changed to AMBER on 28 Sep

Investigations performed

- Drains swabbed in Ward 2A on 29 Aug as thick black and yellow grime visible after cleaning only 4-6 weeks ago - findings are that 2 of 3 cases match the patients. Tests show Coliforms, Delftia acidovarons, Chryseomonas indologenes, Cupriavadis, Pseiudomonas aeruginosa and Klebsiella oxytoca. It is also noted that in one case the patient had a positive blood culture prior to being in one of the rooms from which a positive swab was taken and the hypothesis was that this patient may have contaminated the drain.
- Further investigation of drains and trough sinks show that only some have a problem. This issue is only in RHC and not QEUH. HPS advised drains should not be cleaned so regular cleaning had stopped. Further guidance awaited from HPS.
- IPCT had been visiting the ward daily with more formalised reporting twice weekly. High Standard of environmental and equipment cleanliness was achieved and visits now decreased to twice weekly. IPCT have no concerns and environment and domestic audits score well. IPCT note less people and clutter on ward.
- IPCT conduct physical inspection of drains and sinks and note some appear to have sealant in the drain and black gunge is noted. Reported to F&E team who confirm sealant is a gasket in the drain that has become porous due to the use of hydrochloride cleaning products. Speaking to manufacturer as known issue.
- Greater level of domestic hours for cleaning but general build up of dust especially vents and chill beans. Noted that air changes are 3 in RHC and 6 in Adult Hospital which may explain levels of dust. Air sampling on chill beams is negative.
- Noted staff are being pulled from the ward to work elsewhere in the hospital which makes maintaining standards difficult. Additional funding is being requested.
- Discussion with water experts results in a survey of the drains being agreed as well as scopes down the drains to see if there is any blockage.
- On 17 Sep IMT notes an Executive Management meeting rejected a decant until the results of the drain survey are known. Clinicians concerned about decision and a paper is sent to the Director of Women and Children asking for decant to go ahead.

Hypothesis - Concerns expressed that IMT is no nearer the source of these infections. Feeling is that there are more gram negative cases than usual. Noted that TWG is doing a lot of work to investigate the source. Dust levels consistently high and ventilation changes lower than recommended which may explain dust. HPS reviewing ventilation for Wards 2A/2B. Feeling is that the wards should close

- NHS GGC advise that by this point, SG, HPS and HFS were all involved and regular teleconferences were held with them regarding the incidents in Ward 2A.

Control measures put in place

- Reinstatement of weekly cleaning of sinks and shower drains, with mechanical brush cleaning monthly to agitate any build up.
- Charting of patient pathways to and from theatre with review of drains and sinks in those areas.
- Drain survey and ventilation survey are commissioned. The drain survey did not find any issues.
- Admissions to Ward 2A continue but are restricted and judged on a case by case basis.
- On 18 Sep TWG take decision to decant BMT patients in Ward 2A to Ward 4B in adult hospital.
- On 26 Sep Ward 2A was decanted with BMT patients moving to Ward 4B and all other patients to Ward 6A, both in the Adult Hospital.
- Both wards were inspected by F&E and IPCT and made ready for patients, including repairs being made, full deep cleans (including drain and vent cleaning) and POUF inserted on taps and showers. Prior to decant, IPCT did a final inspection to confirm they are satisfied with the wards.
- Following decant, IPCT make daily visits to Wards 4B and 6A to offer advice and support.

30 Sep 2018

IPC

1 Sep 2018 — 4 Sep — 5 Sep — 10 Sep — 13 Sep — 17 Sep — 20 Sep

GNB 2A — GNB 2A — SM 2A — STM 2A — GNB 2A

CCGC Meeting

- Update on the above "water incident" is given along with progress on actions.
- CCGC advised that a report from HPS is awaited and there is close supervision of the ward with no further cases to date.

Since 5/8/18 there have been 3 cases in Ward 2A of bacteraemia caused by gram negative organisms isolated from drains.

1 new gram negative bacteraemia in Ward 2A.

Total of 21 Cases this year.

1 new case of Serratia in Ward 2A.

Total of 22 cases this year.

1 new case of Stenotrophomonas in Ward 2A.

Total of 23 cases this year.

1 new patient with gram negative in Ward 2A - not yet identified.

This is the last case making the total now 24 cases for this year.

Reported to:

10 Sep – **ACGC** – update regarding 3 bacteraemia cases since 5 Sep and link found to drains. Noted enhanced inspection and cleaning process remain in place.

26 Sep – BICC - update on latest outbreak and relocation of patients. Member noted concerns of the clinical risks of a move. MD advised risk assessment was performed and several options given to the Executive Group which included the Chief Executive and Board Directors to discuss. Risk Assessment of all issues/options to be shared with AICC and ACGC. MD to set up a meeting with SG Policy Unit, HPA and NHS GGC to discuss the incident fully.

1 Oct – BCGF **16 Oct** – Board **26 Oct – AICC** – update given on latest incident and decant.

October and December HAIRT

Timeline for 2018 (October to December)

1 Oct 2018

1 Oct

- New Director of F&E takes up post.

From Oct onwards

- As a result of the "water incident" the Compliance team starts to review and develop standard operating practices for sector estates offices to follow to ensure consistency and appropriate quality of work is performed. The Water Policy is also being reviewed at this time. This work continues into 2019.

Oct onwards

- Following the appointment of the new Director of F&E and the lessons learned from the water incident, new standard operating procedures (SOPs) were created for water and other services (e.g. ventilation, electrical, etc) to provide consistency and enhance compliance. This includes protocols for dealing with DMA reports and AE audits to ensure findings are discussed and actioned, and also for flushing and sampling regimes. Registers are created to record the location of little used outlets, dead legs and flexible hoses to ensure they are monitored and maintained.
- Compliance managers are appointed for each service, including water, and are responsible for ensuring completion of Standard Compliance and Risk Tool process and compliance with SOPs. Internal audits are conducted to identify any issues and ensure these are addressed and best practices shared.
- The above work is progressed over the next 18 months to 2 years.

F&E

31 Oct 2018

16 Oct

Board Meeting

- Update provided on current water incident. Noted there had been no cases since June but there had been further cases in September which were thought to be associated with drainage issues in Ward 2A.
- Following a risk assessment a recommendation was made to the Board Directors to close the ward. This was approved with patients relocated to QEUH on 26 Sep.
- A detailed investigation of the water system in 2A and 2B was underway by external experts.
- Director of F&E advised that plans to dose the water system with chlorine dioxide continued and a mobile dosing plant would be installed by the end of week. Future plans to remove wash hand basins and taps and replace draining system were being taken forward.
- Board questioned about frequency of these incidents in similar facilities. MD advised these did not appear to be common.

IMTs continue in October and HIIAT is AMBER

- IMTs continue to assess environment. Contents of blocked drains discussed, which contain a variety of foreign objects e.g. small toys, syringes, metal and plastic material and lumps of adhesive. ICD to address this issue.
- Consideration of whether waterless ITU can be put in place in BMT setting, but this not fully possible.
- Technical Water Group (TWG) outline scope of work and Completion expected on 14 Dec. Dosing of water with CD to be implemented, taps and wash hand basins changed and elements of plumping to be replaced.
- Consideration also given to changing roles of the prep and treatment rooms.
- Call with Scottish Government on 18 Oct to update on current position with proposed work on Ward 2A and on patients in Wards 6A and 4B.

1 Oct 2018

Oct

16 Oct

IPC

31 Oct 2018

Reported to:
16 Oct – Board - updated on current plans and work being performed. **28 Nov – BICC** - update provided of ongoing work in Wards 2A and 2B with expectation that work will be completed in December. Noted that the ventilation system is being looked at and implications for this and discussions are ongoing with clinicians. Advised that chlorine dioxide will also be done in the adult hospital in January. SG being kept informed. **3 Dec – BCGF** - noted as part of the December HAIRT which covers incidents from Feb to Nov 2018. **28 Jan 2019 – BICC – update given on chlorine dioxide system and "discussion" over removal of sinks in Ward 2A. **October and December HAIRT – continues to be reported in HAIRTs and the various committees during 2019. **February 2019 HAIRT** - covers incidents from Feb 2018 to Jan 2019 noting HIIAT returned to Red on 13 Sep, then Amber on 28 Sep. **April 2019 HAIRT** - covers period from February 2018 to February 2019 noting CD system now installed in both QEUH and RHC.

Timeline for 2018 (November to December)

1 Nov 2018

Late Nov

22 Nov

Dec

Dec

F&E

- Register of assets is received from main contractor in late 2018 after 3 years of asking for the maintenance schedules for the systems in the hospital to be provided. This allowed the F&E team to construct more appropriate maintenance schedules for all systems in the hospital and was completed in 2 to 3 months.
- Children's hospital is dosed with CD. This continues to the present day.
- The actions to address the recommendations set out in the 2015 and 2017 DMA report are completed by 16 December.
- QEUH is dosed with CD. This continues to the present day.

IMTs on 2 Nov and 14 Nov – HIIAT GREEN

Pseudomonas Aeruginosa (PsA) PsA

Following a PAG held on 25 October an IMT was set up on 2 Nov to investigate 5 cases of PsA isolated from patients who had all had appendectomies in same theatre in October 2018.

Investigations performed

- A number of investigations have taken place including sampling of equipment which was all negative.
- Typing results have shown 2 matches, 2 unique strains and 1 results as outstanding.
- Sample of drains found PsA growth in the anaesthetic trough and this was sent for typing.
- Excessive amount of debris, including nail picks, found in u-bend traps of drains also.

Control measures put in place

- All drains throughout theatre have been cleaned.
- No further meetings were planned unless new cases identified. .

Reported to:

7 Jan 2019 – AICC – briefing given and included in document "IPC Summary Oct to Nov 2018" which included in papers

BICC Meeting

Noted that the SOP Entitled "Environmental Organisms in High Risk Areas" is being issued.

New SOP is issued by NHS GGC entitled "Environmental Organisms in High Risk Areas". This refers to Appendix 13 of the NIPCM and appears to be the replacement to the SOP that was circulated and then withdrawn in Aug/Sep 2017.

IMTs ongoing during November and HIIAT is AMBER

Ward 2A

- Updates provided on the progress of work in Wards 2A/2B. Ventilation was discussed and it should be positive in all rooms other than BMT rooms. Design had stipulated rooms to be neutral/slightly negative pressure. Not clear what impact this will have on return of patients if rooms cannot be transferred to positive pressure.
- Following review of ventilation system and other issues noted, an option appraisal is requested from a specialist ventilation engineer on what is required to rectify and bring the system up to standard.
- Significant discussions between ICD and Clinicians over removal of trough sinks and them being replaced with 2 stage hand hygiene process. Trough sinks seen as potential source of bacteria. ICD decides to remove against the wishes of Clinicians.
- Further debris found from scrubbing brushes in theatre drains. Communication strategy had been a previous action of IMT to prevent items in drains. ICD to email lead surgeon and lead nurse to ensure all staff are made aware of findings. Alternative brushes to be sourced.
- Call with Scottish Government on 18 Oct to update on current position, proposed work on Ward 2A and on patients in Wards 6A and 4B.
- ICD noted that now wards are decanted there is marked reduction in bacteraemia. Final HIIAT completed and incident closed on 30 Nov.

11 Dec

CCGC Meeting

- CCGC advised that installation of chlorine dioxide plant is complete with a further 12 localised dosing sites being installed.
- Ongoing reviews of the efficacy of the dosing will be undertaken.
- HPS/HFS and external advisors continue to investigate cause.
- Update on the work being performed in Wards 2A/2B was given. This included replacement of taps, drainage, outlets and air handling unit. CCGC were advised this work may take some months.
- Questions raised by CCGC regarding original design of facility. CCGC were advised that work was underway to consider all the identified issues across the site in relation to the original specification requirements of the building.

20 Dec

31 Dec 2018

- Following concerns on the length of the HFS/HPS report issued in Aug, HPS create a summary report entitled "Summary of Incident and Findings of NHS GGC QEUH/ RHC".
- The report's recommendations refer to those already contained in the Aug HFS report, i.e. to implement the DMA 2015 and 2017 recommendations.

1 Nov 2018

PsA

T 6

Nov

28 Nov

Nov

11 Dec

20 Dec

31 Dec 2018

IPC

Reported to:

16 Oct – Board - updated on current plans and work being performed. **28 Nov – BICC** - update provided on ongoing work in Wards 2A and 2B with expectation that work will be completed in December. Noted that the ventilation system is being looked at and implications for this and discussions are ongoing with clinicians. Advised that chlorine dioxide will also be done in the adult hospital in January. SG being kept informed. **3 Dec – BCGF** - noted as part of the December HAIRT which covers incidents from Feb to Nov 2018. **28 Jan 2019 – BICC** – update given on chlorine dioxide system and "discussion" over removal of sinks in Ward 2A.
October and December HAIRT – continues to be reported in HAIRTs and the various committees during 2019.
February 2019 HAIRT - covers incidents from Feb 2018 to Jan 2019 noting HIIAT returned to Red on 13 Sep, then Amber on 28 Sep.
April 2019 HAIRT - covers period from February 2018 to February 2019 noting CD system now installed in both QEUH and RHC.

12 Nov

ACGF Meeting

- Noted cases of bacteraemia continue and Wards 2A and 2B have been decanted to 4B (for BMT patients) and 6A (for all other patients) in the adult hospital.
- Noted investigation work continues and decant still in place
- Noted discussion about removal of Sinks from Ward 2A is a "hot topic".

10 Dec

ACGF Meeting

- Noted the investigation into the water issues in Ward 2A has uncovered a ventilation issue which may require significant infrastructure work and prolong the current decant arrangements.

20 Dec

- On 20 Dec an IMT is set up following 2 cases of Cryptococcus identified on 17 Dec.
- A PAG was held on 18 Dec and control measures were put in place.
- See first slide of 2019 for further details.

Section 7
Timeline for 2019

Timeline for 2019 (January to February)

The 2018 DMA Risk Assessment Report is finalised and a work plan created to address the recommendations.

Each year the AP for water completes a Standard Compliance and Risk Tool. This is a national tool for monitoring water quality developed by HFS. A series of 60 questions are answered with supporting documents provided. Once completed the tool calculates the level of compliance against national water standards. This results are reviewed by HFS and also by the AE during the course of their audit. The score for Jan 2019 was 98.21%. In Jan 2020 the score rose to 98.96% following introduction of the CD plant and servicing of all thematic mixer taps and values on site.

The HPS report "Summary of Incident and Findings of NHS GGC QEUH/RHC" is published on the HPS website.

1 Jan 2019 — Jan — Jan — Feb — Feb — 19 Feb — F&E — 28 Feb 2019

Cryptococcus Neoformans (CN)

- Two isolated cases (1 adult and 1 paediatric case) of a fungal infection, CN, which is a fungi found in soil and pigeon droppings. NHS GGC have advised each patient had a different type of CN.
- On 16 Jan 2019 air sampling found Cryptococcus albidus (CA) in Ward 6A, which is a different species. No CN was found.
- The potential source was thought to be the plant room on the roof of the adult hospital as pigeon droppings were found there, but air samples did not support this. Pest control removed droppings and the area was cleaned. NHS GGC had advised it was highly unlikely for the plant room to have been the source.
- During investigation a separate issue was identified with the sealant in some of the shower rooms. In order to perform remedial work, some patients were moved to Ward 4B with others moved to the Clinical Decision Unit in the RHC.
- Repairs now complete and air sampling results confirmed air quality in the ward is optimal. Patients have returned to Ward 6A. HEPA filters have been placed in all rooms, corridors and treatment areas in Ward 6A as a precaution.
- No further cases have been identified and of 1,800 samples taken, only 10 detected CA but none have identified CN. Air sampling is ongoing. NHS GGC have advised that no CN has been found in over 8 months of air sampling.
- High risk patients are on antifungal prophylaxis.
- Ongoing work to create more protection isolation rooms which are sealed, under positive pressure and with HEPA filtered air.
- Short life Expert Advisory Group is convened which will report to the IMT. This includes representatives from NHS GGC, HPS, HFS and UK experts on ventilation. The group will review the hypotheses to establish whether a definitive source of Cryptococcus can be established.
- Certain MBs/ICD's advise that CN is a rare organism and all MBs were struck by the fact that 2 patients within 3 weeks contracted this organism – it was considered unusual. They advised that this organism is difficult to isolate from the environment, even if it is present, and that air samples were taken after the pigeons had been removed and the plant room cleaned. The MBs/ICDs note that there was considerable disagreement between NHS GGC and the LICD about the source of this organism. In relation to the showers in Ward 6A, the MBs/ICDs noted that there was a large volume of black mould in all the bathrooms which posed risk of fungal infections to patients and which was caused by water hitting a defective join and water damage to the surrounding areas (these were supposed to be waterproof but were not).

AICC Meeting – Cases of PsA

- The minutes record that South Glasgow Paediatrics advise of 5 cases of Pseudomonas aeruginosa (PsA).
- Patients had all been in Theatre 6 during October 2018.
- Some typing returned – 2 matches.
- Drain samples from the anaesthetic trough found PsA.
- Inspection of drains found excessive amounts of debris including nail picks in the u-bend.
- All drains now cleaned.
- Although not recorded in the minutes, NHS GGC advised that it was accepted at this meeting that these cases represented a normal background level of PsA and there was no evidence of a match between the anaesthetic trough and the patients.

Board Meeting

- The CEO updates the Board on the recent issues at the QEUH and RHC and advises that 3 work streams are to be commissioned, as follows:
  - review of the Estates, Facilities and environmental issues at the QEUH and RHC;
  - review of capacity and flow to assess the current position against original model and planning assumptions for the hospitals; and
  - review of clinical outcomes over the period to provide assurance.
- The CEO advises a Programme Board will be established, chaired by the CEO and comprising the leads of the 3 work streams and other key members of senior staff.
- The Board is also advised that the Cabinet Secretary has announced an independent external review of the QEUH and RHC.
- Following questions around timescales, the Board is advised these will be made explicit through the relevant governance committee for each work stream and a final report will be presented to the Board in due course.
- It was noted that members were pleased with the organisation's good work over the last few months to address the issues and expressed gratitude for the continued work and actions to provide safe, reliable and professional healthcare.

Jan – HIIAT **RED** on 20 Dec and **GREEN** from 15 Feb — 7 Jan — 19 Feb

CN — 6A — PsA — 6A — Ps — SM — PICU — AB — IPC

1 Jan 2019 — 28 Feb 2019

Reported to:
7 Jan – AICC – update on PA and NICU. **14 Jan, 8 Feb** – **ACGC** – update provided on CN. **28 Jan, 25 Mar, 3 June – BICC** - update given on CN and information to be shared with SCI team. **4 Feb, 8 Apr, 27 May – BCGF –** update on CN on 4 Feb. Minutes of 8 April refer to April HAIRT which covers CN. Minutes of 27 May refer to June HAIRT which covers CN **19 Feb, 16 Apr, 25 Jun and 20 Aug – GGC Board -** told and noted CN incident on 19 Feb. Questions on 16 Apr on the publication of Cryptococcus data from sampling. MD advised this is being reviewed and will be presented in the near future. **5 Mar** – **CCGC** - provided with update on the CN incident. Questions asked around the national recommendations and guidance in respect of the use of HEPA filters and nature of the fungus. **February, April and June HAIRT –** includes CN incident.

Jan/Feb

GNB - From 5 Jan to 3 Feb there are 2 Ps, 2 AB and 1 SM cases. A PAG is held on 7 Feb:
- Environmental issues identified
- Repeat of SPE audit section due to low score
- Ongoing monitoring surveillance by IPC Team.

Reported on: 12 Mar and 13 May – **AICC**

Timeline for 2019 (March to May)

AICC Meeting
Noted CD system in both QEUH and RHC to be completed by end of March.

The HFS/HPS report entitled "Technical Review Water Management Issues NHS GGC QEUH and RHS" is finalised but not published.

The work plan to address the recommendations in the DMA 2018 report is completed and tasks are allocated to the the F&E team to begin to complete the work required.

12 Mar | Mar | April

1 Mar 2019 — F&E — 31 May 2019

Meetings: CCGC on 5 Mar, BICC on 25 Mar, BCGC on 8 Apr, ACGC on 15 Apr

- Paper presented providing update on concerns raised by MBs in 2017. Update as at Dec 2017 and Jan 2019 provided. Confirmed paper will be presented to all appropriate governance groups.
- **CCGC –** Question on issues associated with the move of the Adult and Paediatric BMT units into facility in 2015. MD advised adult BMT Unit had high particle counts so unit was moved back to the Beatson and an extensive refurbishment took place.
- CCGC asked about a number of vacancies in the F&E Team and level of training and experience requirements. F&E Director noted they are working with universities to develop expertise in required areas, create modern apprenticeships and management opportunities.
- CCGC asked the LICD if they and their colleagues were content with progress of actions to address their concerns. The LICD confirmed they were content with the good progress made in all areas. The minutes of the subsequent CCGC meeting on 11 June note a correction to this last sentence and that the LICD advised that one colleague had since retired and other colleagues had not raised any further issues with the LICD.
- CCGC were assured of actions being taken, progress made, that patient safety was the top priority and noted lack of water incidents in the last 6 months.
- **BCGC -** noted the plan could be clearer on where concerns were not factually accurate, were already addressed and where there are new concerns with proposed actions.
- **ACGC** noted issues had been addressed, it was a comprehensive update, with no further actions required.

AICC Meeting
Noted HPS issued guidance for consultation which states IPCT will carry out a review for every water infection. Notes do not specify what water organisms or high risk areas are to be included.

- Patients admitted on 20 May to Ward 6A.
- Multiple day care visits.
- Patients positive for Stenotrophomonas on 20 May, 21 May and 22 May.
- Patient had caught their line 2 weeks earlier causing trauma to the site.

- Patient admitted on 28 May to Ward 6A.
- Day visits to Ward 6A and OPD.
- Also attended Ninewells where they had positive culture for Pantaea Septica.
- Test repeated on arrival but negative so far.

5 Mar to 15 Apr | 13 May | 20 May | 27 May

1 Mar 2019 — STM 6A — AB PICU — STM 6A — PanS 6A — EC 6A — IPC — 31 May 2019

13 Apr | PAG 16 Apr – no HIIAT | 29 May

- Patient admitted on 13 Apr to Ward 6A.
- Day patient 15 days earlier.
- Positive for STM on 13 April, 14 April (twice) and 17 April.

Reported to:
16 Jul, 2 Sep, 12 Nov (draft) – **AICC** given update.
29 Jul – **BICC** **19 Aug and 28 Oct** (draft) – **BCGF**
20 Aug and **22 Oct** – **GGC Board** **Aug** and **Oct** HAIRT

Acinetobacter baumannii

- Two cases identified on 21 Feb and 9 Mar. One patient died but AB not on death certificate.
- No link between cases.
- SPE audit section repeated as scored red.
- Ongoing surveillance monitoring by IPCT in place.

Reported to: 16 Jul – AICC

Reported to:
16 Jul, 2 Sep, 12 Nov (draft) – **AICC**
29 Jul – **BICC**
19 Aug and 28 Oct (draft) – **BCGF**
10 Jun and 5 Aug – **ACGC**
20 Aug and 22 Oct – **GGC Board**
Aug and Oct HAIRT

- Patient admitted on 14 May to Ward 6A.
- Positive for EC on 29 May.
- Transferred to PICU.

Timeline for 2019 (June)

1 June 2019

31 June 2019

F&E

IMT on 19 and 25 June - HIIAT - AMBER

Gram Negative Bacteria PAG

- The PAG reviews the 2 STM, 1 PanS and 1 EC case detailed on the previous page (page 21) that had occurred in Ward 6A.

Actions taken

- The results of water samples from Ward 6A are awaited but provisional results found no GNB.
- Review of patient timeline shows patients have visited Theatre 6 and Interventional Radiology. Water samples to be taken from both locations. Drains will also be inspected and swabbed if evidence of grime build up – but were clear at time of PAG.
- Latest hand hygiene and infection control audits both scored 95%. No practice issues were noted by IPCN on the day of PAG.
- Patient isolates are sent for typing.
- Ward considered safe for new admissions.
- There had been some high fungal counts on ward but no water or moisture sources found to explain high counts. Portable filters to be checked for expiry and water fountain to be removed from Ward 6A meeting room.

IMT – Following on from the PAG on 3 June, a further case of Enterobacter cloacae (EC) on 12 June and one case of Mycobacteria chelonae (MC) isolated from a patient's chest wall around line site and also water sampling on Ward 6A. The IMT considers all cases from April. Of the total cases, 2 are HAI (possible source is patients own gut) and 4 are HCAI. Total of 6 cases in April.

Investigations performed

- There had been a case of MC in May 2018 during previous water incidents. Rare pathogen and only 4 adult cases and no paediatric cases reported by NHS GGC in the last decade. Confirmed new MC patient had no contact with unfiltered water.
- Drains in theatre and trough sinks clean but clinical wash had basins in anaesthetic room; clean and dirty prep room have heavy build up of grime.
- Water samples from theatre negative. Drains grew unique strains of Steno, Enterobacter and other organisms. Water sampling in Ward 6A with POUF off found MC in several areas. Significant reduction in gram negative bacteria noted.
- Drains dosed with Hysan disinfectant regularly and have no grime.
- Discussed recent leaks from chilled beams due to a boiler failure and leaking pipe with water ingress into ceiling space. Mould evident on ceiling tile.
- Noted that some areas within A&E, outpatients and theatres have no POUF on their CHWB.
- Three shower heads and Domestic Service Rooms (DSR) from 6A positive for MC. Samples from taps with filters removed show fungal growth.

Hypothesis – MC patient had contact with unfiltered water. Three ways this could have happened:

1) Aerolisation from drains when water from take hits drains.
2) Bio-film creep from staff washing hands in CHWB were aerolisation occurs.
3) Patient washing their hands and touching their lines afterwards.

Control measures taken

- Timeline for patients with MC to be developed to see if any contact with unfiltered water.
- HPS to research what instances other health boards have of MC so NHS GGC can compare own figures.
- Dosage of chlorine dioxide to be increased. MC isolate from patient and water samples to be sent for genome sequencing.
- MC now included on IPCT alert organism list.
- POUFs to be fitted in theatres, Interventional radiography and Out Patient Departments.
- Chill beams to be sampled as leaks reported within the last month. F&E to review all leaks from Ward 6A in last month to see if any commonality with patients.
- Air sample to be done in Ward 6A with water running into the sink to check for aerolisation of drains.
- Hand washing to be followed by gel sanitisation.
- Cleaning of drains in theatre.
- Water sampling in Ward 6A to be done with and without POUFs.
- Talk to POUF manufacturer to see if there is evidence that filters can prevent MC from entering water from the tap.
- Check previous water sample results for MC.

3 June

June

MC EC 6A

IPC

1 June 2019

3 June

12 June

30 June 2019

HIIAT status – Amber

- Patient admitted on 8 April to Ward 6A. New Patient. Tested positive for Enterobacter Cloacae on 12 June.
- Further patient also tested positive for MC which was isolated from lessons around the patient's line site on 19 June.

Reported to:
29 Jul - BICC – update given on this incident. **10 Jun and 5 Aug** – ACGC – minutes of 10 Jun state that incidents at QEUH are noted but not which ones. Minutes of 5 Aug make reference to 2 rare water borne bacteria. **16 Jul, 2 Sep and 12 Nov** (draft) **–** AICC give update. Minutes of 16 Jul note major problems in validating theatre in new ICE building but not why this is the case. **20 Aug and 22 Oct –** GGC Board **19 Aug and 28 Oct** (draft) – BCGF **August** and **October** HAIRT

Timeline for 2019 (July to August)

- The F&E compliance team commence a substantial exercise on Smartsheet (a computer database programme) to create electronic compliance dashboards for Senior Managers and Estates Managers to allow instant visibility of the compliance level of a site/sector and Board level for all Standard Compliance and Risk Tool topics, AE Audits, Water Risk Assessments and sustainability issues, along with all action plans supporting these reports. Evidence to support completed action is also held. The exercise was completed in 2020 and means that all compliance related documents and action plans are in one place rather than in several. Where action plans are not being followed or instigated, these can be followed up more quickly.

1 July 2019 — 31 Aug 2019

August onwards

F&E

IMT on 3 Jul – HIIAT AMBER

Pseudomonas Putida (PsP)

- Two further patients have tested positive for PsP and these have been classed as HAI. No new cases of MC. Total cases now 8.

Investigations performed

- Water results taken from a sink with a filter - the Arjo bathroom is positive for MC. This sample was subsequently found to have been mislabelled at the lab.
- The sink within the DSR cannot have a POUF fitted to it. Discussions with manufacturer to see if filter can be fitted retrofitted to the sink.
- Genome sequencing results are awaited.
- IPCT carried out SICP audit of Ward 6A – score 93%. Very few issues identified and practice was very good.
- Noted POUFs are being fitted everywhere along a patients' pathway and drain cleaning had been completed in theatres and CDU. Nuclear Medicine/MRI areas also to be done.
- TWG are looking into using a higher dose of chlorine dioxide to shock dose the water supply.

Hypothesis – unclear if gram negative bacteria numbers are normal background rate or if related to ward or outlying area environment. For MC cases, working on the basis that patient/staff had access to unfiltered water in another area.

Control measures put in place

- Sink in Arjo bathroom to be retested to ensure filter is working.
- Future water tests to be carried out for half the ward every 2 weeks then other half for following 2 weeks to give an overview of all water outlets in the whole ward.
- Arjo bath to be removed and reinstated once patients move back to Wards 2A/2B.
- Taps in an unused prep room to be replaced as a preventative measure since POUF cannot be fitted to them.

IMT on 1, 8, 14 and 23 Aug – HIIAT RED

IMT – PAG held on 3 June but with a further 1 case and 1 possible case as noted below, an IMT is set up. Total of 11 cases plus 1 possible case since April.
There was a change in LICD from Aug 2019.

Investigations performed

- Water tests from taps with POUFs are negative in Ward 6A and elsewhere. A sample of POUFs have been tested by manufacturer for integrity and all passed.
- Noted that chilled beams suffer from leaks and condensation. Samples show Pseudomonas oleovorans (PO) and Pseudomonas aeruginosa (PA) in the cold water. Swabs of grills on the beams show small growth of Acinetobacter, Klebsiella and Patoae species. Discussion held with HPS on where samples should be taken from.
- Water sample from plant room tests positive for Klebsiella and Psuedomonas Putida. It is not known if this a pre or post filter sample.
- Air samples from patient room en-suites show small counts of Aspergillus.
- Enhanced daily supervision by IPCT; HH and SICP audits continue and any issues identified are raised and actioned. Central line audit produces very good results.
- Clinicians express concerns that patients are in rooms with chilled beams but noted all rooms in hospital are same apart from Ward 4B. Options discussed are use of beds in Ward 4B, a further decant and use of a temporary mobile unit.
- There is disagreement amongst microbiologists with regards to the reliability of swabbing and also whether the level and nature of GNB being seen is unusual.
- Change of chair on 23 August. Chair notes asked to demit but IPCT advised that following a conversation between them about the complexities of being the Chair and an active participant, the Chair was in favour of another chair. Certain MBs/ICDs dispute this point and advise the LICD was not in favour of another Chair and was replaced after asking for MBs to attend IMT meetings.

Hypothesis – patients have either had contact with unfiltered water or the chilled beams are either leaking or dripping condensation onto patients.

Control measures put in place

- Admissions restricted from 2 Aug and new patients diverted to other NHS Boards.
- Patient timeline to be completed.
- Biocide is introduced to chilled beam system and subsequent testing is negative. Cleaning of grills increased to every 6 weeks rather than every 3 months.
- F&E to draw up dedicated action plan for chilled beams in Ward 6A and how Issues/services are managed.
- Cleaning of chilled beam grills increased to every month/6 weekly.
- Clinicians to speak to MD regarding alternative accommodation.
- Review to be done as to what patients could be moved to Ward 4B.
- HEPA filtration units to be installed in patients' en-suite bathrooms in ceiling void.
- All patients receiving ciprofloxacin.
- Chlorine dioxide dose to be increased.
- Change of sink in the domestic services room (DSR) to be completed as it has no POUF and one cannot be fitted.

PsP — 6A — Aug — EA — Ps — CH — EM — STM — EC — 6A — IPC

1 July 2019 — 31 Aug 2019

Reported to
29 Jul (PsP only) – BICC – given update.
5 Aug – ACGC – given update on incidents to date.
19 Aug and 28 Oct (draft) **– BCGF** - August HAIRT
20 Aug and 22 Oct – NHS GGC Board
2 Sep and 12 Nov (draft) **– AICC** Noted at 2 Sep meeting that the re-opening of Ward 2A/2B is due March/April 2020.
August and October 2019 **HAIRT**

- **Between 3 Jul and 1 Aug** –
  - 1 patient with Chryseomonas who also developed Pseudomonas a week later.
  - 1 patient with Enterobacter cloacae and Elizabethkinga Miricola.
- **Between 2 Aug and 8 Aug** –
  - 1 patient with Stenotrophomonas on 6 Aug, admitted 4 Aug.
  - 1 patient in at Raigmore in Inverness with Enterobacter Aeromonas who previously had Psuedomonas. This second patient is possibly linked to Ward 6A due to post transplant at RHC.
- Total cases now 11 plus 1 possible case which is patient admitted to Raigmore.

Timeline for 2019 (September)

AICC Meeting - A specialist sub group formed to look at ventilation in PICU. This group includes clinicians, IPCT, F&E and ventilation AE. PICU is non-compliant as it has a lower number of isolation rooms than required. An options appraisal was done and an option will be recommended to allow a derogation to be signed off and agreed so that the unit can operate in its current set up. This will be shared with HFS.

The work to address the recommendations of the 2018 DMA report is completed.

A review of NHS GGC's Water Safety Policy is conducted by an external consultant - a first draft is produced.

1 Sep 2019 — 2 Sep — Sep — Sep — 30 Sep 2019

F&E

IMTs held on 6, 13, 18 and 20 Sep. HIIAT starts as AMBER and reduced to Green on 18 Sep

IMTs continue. 12 + 1 new case of GNB to date. 3 patients remain as inpatient - one in Ward 6A, one in Ward 4B, and one in PICU. It is noted from this point that previous Chair of the IMT is not in attendance.

Investigations performed

- An SBAR is received from MBs outlining a number of concerns which include issues about air changes and pressure, use of HEPA filtration, infection risks from chilled beam technology, existence of pathogenic fungi, exposure to unfiltered water, risk from toilet plume, ceilings not solid, lack of play area, door entry, sinks and prep room. The issues and responses sent to the MBs discussed at the first IMT meeting in September. At the next IMT meeting on 13 Sep it is noted the Chair has received a response from the MB but this is not shared with the IMT.
- Enhanced supervision by IPCT; HH and SICPs audits continue and are achieving good scores.
- Environmental sampling in Ward 6A and Beatson is negative.
- Noted that the typing of the GNB organisms from sampling and from patients are different and unique.
- Discussions about patients feeling unwell due to the prescribing of ciprofloxacin.
- F&E visited Great Ormand Street to look at the water and air ventilation systems and will provide a report on their findings. F&E state all work is completed on the ward apart from installation of HEPA filtration units in patients' en-suite bathrooms which will be done in 6 weeks time when units arrive.
- Discussion on a number of epidemiology reports produced by MBs and HPS on the numbers and types of infections compared to other hospitals. The MBs conclude that the environment is safe but there is debate over methodology and whether measures are appropriate. Clinicians state there is an impasse between MBs and what is to be done to resolve this. These reports are to be submitted to the Executive Committee following further analysis being performed.
- An options paper is prepared by the clinicians for moving patients to alternative accommodation and is submitted to the Executive Committee, MD and CEO. Agreed to be used if further problems occur.
- On 18 Sep the Chair reduces the HIIAT to Green based on above data but clinicians and SG express concerns. Chair asks HPS to explain to SG the level of detail considered by the IMT and that Green rating is based on the decision to lift restrictions.

Control measures in place

- Confirmation that patients transferred from other hospital did not have positive blood cultures.
- Timeline to be created for new patients.
- Restrictions on admissions continue.
- Weekly enhanced supervision by IPCT to continue.
- Detailed review of all confirmed (12) and possible (1) cases to be done.
- Full microbiological analysis and root cause analysis (RCA) to be performed on all cases going forward.
- SOP developed for obtaining regular water, environmental and chilled beams sample. HPS to help with this.
- Central line infection triggers to be put in place so if reached action can be taken.
- Consideration of how IMTs are triggered, i.e. NHS GGC suggest 2 cases of same infection in 2 week period (proposed by NHS GGC) or 2 infections regardless of type (proposed by HPS). Paper to be circulated for comment and approved on basis of discussion.

1 patient admitted on 22 Sep tested positive for Achromobacter spp on admission.

1 patient admitted on 27 Sep tested positive for Stenotrophomonas maltophila on 29 Sep.

Sep — 22 Sep — 29 Sep

GNB **6A** **AC** **6A** **STM** **6A** **IPC**

1 Sep 2019 — 3 Sep — 30 Sep 2019

1 patient admitted on 2 Sep has a positive culture next day. Details not provided but there were multiple organisms. Patient was in Ward 3B, then 6A mid Aug and then day care. Line accessed at day care on 27 Aug in Beatson and 28 Aug in Ward 6A. Patient was home between mid and late Aug.

Reported to:
28 Oct (draft) **– BCGF -** August HAIRT
22 Oct – NHS GGC Board
12 Nov (draft) **– AICC**
October 2019 **HAIRT**

Reported to:
7 Oct and **11 Nov**– **ACGC** – update. **22 Oct – NHS GGC Board** – noted the 3 work streams commissioned in Feb are nearly complete. **28 Oct** (draft) **– BCGF** - through HAIRT. **12 Nov** (draft) **– AICC** – ongoing reporting of these incidents. **Oct HAIRT**

Timeline for 2019 (October)

1 Oct 2019

31 Oct 2019

F&E

IMTs held on 8, 11 and 25 Oct - HIIAT AMBER then GREEN on 25 Oct

IMTs continue and SG representatives join the first IMT following its and clinicians' concerns on the lifting of ward restrictions. Agreed at meeting that these should continue.

Investigations performed

- Discussion and development of the RCA started in Sep to include detail on patient pathways when outside ward and what they do. Noted lines are accessed in multiple areas e.g. ward, OPD, Beatson, oncology, patient's home etc.
- Debate on case definition and if informed by the past or is more forward looking. Agreed aim is to identify common source, link and route of transmission but accept definition evolves over time.
- Noted water sampling results are reported through TWG. August results show some very low and some high levels of coliforms but sequence testing was negative. September results show DA and STM but retest results are awaited. Noted HPS/HFS sit on TWG but currently no MB sits on both TWG and IMT. Noted previous chair had been this liaison.
- A leak in the ward kitchen (which was being used to store patient food) has been repaired and is now open. The leak was from a tap fitted in August and corrosion of the pipe work has been found. The tap was replaced with one compatible with a POUF. Questions raised over what reassurances there are that no other taps are leaking. F&E Director advises they rely on visual inspection and that any leaks behind panes would be a major undertaking as over 120 water outlets are in each ward. IMT agree this check would not be done at this time. If the integrity of the wall and ceiling are intact then there is no evidence of water seepage through the water ingress. It is later found that the leak is from the hydro unit and not the tap.

Control measures put in place

- Ciprofloxacin only to be given to inpatients and not day case patients.
- Seek external advice on recommendations made when patients go home.
- Smart site hubs to be tested. Normally replaced weekly but will now be replaced when contamination spotted.
- Agree the use of a multi disciplinary team for cases going forward.

Hypothesis – new hypothesis from RCA that infections may be from Smart Site Hubs which allow needleless injections of medication into patient line.

- In October 2019, NHS GGC requested HPS to provide independent support to review the data being used to inform their risk assessment and decision making in relation to Wards 6A and 4B at QEUH. At this point the wards were closed to new admissions. This request resulted in an HPS report entitled "Review of NHSGG&C paediatric haemato-oncology data" in Oct 2019. The report was published in Nov 2019.
- The report states its key objective was to assess NHS GGC's datasets and ensure assurance data provided an accurate reflection of the current epidemiological situation in this patient population and, where differences existed, to understand reasons and assist with interpretation. The report also sought to review the environmental gram negative blood cultures and whether there had been a change in the type reported.
- The review compared different sources of data (3 datasets from NHS GGC and one from HPS) on positive blood samples from haemato-oncology patients. Blood samples were divided into four groups - GNB, GPB, Environmental Bacteria and Environmental Bacteria including Enteric Bacteria (those found in the gut). Analysis covered the period between July 2013 and September 2019.

Conclusions of report – these were as follows:

- The analysis presented did not provide evidence of a single point of exposure causing bloodstream infections.
- Admissions should be reconsidered but the analysis also underlined the need to continually monitor risk in this patient population.
- The results suggested the NHS GGC datasets were broadly consistent with national data held by HPS and were suitable for ongoing monitoring. Statistical analysis highlighted months where positive blood sample rates were higher than expected – the purpose of this analysis was to prompt further investigation and to ensure any appropriate action is taken.
- Analysis of different types of bacteria showed some changes, but numbers in each group were small, meaning the significance of this was not fully understood and should be part of the ongoing monitoring.

Recommendations from the report – for NHS GGC to consider were as follows:

- Systematically collect clinical data on cases to describe the risks in this patient population and ensure ongoing monitoring is in place.
- Categorising cases in terms of "person" and "place" to identify when there are more cases than normally expected.
- Consider the epidemiological characterisation of cases in the context of environmental risks, e.g. water and ventilation testing results.
- Consider the data provided in the context of the findings from the action plan.
- Consider lifting the restrictions on admissions as based on HPS review of the data there is no evidence to support this continuation.
- The report also notes recommendations for HPS including review of categorisation of environmental organisms for inclusion in the new Chapter 4 of the IPCM, along with development of appropriate triggers for ongoing monitoring.

Oct

DA

6A

IPC

1 Oct 2019

1 Oct

31 Oct 2019

- 1 patient who had a line inserted on 24 Sep, came in for treatment on 1 Oct and tested positive for Delftia acidovorans (DA).
- The total is now 15 cases and 1 possible case.

Reported to:
7 Oct and **11 Nov**– **ACGC** – update.
22 Oct – NHS GGC Board – noted the 3 work streams commissioned in Feb are nearly complete. **28 Oct** (draft) **– BCGF** - through HAIRT. **12 Nov** (draft) **– AICC** - ongoing reporting of these incidents.
Oct HAIRT

Timeline for 2019 (November)

1 Nov 2019

30 Nov 2019

F&E

IMTS on 5, 11 and 14 Nov when incident closed. HIIAT GREEN

- IMTs continue into November with incident finally closed on 14 Nov. A report by HPS notes there is no clinical reason to keep restrictions in place and no single source of infection has been identified. HPS give formal agreement to lift restrictions.
- Genetic sequencing of Enterobacter cases shows there are no links and source is likely to be patient's own gut. Cases are removed from RCA.
- RCA is finalised with SG and HPS.
- New procedure for cases is agreed as follows:
  - RCA to be done for all cases;
  - PAG set up if there are 2 GNB cases in 30 days or upper warning limits of SPC charts are met;
  - Escalation to IMT will be based on Board's standard outbreak procedures;
  - If immediate source not identified, external advice will be sought early;
  - Findings of PAG will be reported to Clinical Review Group;
  - Data collection form, developed with help of HPS, to be used by multi disciplinary team to collect the relevant data.
- Water results are noted as being pristine with very low TVCs.
- Patients to be given Taurolock rather than Ciprofloxcin.
- Enhanced surveillance by IPCT is still ongoing with education being given to parents on HH which scored very poorly.
- Agreed increased portering, nursing, potential housekeeper resource & water testing will provide reassurance to patients/parents.

19 Nov - HIIAT **GREEN**

- IMT convened to review 2 PsA cases in PICU noted below to asses if HAI or not. Medical history of patients discussed and it was agreed that it is HAI.
- Noted that typing results do not match.
- Both had treatment on an ECMO machine on 21 Sep and 7 Nov respectively. ECMO has disposable circuits and is sterilised weekly and after patient use. Water in machine is tested after each patient and has been negative.
- Also both used haemofiltration unit which has disposable circuits - not sure if this was tested.
- Noted that patient 1 came from NHS Ayrshire and Arran. No samples taken so unclear where infection is from. Suspect infection already present given rate of deterioration.
- Patient 2 was negative before going on ECMO.

Actions taken

- ECMO out of use pending results of water samples taken last week. Water samples to be taken from NICU and Theatre 8 as patient 2 was in both. If all negative, ECMO can be used.
- HH education to be put in place and IPCT to do an audit.
- Trial of BD Pure Hub sites as these now used in Ward 6A after a successful trial.
- Lead Nurse and SCN agreed to carry out peer hand hygiene reviews.
- No water checklist or domestic issues were highlighted.

- IMT convened to review an **SM** case (noted below) and discuss cases since 5 Oct for **AB** and **PsA**. Noted case of **PsA** reported 27 Nov which is still to be investigated and may be a transfer in.

Investigations performed

- Water samples taken with filters removed were negative. Noted that only connection is between the first two PsA cases - Theatre 8 which has tested clear.
- Noted no recent cases of SM to compare typing. Last reported in Aug 2019. A retrospective case mentioned at IMT for Ward 6A is mentioned but no details provided in minutes. HH education is ongoing and ward is getting excellent HH results despite lots of visiting doctors.
- Observation of bronchoscope investigation to gain sample from lower airways (BBAL) procedure noted no issues.
- Weekly assurance checklists for equipment are being completed and new keyboards ordered that can be immersed in water.
- Discussion around sinks and little-used outlets and uncertainty about changing style of sink. Agreed this would be looked at separately.

Hypothesis –SM is likely a sporadic case in a susceptible patient. No hypothesis noted in relation to other cases.

Control measures being performed

- Patient equipment control measures to be tightened up. A plan on splash risk at sinks to be developed.
- Discussion with domestic staff around who is responsible for cleaning the relatives' room to be taken forward. Parent education to be provided.
- Environmental sampling of frequently touched surfaces is being done.
- SM case to be sent for typing.
- To look to address visiting doctors from a HH perspective.

November

19 Nov - HIIAT **GREEN**

27 Nov HIIAT **GREEN**

AB PICU | PsA PICU | PsA PICU | SM PICU | IPC

1 Nov 2019

30 Nov 2019

PAG 5 Nov

- PAG held after 3 cases (5, 9 and 17 Oct) of AB over a 12 day period. HAI trigger is 3 cases in 2 weeks.
- Two patients in same bed bay so cross transmission suspected. These match the patient in Aug but patient in PICU on 16 Sep.
- **Actions –** use of checklist to ensure weekly cleaning of shared patient equipment after issues found, enhanced IPC surveillance, HH and IPCAT audits to be repeated.

PAG 12 Nov – HIIAT **GREEN**

- PAG held on 12 Nov following 2 cases of PsA.
- First identified on 21 Sep was community acquired. Patient died on 27 Sep and PsA noted on part 1b of the death certificate.
- Second identified on 7 Nov was a HAI and patient died on 9 Nov but PsA not stated on the death certificate.

PAG 21 Nov – HIIAT **GREEN**

- PAG held following another case of PsA Identified from a bronchoscope investigation to gain sample from lower airways (BBAL) on 18 Nov. Patient transferred from Crosshouse Hospital on 29 Sep.
- HH education being coordinated and further audits and IPCT to observe procedure for BBAL.
- No domestic or water checklist issues identified.
- Water samples taken on 14 Nov are negative.

24 Nov

- Case of Serratia marcescens on 24 Nov. Patient died on 25 Nov.
- SM not cited on provisional death certificate but now retracted and post mortem to be performed.
- Transferred from NHS Highland.

Timeline for 2019 (December)

- Since the appointment of the Director of F&E, the structure of the F&E team has been changing and this is still the case in 2020. The date this reorganisation started is not clear but F&E activities have been separated where previously they were both the responsibility of a sector general manager. There are now a separate Associate Directors in charge of Estates and of Facilities. There is also greater definition around each role as well as specific allocation of responsibilities to allow individuals to develop expertise in specific areas.

1 Dec 2019 — Dec???? — 31 Dec 2019

F&E

- SG advise that the last 3 incidents in PICU are investigated together retrospectively and prospectively using the HPS case definition used in relation to the recent GNB incident in Ward 6A.
- The IMT consider each infection category and come up with 3 separate hypotheses as follows:
- Pseudomonas – 3 cases reviewed by IMT on 19 Nov. Noted that case 1 was sepsis as per death certificate and not a bacteria as per the minutes. Patient had 5 negative blood cultures. Hypothesis was that, as cases 1 and 2 had both attended Theatre 8, there had been transmission. There was no link for case 3.
- Serratia – 1 case was referred to procurator fiscal as unable to establish cause of death. Noted IMT hypothesis was a possible water transmission.
- Acinetobacter – 3 cases; hypothesis was cross transmission between cases 1 and 3 as typing was identical. Noted typing also matched a case in Aug 2019. Noted appropriate controls were in place.
- Water samples from PICU, Theatre 8 and NICU are negative. HH and IPCAT audits also reviewed with deficiencies noted in SPE section.

Additional control measures put in place

- Weekly Safe Patient Environment audits to be put in place.
- Weekly swabbing of POUFs, drains and CHWBs and water sampling for GNB over a 4 week period. Monthly water sampling for Mycobacterium.
- Drains will have weekly Hysan dosing.
- A SPC chart for all Gram negatives in PICU with bed days to be supplied.
- Trigger is 2 GNB in 30 days or 2 HAIs in a 2 week period - RCA to be completed.
- Retrospective look back of a 6 month period and RCA completed for 2 cases In that period.

- IMT noted that GNB cases were to be investigated collectively but this was complicated by different case definitions applied when GNBs were being reviewed separately.
- Agreed that SPC chart for blood cultures is to be used going forward as well as normal triggers.
- Noted that robust definitions for the above were required to ensure consistent reporting.
- Clinical review of all cases is suggested to allow for a more descriptive picture of the situation. Agreed that SPC will be completed first, then RCA on patterns identified and then patterns will be discussed.
- Noted a new case of Serratia on 10 Dec. Not HAI based on review by clinical team.
- Tests in Theatre 8 were all negative. All water sources tested against PsA, SM and AB on 10 Dec including inside filters, trough sinks and HH sinks in peripheral rooms.
- Environmental screens picked up a number of organisms in drains including SM in trough sink adjacent to bed space. Sent for typing and re-swabbed this morning.
- Hypotheses updated as follows:
  - AB – patient to patient transmission, all in same bed space with index case being Aug 2019. One sporadic case. IPC continue surveillance monitoring, ensuring shared equipment is clean and all TBPs are in place.
  - PsA – potentially Theatre 8 for cases 1 and 2 but water/environment samples show no links so water hypothesis now closed.
  - SM – 2 cases with different typing. First patient died, second patient came in colonised. Water hypothesis now closed. New hypothesis about drains as a positive sample was found in the room the patient was nursed in. IMT agreed that patient colonisation status should be reviewed.

Additional control measures put in place

- Clinical Review Group set up for Ward 6A and suggest same done for PICU. Should meet weekly and include directorate management, F&E, IPC, Clinical Staff and Deputy Director of Nursing.
- Results as to why staff fail HH audits should be recorded.
- SPC to be developed for first isolates of any other clinical sample, e.g. wounds, BAL etc. Noted that this should be sample type specific for every GNB and to use 3 organisms PsA, AB, SM. Noted that patient pathway also needs to be considered as BAL could be done in theatres as well as PICU.

- Fourth case of AB since 5 Oct.
- Environmental samples (including drains) taken on 11 and 19 Dec are negative.
- IPCT contacting Wishaw to see if patient had any historic organisms.
- Work in Oct/Nov to upgrade ventilation with all 4 bedded rooms complete and few cubicles still to be completed.

Hypothesis – sporadic case as no overlap in time and place or equipment. No AB isolated in environment, water, Theatre 8 or in specific rooms tested. Possibly transmitted by hand but awaiting typing results. No further IMT arranged but will be held if another new case or trigger activated.

Control measures put in place

- Patient being isolated in single room.
- Enhanced IPCT supervision weekly.
- HH scored 90% the same day.
- SPC regarding BC and BAL specimens from PICU being drawn up for submission to to Clinical Review Group once IMT closed.
- Facilities will survey PICU to check for leaks and dampness.
- Water samples of all water outlets in 4 bedded areas and also room 17 to be done.

1 Dec 2019 — **SM** / **PICU** — 10 Dec — 17 Dec — 30 Dec — 31 Dec 2019

IPC

10 Dec

- Second case of Serratia (SM) reported from a blind BAL sample. Patient discharged to Ward 2C on 16 Dec.
- Typing was different from any seen in the hospital so far.
- Patient transferred from Crosshouse Hospital.
- Clinical team consider not HAI on review of the case.

23 Dec

- Case of AB on 23 Dec taken from a blind BAL.
- Patient admitted on 28 Nov from Wishaw General Hospital.

Section 8
Timeline for Water Groups

Technical Water Group Timeline for 2018 (January to May)

1 Jan 2018

Board Water Safety Group (BWSG) Meeting — 6 Mar

- Given an update on the "water incident" in Ward 2A.
- Noted the need to identify if problem was elsewhere to determine if there was an issue with the cleaning regime or simply the implementation of the cleaning regime in that ward.
- Noted the need to be proactive with this situation given nature of patients. Agreed a different practice (not stated what this is) for this ward would be needed and this should be reflected in the written scheme.
- Use of disposable shower heads was discussed.
- ICD recommends water sampling on the ward is increased to monthly and on instruction from ICT.

BICC Meeting — 28 Mar

- A copy of the Terms of Reference (ToR) for the TWG were issued with the agenda and noted.
- Agreed that these would be reviewed as part of the IPCT annual work plan and ToR should set out how TWG reports to BICC and Health and Safety Group. It will also take account of any local or national advice on water safety.
- Chair of the TWG to keep the executive team and Board updated on Progress.

6, 13, 20 and 27 Apr

- To understand where bacteria is located water samples were taken from all parts of the water system. Results showed each floor had some contamination indicating that problem is widespread.
- Positive results were returned from water coolers (which are maintained by a third party) and were disinfected.
- Group agrees that POUF will only be fitted to high risk areas rather than the whole campus.
- Discussions held with tap manufacturer who advises issues with Pseudomonas in the flow straightener are known but not other organisms. Manufacturer notes these should be decontaminated and replaced as required. Taps are sent for further analysis to determine if source, but replacement of taps is also discussed.
- Discussions held on how long bio-film takes to develop – opinions vary from a very short period to up to a year.
- The TWG minutes of 27 April 2018 record that a report from water expert (Sarah Lees) notes it likely that system was contaminated before handover and that fluctuations in the water temperature experienced since opening were also a likely contributing factor. Fungus in the system is thought to be due to dust levels around the site during construction and demolitions. Noted air tests carried out during the works were all recorded within parameters. Visits by further expert – Tom Makin - is planned.
- Discussions about plans to review information on water temperature to identify trends but advised majority of data has been lost due a system failure. Some manual records can be reviewed but these are not extensive.
- Group discuss long terms solutions. Options include shock dosing, thermal cleaning and chemical cleaning (including chlorine dioxide). Each option will require investigation into the impact on the water system, effectiveness against organisms and bio-film, and impact on hospital. Paper on all options to be prepared and presented to group. Noted that whatever option is selected a full risk assessment would be required and options selected that would cause minimum disruption to wards/patient care

4, 11 and 18 May

- The Group decided that chemical cleaning is more appropriate than thermal disinfection (which raises the water temperature in the system to 90 degrees to pasteurise the water) due to risk of scalding and other safety concerns. In addition, raising the temperature in cold water systems is not always possible due to the lack of a mechanism to raise the temperature and impact on the system as pipework expands because of the temperature differential.
- The Group decided they will start with continual dosing followed by a shock dose and then revert back to continual dosing. Water will not be available during the shock dose. The process for shock dosing is to be written up and a risk assessment performed.
- The TWG minutes of 11 May 2018 record that a meeting was held with another water expert (Tom Makin) who concluded chlorine dioxide (CD) is the best choice for striping bio-film. The TWG minutes also record that the expert noted there are issues with new builds and method of construction – many sealed buildings are now showing water issues never previously seen in hospital buildings. Agreed input of experts should be continued going forward.
- Manufacturers being contacted to determine the appropriate doses of CD and what impact this will have on pipes.
- Agreed that flow straighteners are replaced on a 3 monthly basis and taps are steam cleaned and put back with POUFs in place. Noted that, until replaced, caution must be taken that taps do not re-cede the system. Suggested flow straighteners are analysed. Taps will be replaced in Wards 2A and 4B and rest of the RHC and QEUH will be monitored.
- Group agreed that acceptable sample levels need to be agreed going forward.
- Efforts are being made to locate water certification sign off at time of handover.

16 May

South and Clyde Sector Water Group (SCSWG) Meeting

- Update given to group on the "water incident" at QEUH.
- Noted over 2000 water samples taken and mapped to floor plans and within schematic diagrams concluding there was a bio-film build up in the system which requires to be eradicated and preventative measures put in place.
- Water dispensers were removed from RHC.

23 May

BICC Meeting

- ToRs for the TWG are now included in the IPCT work plan.
- MD asks that lessons learned from recent water issues are reviewed and a plan prepared to address these for review by the TWG and then BICC.

31 May 2018

Technical Water Group Timeline for 2018 (June to July)

- Group confirmed chlorine dioxide (CD) dosing is their recommended option. NHS GGC Board to be informed of the process and financial implications. It is noted in the minutes that the potential impact on the pipework is unclear but the level of the doses which are anticipated to be applied will not affect pipework warranty. It is noted that various checks will be performed during the CD process to monitor any impact and it was important to note that the Board will be kept informed. The water sample testing regime to be performed following implementation of CD is discussed.
- Purchase of dosing plant will be by an accelerated tender process and plant will be placed by Oct/Nov with continual dosing starting on 1 November.
- A work programme setting out the logistics for the implementation of the shock dosing is discussed as water will be turned off. Discussion includes use of portable wash hand basins, bottled water, flushing of system after shock dose, and impact on patients and wards. Noted a better system is required to record and audit flushing regimes by domestics. Noted Board Water Safety Group and South Sector Water Group should assess risk assessment outcomes and be involved in the work plan. Noted that POUFs will need to be changed after shock dosing.
- Following discussions with experts a replacement tap (the Marwick with Bio Guard) is selected for high risk areas. The tap chosen requires the flow straightener replaced every 3 months. Raw and bulk water tanks and one section of the filtration plant are sanitised during this month (with rest to be completed in July). Debris is found in a tank (which one not stipulated) which looks like sponges and this has been sent for analysis.
- Cleaning of drains and replacement of flow straighteners in high risk areas is ongoing. Water coolers also removed from Wards 2A and 2B. HFS informed of debris found in drains as this is a potential national issue.
- Noted that commissioning validations record data cannot be found and contacting project advisers, Director and IPC to see if they can provide any clarification on what was done and signed off. Some flushing carried out at time but not all for the period after handover or records from main contractor on its flushing regime.

1 June 2018

5 June

BWSG Meeting

- Noted no legal requirement for Scottish Water to supply water at a particular temperature which is an issue as water supplied is at a higher temperature than that required for a hospital setting.
- Discussion on possible causes of the issues in new buildings being created by the temperature of water increasing from the inlet to the actual user. When new buildings are being constructed, consideration should be given to ensuring there is sufficient space to include chillers to ensure temperature of water remains stable until the last user outlet.

8, 15, 22 and 27 June

19 June

AICC Meeting

- Advised that a TWG has been set up which will report to the BICC and is looking to resolve long term issues on tap replacements, implementation of water dosing on the full campus and ongoing HPV cleaning of patient rooms in Wards 2A/2B.
- The ToRs for this group will be confirmed at the next BICC meeting.

6,11, 13, 20 and 27 July

- Group discussed for how long continuing dosing should be performed before a shock dose is administered and if latter is required. Agreed position will be monitored through test results and if counts do not fall to below acceptable levels, shock dosing will be undertaken.
- Development of the work plan continues and looks at impacts on clinical services and the detailed logistics that need to be in place for the shock dosing.
- Group discussed options for taps in other parts of the hospital. Options are for the existing taps to be retained with tap being modified and regulator removed, or to regularly replace the flow regulator or completely replace the taps. Modification of the current tap is not viable. Other taps on the market would need to be modified to contain a bio guard making the tap either not compliant or creating separation of components which is not recommended. A Delaby tap is to be investigated as it has smooth surface and disposable parts that can be changed. It has a disposable spout and a built in POUF. Discussion with manufacturers and guidance was being sought from HFS/HPS.
- Regulators that were sampled have counts but no bio-film. Replacement regulators are not individually sealed and also show counts when they arrive. This means they have to be sanitised before being put in place. Re-cycling also considered through use of a ultrasonic bath and then soaking in a sanitising agent.
- Advice being sought from HFS/HPS on whether drains are to be cleaned and if so what agent to use. Cleaning is against national policy but agreed that this should continue in high risk areas. Drain parts affected by cleaning are being replaced. Debris noted down the drains and this is to be addressed with nursing staff.

31 July 2018

Technical Water Group Timeline for 2018 (August to September)

1 Aug 2018

30 Sep 2018

SCSWG Meeting – 15 Aug

- Noted that water temperature coming into QEUH is above acceptable levels.
- Noted that there were similar issues at the GRI site.
- Noted a large increase in daily water usage at QEUH and 23 dump values to dump water were constantly open to try and resolve issue. Consumption being monitored.
- Noted that flushing was being undertaken and POUFs would remain in place.
- Hoped that drop in external temperature will significantly reduce water consumption.

3, 10, 17 and 31 Aug

- Following further discussion it was agreed that shock dosing would be difficult to deliver given the extent of disruption. Agreed continual dosing would be done with increasing amounts of CD being injected into the system and results will be monitored. The initial dose would be 1ppm increasing in 0.5ppm stages up to 2ppm for a 3 month period. If the results were still not within limits, a risk assessment would be required. This option is more flexible and allows fine tuning of dosage as and when required.
- Noted that in hot water system CD will become a gas and could lead to corrosion of pipes which will invalidate warranty. Noted that dosing will be within manufacturer recommendations but Board has little choice and will incur the cost of any adverse impact.
- Tender process for CD system has resulted in only 1 bidder with 2 possible bidders withdrawing due to lack of resources. Remaining bidder has proven track record and process is accelerated so contract can be placed. First meeting is to take place 3 September and timelines for work to be agreed. CEO to be notified of timeline. Anticipate dosing of RHC will occur mid October.
- Testing of flow straighteners shows that bio-film has built up after a month. Consider whether filters can be fitted further up the taps but this is against regulations. Not clear whether flow straighteners are the issue or water supply. Agreed that once CD in place, could review and then plan a maintenance programme if the former is the issue.
- POUFs will remain in place for at least 6 months after dosing starts to catch any bio-film dislodged. POUF will only be in high risk areas as organisms only harmful to these patients. Sampling will occur every 4 weeks to obtain a baseline before CD implemented. Work ongoing to determine monitoring points in system once CD is in place to monitor counts. Automatic and manual testing will be done – former will give early warning if results are not within limits.
- Water testing of tank room shows water mostly negative post filtration but raw water tanks have positive results from drain connections which are not capped or sanitised. This action is to be progressed. Bulk storage tanks also positive - believed to be due to environmental conditions – noted to be cockroaches, fungal odour, room not ventilated, water ingress and dried algae on floor. Area to be disinfected, repainted with anti-fungal paint, repairs made and pest control called in. Testing to be done once work completed.
- HPS noted build up of grime in drains in Ward 2A/2B despite only recently being cleaned. Investigated and believe silicone washer is the source. Speaking to manufacturer to see if it can be re-designed and also whether it can cope with CD.

7 and 20 Sep

- Air sampling in tank room found fungi. Leak found in one tank and manhole cover are both repaired. Room being monitored and HEPA filters installed.
- Timeline agreed for CD system. Monitoring system to be put in place to give indication of strength of the CD in different parts of the system and give early warning of any issues. Drawings will map the efficacy of CD around the site and allow dosage to be adjusted. Noted it can take 3 years for CD to be effective but as pipework is new it will not provide any resistance to CD, so effect may be quicker. Noted taps may need to be removed and cleaned separately.
- Updated on incident with drains in Ward 2A and the need to understand where this is coming from. CCTV survey suggested to rule out blockages. Agreed drains are to be cleaned weekly with CD and mechanical agitation monthly. Shower drains pooling and this is to be investigated. A German product which does a thermal clean of drains and is fitted to the pipework to be researched. There are concerns around scalding and damage to pipework but would elevate the effect of chemicals on seals.
- Group also reviewed progress to date and decisions taken. No guarantee CD will work but water experts, MB, Department of Health and other agencies indicate best option. Other options were Clorus2 but this has not been proven, as CD was, in a healthcare environment. Copper silver and hydrogen peroxide were proven not to work. Shock dosing ruled out after discussion with clinicians due to smell, effects on pipework, and the need to decant hospital.
- Discussion held on work needed in Ward 2A/2B with regard to pipework, drains and ventilation. Agreed taps will not be changed as no suitable alternative. Cause of issues discussed and if it is water, drains, ventilation, combination or simple hand washing. Decant will allow full investigation. Noted that only Haemato-oncology but not BMT patients were affected even though bio-film was found in both areas.

4 Sep

BWSG Meeting

- Noted that TVC guidance is likely to be changed nationally to include GNB testing but this cannot be introduced until this is confirmed.
- Noted that this specifically is an issue for immunocompromised patients and this is why POUFs are currently in place in these high risk areas in RHC in particular.
- BWSG noted it is taking the correct approach as this is based on information received from clinical, water experts and HPS.
- Noted there needs to be careful management of placement of patients in a hospital setting but this is ultimately for clinical decision and determination.

Technical Water Group Timeline for 2018 (October to November)

1 Oct 2018

30 Nov 2018

5, 12, 19 and 26 Oct

- Timescales for CD system are agreed with the contractor. Work will start on 22 October and anticipated that dosing of RHC will begin on 19 November. Anticipated work will be concluded by 21 December at latest, so patients would not be back until January 2019.
- The impact of the work is considered by the group and discussions are held with clinicians to decide when the work involving the installation of the CD system can be done so that it limits the disruption to clinical services.
- A work plan is developed detailing all work to be performed in Wards 2A/2B and to progress procurement of the necessary materials and contractors. Costs of the work are also obtained so that budget can be approved. This also includes alterations to the treatment and prep rooms as discussed by the IMT and also the removal of certain sinks including trough sinks.
- Agreed by group that clinical sinks are to be replaced with ones that have a trap type to prevent material going down the drain. Chosen sink is Contour 21 which is easy to maintain.
- Various different taps for Wards 2A/2B are assessed and discussed by the group and a final decision is taken to fit a tap called Marwick 21.
- Testing of a sample of POUFs is done following two POUF testing positive for rust. Test for integrity is passed and it is unclear where the rust originates from. Agree to check with domestic supervisors that this not due to cleaning issues.
- Reports are received on the survey of the drainage and ventilation system. The report on drains finds nothing of concern that would impact Ward 2A/2B. The ventilation report shows the system does not have as much capacity as initially thought. Currently there is negative pressure in the ward which is not suitable for immunocompromised patients as the pressure needs to be positive. A meeting will be held to review the findings and discuss what options are available to address this issue and what work will be required – this is likely to be extensive.
- Drains were checked and rated for level of contamination by domestic staff. Clinical drains score the worst.

16 Oct

Board Meeting

- Board is advised that a detailed investigation of the water systems in Wards 2A/2B is currently being performed by an expert external company.
- Director of F&E advised that plans to dose the water supply with CD continue and a mobile dosing plant would be installed by the end of the week. There are also plans to remove wash hand basins and taps and to replace the drainage systems which are being taken forward. This work would result in the requirement for extensive flooring repairs and redecorating.
- Board members ask about the frequency of these incidents in similar facilities but are advised that they do not appear to be common.

26 Oct

AICC Meeting

- AICC were updated on the programme for the water dosing being introduced to the QEUH and RHC hospitals.
- Advised that there will be a period where there will be no running water for 4 hours and no hot water for 24 hours.
- Guidance has been written for staff/patients which is currently being reviewed and will be issued once it has been agreed.
- The water dosing of the two hospitals is planned to be completed by 12 Jan 2019.
- AICC advised that F&E will arrange for portable toilets, mobile hand washing sinks and bottled water to be provided to each of the wards in advance of the water being turned off.

28 Nov

BICC Meeting

- Provided with an update of the ongoing work in Ward 2A/2B. A list of remedial actions had been drawn up and this includes changing the clinical taps, lights and flooring - work will be completed in December.
- Advised that ventilation system is also being looked at and the implication for this; discussions are ongoing with clinicians.
- Noted that with regards to CD there is a wider plan to carry this out in the adult hospital on 24 and 27 January, where the water system will need to be shut down.
- Advised that the SG are being kept informed of the work and communications are ongoing.

9, 16 and 23 Nov (note meeting also on 30 Nov but minutes not provided)

- Updates on the installation of the CD system - CD starts to be fed into the system on 12 Nov. It is noted that there are issues with connecting the tanks to the CD system and that existing pipework requires modifications. Incorrect parts were ordered meaning the deadline may extend beyond 29 Nov. A temporary dosing plant is put in place for Wards 2A/2B but there is less control over dosing. Once CD is embedded, water testing can begin. If deadline of 29 Nov is met then whole site will be dosed by 25 Jan 2020. Impact on clinical services continues to be managed and discussed with clinicians.
- Main contractor who built the hospital has been asked to provide certificates for pipework to show this is WRAS approved to give assurance it can cope with CD. Current contractors on site (who previously worked with main contractor) advise that water was in the system for 9 months during construction but no flushing was done. Group advised that while installing CD system in Ward 2A some corrosion of values was noted and could be the reason for metal findings in recent water tests, although noted this is within parameters. Group considered whether these issues could be the cause of the increase in bacteria.
- New shower heads and hoses sent through by PAL (filter manufacturer) are being trialled in staff changing area. Only require one part to be replaced. MBs note that, while effective, once contaminated they become less so. Literature and research is gathered and members asked to comment. Group agree high risk areas should continue with disposable shower heads and hoses but PAL ones could be used for other parts of the hospital depending on trial results.
- Discussion and review of ventilation report highlights problems with pressure and air changes. Air changes were recorded during commissioning but not air pressure. Derrogation was made from 6 to 3 air changes and this applied everywhere apart from BMT areas. Noted that the Project Board did not have the capability to challenge the impact of this change. This was not a deliberate error but was just not picked up. Report also highlights that the dirty and clean extractor fans are connected which means dirty air could be re-circulated, potentially causing the problems with bacteria.
- A variety of solutions to address the recommendation made in the ventilation report are discussed but none are thought to be a viable solution. A ventilation specialist is to be engaged to complete a design feasibility study but this will delay the move back to Wards 2A/2B. Clinicians are advised that it may be end of Jan/beginning of Feb before patients can move back.

Technical Water Group Timeline for 2018 (December)

1 Dec 2018

ACGC Meeting

- ACGF are advised that investigation into the water issue in Ward 2A has uncovered a ventilation issue which will require significant infrastructure change and will prolong the current decant arrangements.

10 Dec

4 Dec

BWSG Meeting

- A sector update noted disposable shower heads are being considered for the QEUH campus.
- Update also noted there was an increase in the incoming water temperature to above what is acceptable over the summer period which has been flagged to HFS.
- QEUH has dump valves with an associated cost to dump water.
- The minutes note that water expert Suzanne Lee had advised that biocide could be utilised to sanitise the water as there is difficulty in cooling the water temperature, which HFS are also aware of.
- Noted a discussion is required with HFS and HPS to resolve this issue as it is not Board Policy to install cooling equipment at the water inlet.
- Discussion required with IPC colleagues regarding impact on patient safety.

- Further updates are provided on work plan for Wards 2A/2B and noted that work is progressing.
- First set of water samples retuned with good results. No legionella returned and all results are within parameters. Samples were taken from tank room, sentinel points at start and end of ward, and shower points. The Group agreed that this would indicate that the taps have held the bio-film.
- The Group noted that tests later in the month from 13 Dec are clear but indicate fungi, though not in Wards 2A/2B. Noted this appears to have increased from first samples but also noted that fungi are difficult to overcome and CD would take longer to take effect. Also noted increase may be due to CD breaking the bio-film down and ICD to be asked for their opinion. Group agreed to not have a “knee jerk” reaction to this result as data was still being gathered but it should be recorded that an increase had occurred.
- Testing to be extended to whole of hospital to get a baseline to compare to once CD dosing commences throughout campus. Labs would not be able to cope over Christmas with additional samples so this would be commenced but suspended over the Christmas break.
- Noted that more flushing has been performed to get the CD through and for it to penetrate.
- Dosing of the water tanks begins this month with further dosing to be carried out in January. Go live date for whole system is now 4 Feb 2019.
- Decision taken not to fit new taps in Wards 2A/2B until 3 consecutive water results are negative and would be left until after the holiday period.
- Scope of work is being progressed for the ventilation specialist. It is noted that there are challenges in the size of the duct work that need to be overcome for any alterations that may be needed.

10 and 20 Dec

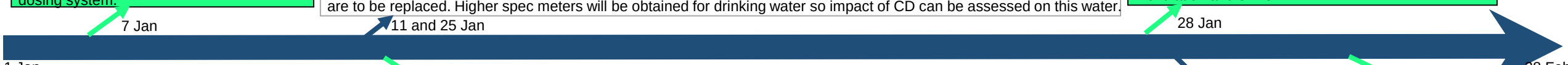
11 Dec

CCGC Meeting

- Advised CCGC that installation of the CD system to dose the water supply is now complete. An additional 12 localised dosing sites were also being installed in the next few weeks and work would be completed by January 2019.
- Ongoing reviews of the efficacy of the dosing would be undertaken.
- HIS, HFS and external advisors continue to investigate the cause of the contamination.
- CCGC advised that an extensive replacement programme was being undertaken including replacement of basins, taps, drainage outlets, with additional work being done to replace the flooring, décor, entry systems, lighting and ventilation. Work was required to replace one of the air handling units which would mean that the ward would be out of use for some months.
- Committee members raised questions about the original design of the facility. CCGC were advised that work was underway to consider all of the identified issues across the site in relation to the original specification requirements for the building.

31 Dec 2018

Technical Water Group Timeline for 2019 (January to February)



1 Jan 2019

AICC Meeting

- AICC advised that upgrading of the ventilation system in Ward 2A is required to bring the system up to the standard required for these patients
- Advised that the work will take 12 months to complete.
- Patients are to remain in the adult hospital in Ward 6A while the work is being performed.
- AICC advised that there had been no cases associated with water since the ward moved to the adult hospital.
- Clinicians noted that the communication from F&E had been really good and no issues were reported when wards were without water during transition to the water dosing system.

7 Jan

ACGC Meeting

- Sector update advises that water and ventilation issues found in Ward 2A will now take up to 12 months to address.
- Sector also advises that to address the ongoing water quality issues at QEUH and RHC, chlorine dioxide dosing will commence in December/January to bring the system under control and allow removal of filters which were a short term control measure only.

14 Jan

- Update on work plan for Ward 2A/2B was given. CD run through RHC system since 22 Nov and by end of Jan work is complete with 4 CD units in place for hot and cold water systems.
- Water results for Ward 2A/2B show some out of spec, some very low level counts which is acceptable, some fungal counts and 4 CU counts. Pre CD results were much higher. One consultant room in Ward 2B and treatment rooms show higher counts. The latter is being modified and sanitised. Playroom wash hand basin and sink show positive on cold water. Agreed to address issues, retest and if still an issue CD level will be increased. If fungi levels are acceptable new taps can be fitted. When taps are fitted they all leak which is resolved by adjusting the connection. Tap must also be aligned manually to prevent a splash risk but noted it could still be easily knocked and create this risk. These issues are taken up with manufacturer. Ventilation review is postponed as ward is used for low risk patients due to winter pressures.
- Discovery that Slop sinks used to dispose of clinical waste have flexible hoses which is against guidance. These are all over hospital and ICT had advised not to use them. Group will talk to nursing staff to ask if used. If so, they will be included in flushing regime and if not, they will be removed.
- CD is now embedded in RHC and cold water system for rest of campus and will next be introduced into the hot water system.
- Noted that across campus, 240 water samples were taken with only 30 showing issues. Both hot and cold systems tested to indicate where issues are and allow these to be targeted. Monthly samples being taken but will increase to weekly when system fully up and running.
- Water meters are corroding (prior to introduction of CD). Manufacturer to be asked about this before deciding if they are to be replaced. Higher spec meters will be obtained for drinking water so impact of CD can be assessed on this water.

11 and 25 Jan

- CD is introduced into the hot water system and monitoring system goes live. All work will be completed by 15 Mar.
- At start of month, out of a total of 142 water tests, only 12 were positive for fungal yeast. These have gone for typing. Later in the month good results are being seen but there are 3 legionella results which may be due to bio-film being removed. Decided resampling of the area is to be conducted, test area is to be extended to ensure it's not further afield, taps and shower heads are removed and tested, as are rooms on either side. Both hot and cold outlets are tested.
- Tender process for ventilation has recommenced and review identified one preferred bidder. Purchase order being raised and tender and design phase will take 3 to 4 months to complete.
- Issues identified with taps last month were discussed with manufacturer. The leak is due to a production fault and being addressed. The movement of the tap is thought to be due to a stress or corrosion crack through incorrect fitting. Manufacture is attaching a locking mechanism to the tap and providing training on installation and working with tap.
- A TVC protocol document is agreed setting out when POUFs could be removed. This would be after 4 week of consecutive clear tests, then moving to monthly and then quarterly for 3 consecutive acceptable results to confirm control values are maintained long term. Noted that getting below thresholds may not happen and may need to accept results are as good as can get. Monthly checks will remain in the high risks areas for Legionella and Pseudomonas.
- Communication and protocol for reporting little used outlets is developed and shared with nursing staff to ensure such outlets are reported and actioned, and not left. This includes escalation if report is made to senior nurses and F&E but no response is received. To be ratified by Board Water Safety Group.
- Manufacturer confirms water meters will be affected by CD and should be removed when system is sanitised. Not practicable with continual dosing. Guidance from HPS being sought.
- Following a review of the options for shower heads and hoses, conclusion is hose is the issue and none on market are better than replacing a hose on a regular basis. With CD in place, Group agreed that replacement can be reduced to 3 times a year instead of every 43 days but in high risk areas this remains at 62 days.

8 and 22 Feb

BICC Meeting

- Advised there is bacteria in the water system in RHC but there have been no water related cases since September 2018.
- Following advice from HPS, HFS and national water experts a CD system had been installed in RHC and will be completed in QEUH by end of March 2019.
- Chair of the TWG advised that the group will not be stood down until TVCs are at an acceptable level but the results appear to be better than anticipated and the TWG continue to meet fortnightly.
- One clinician notes there is debate about the number of sinks that need to be changed and is concerned regarding the implications for patients. The ICD advises that there is agreement to reduce the number of sinks and remove the trough sinks but there will still be sinks available.
- Noted that a meeting will be arranged with senior clinicians and TWG to discuss the plans regarding the ventilation and sinks.

28 Jan

South and Clyde Sector Water Group (SCSWG)

- Noted that written scheme is being updated to reflect the installation of the CD plant.
- Confirmed to group that both the QEUH and RHC are both receiving CD dosing with good positive results.
- Group noted that installation of the CD will make a good impact on quality if correct dosage is utilised.

25 Feb

28 Feb 2019

Technical Water Group Timeline for 2019 (March to April)

- Remedial work has been completed to address the Legionella results from Feb and test results are clear. The Feb 2019 results showed Ward 2A had CU in certain rooms. This ward has received the most exposure to CD but Is the only one showing CU. CD dosage to be increased for this area. Noted that if this does not solve issue then further works will be required to look at potential engineering issues.
- Report on water meters shows that paintwork on cases is unevenly applied and affected by water with damage caused prior to CD implementation - it does not meet healthcare quality requirements. Report to be sent to HFS who advise consulting WRAS to see if approval process covers paintwork. WRAS confirms testing does not cover coatings and paint coverings. NHS GGC to request HPS to update national guidance on this basis.
- The CD installation will be completed this month with only 6 hot water systems still to go live.
- Ventilation tender has been awarded and a pre-start meeting is held this month to discuss feasibility works. The full design and feasibility work will take 4 months and construction work will be phased over 6 months.
- Slop hoppers found to be in dirty utilities and not used for disposable waste. Hopper to be disconnected, capped and sanitised, then covered to make a work surface – where these are not used.
- Water results for March show only one sample has Legionella count of over 200 counts. This area was serviced and sanitised and results are awaited. Group agreed to sample a few rooms either side and check pipework to determine if testing was required as far as the pipework runs.
- Complaints received about odour and taste of water. Noted this may be due to bio-film breakdown which can cause odour and taste issues for short 24-48 hour period. Investigate to see if test can be carried out to determine.
- Second report in connection with tap connection failure notes that a chemical reaction with ammonium compound may have caused the failure. This chemical had been used many times before to disinfect but manufacturer will propose an alternative.

8 and 29 Mar

1 Mar 2019

12 Mar

AICC Meeting

- Update that CD installation is scheduled for completion by end of Mar 2019 and will service both QEUH and RHC.
- F&E staff continue to undertake drain cleaning arrangements with areas specified by IPCT colleagues.
- Domestic service staff will perform flushing as part of their duties and a SOP has been developed and will be implemented to inform domestic staff on how flushing is performed.
- Water coolers/dispensers are being removed from high risk areas across NHS GGC.

18 Mar

ACGC Meeting

- Now confirmed that the the water and ventilation issues found in Ward 2A will take up to 12 months to address.

25 Mar

BICC Meeting

- ICD reported that the taps and sinks in Ward 2A/B were changed and the filters will be kept on long term in the Haematology unit as fungi was identified there.
- ICD also advised that low levels of Legionella were picked up but levels are not clinically significant.
- ICD also advised that discussions are underway to determine if the taps should be removed from other critical care areas.

8 Apr

BCGF Meeting

- Forum noted that installation of a continuous (low level) chlorine dioxide water treatment system had been completed in the QEUH and RHC.
- Forum noted that results have been extremely encouraging with no cases of bacteraemia associated with water in RHC since September 2018.

16 Apr

Board Meeting

- The report provided an update on the water and ventilation system at QEUH and RHC, and MD noted that installation of a continuous (low level) chlorine dioxide water treatment system was now complete and there had been no cases of bacteraemia associated with water since September 2018.

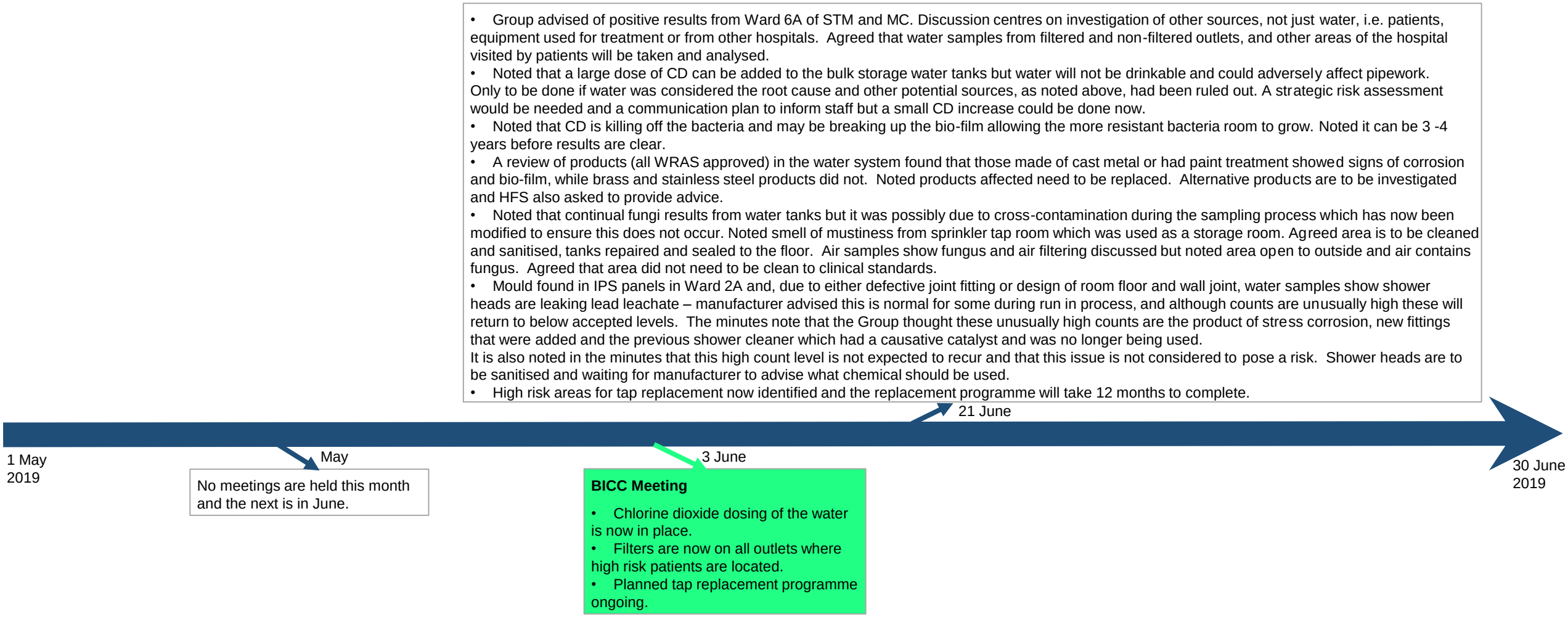
MD also advised that over 800 air samples had been taken in relation to Cryptococcus neoformans, however Cryptococcus had not been identified in air sampling since the end of January 2019. Air sampling continued and no incidence of infections had been identified since December 2018.

11 and 26 Apr

- Work is completed on the CD installation and snagging list is also addressed by the end of this month.
- Water tests for March show 16 fungal results but agree CD will eradicate these over time. High TVC counts recorded in the Acute Receiving Unit (ARU) which will be investigated. Feb E.coli results were in the porters' rest room and pipework was reconfigured to remove dead legs and 5 little used outlets.
- General results for RHC are good apart from certain areas in Ward 2A - Hospital at Night (HaN) tested positive for EC in cold water system and TCT rooms 3 and 6 routinely record fungi counts and Cuprividus Pauculis, respectively. Noted 2 water coolers, dead legs and a little used wash hand basin in HaN room were removed and automatic flushing of outlets was installed. Pipework configuration will be examined if followed by a high level CD treatment programme and resampling of whole area. If this does not work then further investigations will be required to see if this is an engineering problem.
- Complaints from staff about removal of all water dispensers – a preventative measure taken by the BWSG. Staff do not believe assurances that water is safe to drink. Matter to be raised at next BSWG.
- Noted that other products are in the water system that have the same coating as water meters. Given the concerns raised, a sample of these will be tested to assess condition and impact on water quality.
- Water meters designed to monitor and automatically dose the water based on volume are found to be underdosing the water system. Other sensors are still to be installed which may resolve this issue. Replacement of water meters would involve additional cost and shut down of the system and require senior management approval. Group agreed to defer decision until other sensors are in place.
- Group decided that they will meet monthly from now on and technical advisers will attend quarterly.
- Discussion held on replacement taps for all high risk areas given issues found in Ward 2A.
- Selection of taps for high risk areas is reviewed given issues found in Ward 2A. Agreed that Marwick 21 is still the tap of choice as it is fitted with a copper lined open orifice bio-guard antimicrobial flow straightener.

30 Apr 2019

Technical Water Group Timeline for 2019 (May to June)



Technical Water Group Timeline for 2019 (July to August)

- At the previous month's meeting it was decided that the sprinkler water system on the helipad should be treated with CD but manufacturer information reveals this cannot be used with aluminium which houses the system. A SOP is to be developed to ensure there is sufficient turn over of the water in this system. The firefighting water tank can have CD treatment but clarification on the dose is being sought.
- DMA are commissioned to carry out a survey of the products in the water system that are cast iron or have paint treatment but no replacement is to be carried out. Noted that only able to survey accessible products but it will help to develop a plan for replacement and what would be involved.
- The work to address the mould in the water tank has been carried out but a visit yesterday found that there was standing water and hoses left on the floor. The room will be checked and a message relayed to those using the room that it should be left in a clean and tidy state.
- Following the reports of STM in Ward 6A in April/May, a sweep of tests were performed on outlets but the results from these are all negative.
- Weekly testing will commence from first week in August as the CD is now embedded into the domestic hot water supply. Commencement of weekly testing is dependent on the "residual" values reaching a certain level across all water systems. These "residuals" are the elements such as bacteria and particles being extracted from water.
- The automatic flushing has been stopped in Ward 2A as this is thought to have exacerbated the mould found in the IPS panel. Investigation being carried out in other areas of the hospital to check if this is just located in 2A or further afield.
- Following installation of sensors, the issue with water meters under-dosing the system is resolved.
- Noted tap replacement in 12 high risk areas will take 2 months to complete.

BICC Meeting

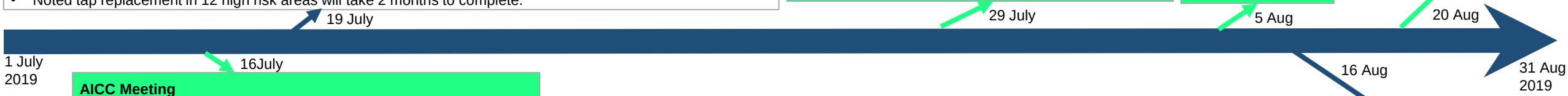
- BICC advised that after positive pre filter water results being returned for Ward 6A, the CD dose to the water supply was increased but remains within WHO standards.
- A shock dose treatment to Ward 6A water is being considered but post water results are negative.
- Current samples taken on 8 July are looking specifically for Mycobacterium but results will not be available until mid August.
- BICC advised that one theory as to why Mycobacterium is showing up is that it is resistant to chlorine and with the introduction of CD has eliminated other types of organisms which is allowing more unusual types of bacteria to grow.
- TWG to work with IPCT and Public Health Consultant to research public literature to see what advice and guidance is available.

ACGC Meeting

- Advised that the estimated completion date for the work to address the water and ventilation issues on Wards 2A/2B is now March 2020.

Board Meeting

- Following a briefing on the incidence of unusual GNB being found on Ward 6A Board members ask how long children would be accommodated in ward 6A. The Director of F&E advised that while Wards 2A/2B were being renovated patients would remain in Ward 6A. The work on Wards 2A/2B is expected to be completed by March 2020.



AICC Meeting

- AICC informed that the QEUH chlorination system is fully fitted and there have been good results. Gram negative count has reduced significantly, however the mycobacteria issue has recently appeared and is resistant to chlorine at the original used levels. It is noted that the increase in mycobacteria may be due to existing bio-film or it is being selected out and proliferating because it is resistant to chlorine.
- AICC are advised that the initial step is a slight increase in the chlorine levels, and that the level is still within the WHO guidelines. AICC are advised that if this measure is not successful then shock dosing may be considered but this would have a significant impact on all clinical areas (water would have to be closed down for a period of time).
- The Water Technical Group continues to meet and support the QEUH.
- The Board also continue to have international water experts on retainer for advice as required.
- The issue of bottled water coolers has been discussed at the BSWG and there is a current National Directive that all bottled water coolers, irrespective of location, should be removed. This will be discussed at the next BWSG meeting.

- SOPs for sprinkler and helipad firefighting water tanks have been drafted and further information is awaited on the dose of CD to be applied to the latter. A CD dosing apparatus will not be installed for these tanks due to cost and ongoing maintenance requirements. Manual dosing will be performed.
- External contractor appointed to perform tap replacement and a survey was performed for establish the scope of work and approximate costing - this will be provided next week.
- Water tank room now in good order. The new CD apparatus has an ongoing leak making the floor wet. Leak is being managed on an ongoing basis until principle contractor has remedied the defect.
- Group advised that there was MC in the water and whether the CD should be increased further was discussed. Dose currently 0.5 ppm and increase to 0.7 ppm suggested. Noted by one member this was unlikely to have a major effect based on literature read and dose of 1.2ppm should be considered. Group considered this not feasible given engineering challenges and potential impact on services.
- Testing showed positive results for Ps and coliforms from the main water tank room. Two filtered water tanks and an outlet downstream of the tanks in the children's OPD on ground floor were sampled and have been submitted to lab. Noted that water sampling is identifying consistent activity for mould and yeast which have been sent for typing. Noted that where counts are low this is often due to dirty taps or sampling errors. Need to know coliform counters and results of nearby outlets upstream and downstream, and results following disinfection and resampling. The ongoing issues in the basement plant room in terms of yeast and mould need to be further investigated, including broadening of the scope to include air sampling.
- Noted that issues with mould identified in Ward 2A are only in this area and not further afield. Work to be added to ventilation upgrade project.

Technical Water Group Timeline for 2019 (September to October)

1 Sep 2019

13 Sep

- SOP for sprinkler system and fire tanks now completed as CD for fire tanks has been provided by manufacturer. DMA are currently draining and flushing these tanks so they do not become a little used outlet.
- Basement tank is found to be leaking and repairs are instigated.
- Discussion on whether air quality testing should be performed in tank rooms and areas outside as this would indicate if any mould spores are in the humid air. After further discussion it was decided this instruction would have to come from an IC representation and this decision would be taken outside of the meeting.
- A review of sample results of failures showed there was an increase initially but then a steady decrease over the following weeks. These results are only showing yeast and moulds – initially results had shown coliforms and E.coli, but no Legionella or Psuedomonas had ever been found. The group discussed the possible environmental impact as it was noted the results had been higher during a period of wet weather. Thought that a look back might reveal increases during wet periods of weather and lesser numbers or none during warm weather.
- Cost of tap replacement is £3m which includes replacement of sinks, reduction of pipework and replacement of taps and IPS panels, including any additional work required. The decision to progress has not yet been made and there is likely to be a phased implementation. Taps will be replaced with Marwick - although issues have been noted with these taps in other areas, it removes the Optitherm taps which giving cause for concern in other areas.
- Showers in Ward 2A are now being manually flushed and funding is available to remove and resolve the mould issue within this ward. Will investigate market to obtain options to resolve this issue.
- Noted that some rooms in Ward 2A had high humidity at 15% (12% is the accepted limit).
- Agreed that water sampling would stop in Ward 2A as there are no patients and flushing of system is continuing. Testing will be recommenced once work is completed and patients are due to return to the ward.

2 Sep

AICC Meeting

- Advised that further sampling for Mycobacteria had been carried out across QEUH to find out how widespread the issue is and the results are expected within 4-6 weeks.
- The dosage applied to the water supply for Wards 2A/2B is to be increased from 0.5ppm to 0.7ppm - this is to be monitored for a period of time to review its impact on water results.
- The increase is within the WHO guidelines and has been approved by the TWG and IMT.
- The TWG continues to meet, support the QEUH and continue to have international water experts on retainer for advice as required.

25 Oct

- Tests of flow straighteners for last 3 months show no Ps or bio-film. Conclusion is that CD is keeping these clean but this needs to be confirmed by experts. Agreed periodic testing should continue as agreed to allow any changes to be noted quickly and actioned. Agreed to re-run test and previous results are to be reviewed by the expert group.
- Testing of basement tanks post filter shows Delftia in one tank and room. One Ps found in the drain points and TVCs are showing in raw water tank but only in certain lines. Noted that room has high level of humidity and musty smell. Air sampling to be done in the room and corridor to see if any spore counts and justify a dehumidifier being installed.
- Out of 142 samples from campus only one shows bacteria. Noted that samples over the last couple of months are clearer and clearer. However minutes also note a minor TVC and one coliform was found. The DSR and dirty utilities had positive results (agreed that this is not surprising) and adult first floor critical treatment room recorded a repeat coliform failure and high TVCs which need to be investigated.
- View of Scottish Water around coliform failures in August and September is that, based on the pattern of results, this is due to either tap hygiene or lab issue, but probably a sampling issue. Advised length of flushing time should be increased given the size of campus. Offered to review NHS GGC SOP and carry out observation of practice for water sampling - this was agreed as a good way forward.
- Meeting discusses what information IMTs want from this group and it was agreed that the following was needed:
  - Visibility of any current positive water samples;
  - Local water groups are to discuss any issues with IC and F&E are to be present at these meetings;
  - Any positive results are to be reported to IC and patient pathways followed to identify any issues;
  - Written statement of process to be followed when positive results found (currently only for Legionella and Ps);
  - Agree to carry out more than usual sampling on QEUH and this would include yeast and mould samples; and
  - Statement on the water quality and potability and also on status of flow straighteners.

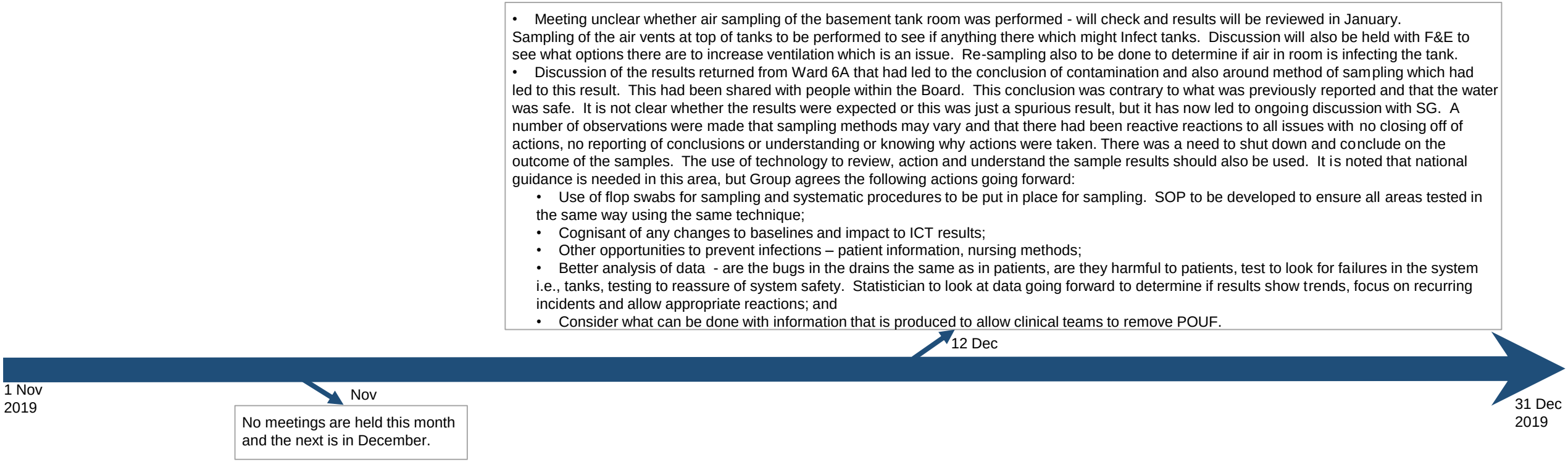
28 Oct

BCGF Meeting

- Advised that the work to address the background water/ventilation issues in Ward 2A/2B is estimated to be completed by March 2020.

31 Oct 2019

Technical Water Group Timeline for 2019 (November to December)



Water Testing Process

F&E has provided further detail on the water testing that is performed and copies of spreadsheets showing the results of tests that have been performed in late 2019 and early 2020.

Testing Process

- F&E advised they maintain a register of the total ongoing sampling that is being conducted at the QEUH on a weekly basis. 142 tests are taken from 71 designated points throughout the QEUH and RHC. Two samples are taken from each designated point such as a tap or shower and an outlet to a drain.
- The results are recorded on a 'sample matrix ' for the QEUH which F&E receive on a regular basis. Any time samples are taken, the matrix is updated by a specialist water consultant. This means the frequency of getting this matrix varies depending on the sample being taken and analysed. This matrix covers the 'full sampling regime' across the Adult and Childrens Hospitals.
- From this sampling grid the operational estates team reviews two specific areas (as required by SHTM04-01) - Legionella and TVCs at a water temperature of 37 and 22 degrees centigrade . If these results are found to be 'out of spec' then the results are uploaded onto a further spreadsheet and actioned accordingly. The spreadsheet lists the sample reference and actions taken to address the out of specification issue.
- All other bacteria found in the samples are reviewed by the ICD and if action is required to be taken then the ICD discusses this with F&E. These other bacteria are:
  - Coliforms
  - LP Sero Group
  - Psuedomonas
  - SAB at a water temperature of 30 and 22 degrees centigrade
  - Cupriavidus
  - AMS
  - Other (which includes GNB)
- Samples of these spreadsheets were provided by F&E. The below spreadsheet covers the period from 7 Jan 2020 to 6 April 2020. The spreadsheet also pulls out into a separate tab those results that are out of specification. A summary of the results is given is in the table below.

Month and Year	Total number of samples	Samples not received	Samples awaiting results	Results returned	Out of spec samples
January 2020	347	-	-	347	14
February 2020	352	2	4	346	21
March 2020	357	-	27	330	3
April 2020	55	-	52	3	0
Total for period 7 Jan to 6 April 2020	**1,111**	**2**	**83**	**1,026**	**39**

- Although 39 samples were out of specification, some samples had counts of more than one type of organism. In total there were 62 organisms classified as follows:

Organism	January	February	March	Total
TVC at 22 degrees centigrade	2	4		6
TVC at 37 degrees centigrade	2	6	-	8
SAB at 22 degrees centigrade	3	4	-	7
SAB at 30 degrees centigrade	6	6	1	13
Psuedomonas	2	9	-	11
Cuprividus	1	3	1	5
Coliforms	2	-	2	4
Enterobacter cloacae	2	-	-	2
Other	-	6	-	6
Total	**20**	**38**	**4**	**62**

- The Other category is made up of a number of GNB organisms which are
  - Aeromonas Media (1)
  - Sphingobium Xenophagum (1)
  - GNB Enviro (1)
  - Delata Acidovorans (2)
  - Chryseobacterium Indologenes (1)
- The sample spreadsheet provided by F&E also shows actions that have been taken in relation to out of spec samples.
- SOP was developed in December 2019 in respect of the sampling that was required to be undertaken and what action should be performed, once the sample matrix is received, around those samples that are out of specification.
- While the overall number of samples that are out of spec seems relatively low, there is a lack of context around these results to allow any meaningful conclusions to be drawn. This highlights the need for a more statistical approach to the analysis of these results to identify trends over a period of time and whether there are "hot spots" within the campus where bacteria is located.
- It is noted in the December 2019 minutes for the TWG that statistical analysis was being proposed and NHS GGC have advised that data has been shared and discussed with HPS and a software company. However, Covid-19 has halted work on the analysis. It is suggested that this work is revived as soon as practicable to ensure that there is a continuing trend downwards in respect of all bacteria across the RHC and QEUH and ensure the CD is adjusted accordingly for "hot spots" identified by such analysis.

Section 9
Heat Map of Infections

Summary Table of Incidents

The following table provides a summary of the incidents which are set out in the timeline which is based on the information sources set out in the Introduction at Section 1. The table brings together in one place the different types of GNB and Fungal organisms that were reported, the month and year they were reported, the ward and number of patients affected. The table aims to show the spread of these incidents across the RHC and QEUH (but only after patients from Ward 2A/2B were transferred) and also the variety of organisms identified. It should be noted that the table does not detail the organisms by strain or typing or whether they were related – the information in this respect was limited in the documentation that was reviewed. The table is therefore not an epidemiological analysis of the incidents which occurred.

Ward/Year	2015	2016	2017	2018	2019
Ward 1E - RHC			AB (Nov) (1)		
Ward 2A – RHC		A (Aug) (1) EM (Sep 2016 to Feb 2017) (3) CU (Feb) (1) NUO (Jul 2016 to Feb 2017) (???)	A (Mar/Apr) (3) STM (Jul) (2) CU (Sep) (1) A (Oct) (1)	STM (Mar) (5) CU (Mar) (1) PsA (Mar) (1) Pan (May) (1) AB (Jun) (2) CU (Jun) (1) GNB (Sep) (5) SM (Sep) (1) Ps (Mar) (2) FG (Mar) (1) EC (Jun) (6) STM (Jun) (9) Ps (Jun) (4) STM (Sep) (1) Ward Closes 26 Sep	
Ward 3A – RHC			AB (Oct) (4)		
Ward 6A - RHC				CN (Dec 2018 – Jan 2019) (2) PsA (Jan) (5) STM (Apr) (1) PanS (May) (1) STM (May) (1) MC (Jun) (1) EC (May/Jun/Aug) (3) PsP (Jul) (8) CH (Aug) (1) EM (Aug) (1) EC (Aug) (1) EA (Aug) (1) Ps (Aug) (1) STM (Aug/Sep) (2) GNB (Sep) (Multiple) AC (Sep) (1) DA (Oct) (1)	
PICU - RHC	PsA (Dec) (2)	AB (Jun) (2) SM (Sep/Oct) (6)	SM (Feb) (?) SM (Mar) (3) Ps (Aug) (2) SM (Oct) (4) AB (Nov) (1)	PsA (Jan) (4) AB (Feb/Apr/May) (6)	AB (Jan/Feb) (2) AB (Apr) (2) PsA (Nov) (3) Ps (Jan/Feb) (2) AB (Nov) (3) AB (Dec) (1) SM (Jan/Feb) (1) SM (Nov/Dec) (2)
Ward not identified			MA (Jul?) (?)		
Theatre 6 - RHC				PsA (Nov) (5)	

Key

(17) – the numbers in brackets are the number of patients that were identified with this organism.

(??) – the number of patients that were identified with this organism is not known

Key for Summary Table of Incidents

Gram Negative Bacteria

- AB - *Acinetobacter baumanii*
- AC - *Achromobacter*
- CH - *Chryseomonas*
- CU - *Cupriavidus*
- DA - *Delftia acidovorans*
- EA - *Enterobacter aeromonas*
- EC - *Enterobacter cloaecae*
- EM - *Elizabethkingia miricola*
- Pan - *Pantoea*
- PanS - *Pantoea septica*
- Ps - *Pseudomonas*
- PsA - *Pseudomonas aeruginosa*
- PsP - *Pseudomonas putida*
- SM - *Serratia marcescens*
- STM - *Stenotrophomonas matophilia*
- GNB - *Gram Negative Bacteria not yet identified*
- NUO - *Numerous unidentified organisms*

Fungal Infections

- A - Aspergillus
- CN - *Cryptococcus neoformans*
- FG - *Fungal Growth*

Gram Positive Bacteria

- MA - *Mycobacteria abscessus*
- MC - *Mycobacteria chelonae*

Summary Table of Incidents

The previous slide provides a pictorial representation of all the incidents contained in the timeline by location, month they occurred, the type of organism involved, and the number of patients that were identified with this organism. It should be noted that this does not represent the total number of patients affected as some patients had more than one organism at any given time.

There are a number of observations that can be drawn from this table and from the narrative within the timeline, as follows:

Development of water contamination hypothesis and timing of incidents

The table shows that the incidents started to appear in 2017 but were more numerous in the subsequent years. Although there appears to be an increase in incidents from 2018 onwards, as already mentioned, NHS GGC advised that this was a direct result of update to the NICPM in June 2017 which resulted in environmental organisms being added as alerts.

It will be noted from the timeline that the hypothesis that the incidents were due to contamination of the water system started to develop in 2018. Actions, such as replacement of taps or removals of basins, were precautionary measures or ones where a definite link had been identified to the tap or wash hand basin, rather than indicating a real concern about the quality of the water.

Some GNBs can originate in water so the development of the hypothesis that water was the source was not an unreasonable one. However, and importantly, while some GNBs are contained throughout the environment and others are contained in the human body, they generally remain harmless and do not affect a normal healthy individual. Those such as haemato-oncology patients are, however, at greater risk from GNBs as their immune system is compromised and, as a result, they are more susceptible to infections from these organisms. Such infections can therefore be obtained either from organisms in the patient's own body or from an external source. NHS GGC have advised that endogenous infections, i.e. from the patient's own flora (body), are very common in patients whose immune system is compromised.

Although the development of the hypothesis around water began in 2018, other avenues of investigation and hypotheses as to the cause were pursued, both at the time and prior to this:

- levels of hand hygiene and ward cleanliness;
- operating practices;
- issues with drains – although it is noted in the timeline that a survey revealed that no issues had been found with the drainage system for either hospital. However, certain MBs/ICDs note the survey did not, and could not, look at issues with drains detected at the back of sinks, such as evidence of corrosion and heavy bio-film and pools of stagnant water;
- issues with ventilation systems and leaking chilled beams (in relation to the fungal incidents);
- investigation of water leaks and ingress – especially in relation to a long standing slow leak in the ward kitchen;
- the work undertaken in respect of line infections (CLABSI work which did lead to a reduction in infection rates); and
- analysis of patient pathways to identify other potential sources of these infections.

Given that some GNBs are contained throughout the environment and others are contained in a patient's own flora and considering the risks in terms of transmission and wider spread of such organisms, it would appear reasonable that these other lines of investigation were pursued as well as those relating to the water supply.

It is noted in the timeline and was ascertained through the HPS/HFS investigation in 2018 that prior to the hospital being handed over there was water testing performed by the main contractor which returned high TVC counts in some locations. These areas were sanitised and retested but it was noted that not all locations passed the second test and HPS noted that the records were not clear as to whether these areas subsequently passed.

IA senior estates manager instructed two members of his team to conduct water sampling following the building being handed over. An interview with one of these staff members revealed that only tests for Legionella were conducted and they and their colleagues had no training in taking water samples. Where positive results were identified these areas were sanitised and retested. Only once three consecutive negative results had been obtained was no further action taken – if positive results were obtained, then further sanitisation was performed.

The HPS report and the findings of water experts engaged in 2018 concluded that contamination was likely to have occurred during the building of the hospitals and it led to the build up of bio-film and consequently the organisms that were seen. The water experts also concluded that the advent of fungal bacteria was the result of temperature fluctuations of water. The temperature is controlled by the Energy Centre and there have been issues with this building since it first opened.

Certain MBs/ICDs have advised that they raised concerns over the water system prior to the hospital opening and then repeatedly since 2017. The review of the information sources used to create the timeline does not contain any record of these concerns being raised, other than the SBAR in September 2017 and again in September 2019. Certain MBs/ICDs advise that these SBARs highlight the importance of ICDs requesting water testing as this is a key measure in the investigating and managing of the incidents included in this timeline. It is noted in the timeline that an action plan was put in place to address the concerns raised in 2017 but the MBs/ICDs advise that this was not agreed with them and it contained inaccuracies and misrepresentations – although this is not noted in any of the various committee or Board minutes.

The report generated by DMA in 2015 should have been a key indicator that there were issues with the water system but this report seems to have been "lost" amongst the host of other issues that were being experienced in both hospitals following handover. The extent of the issues being identified with the hospitals and the level of work still to be completed resulted in this report not being actioned due to the firefighting that was being performed at that time by the F&E team.

It can be seen that the "loss" of the DMA report and the main contractor not informing the project board that there had been high TVC counts noted, resulted in the opportunity to address any issues in the water system being lost. In addition, if the findings in the DMA report had been known at the time together with the concerns raised by certain MBs/ICDs prior to the hospital opening, then the actions taken during the incidents noted in the timeline and the various hypotheses pursued may have been different.

Summary Table of Incidents

NHS GGC advised that the hypothesis around the water system causing the incidents highlighted in the timeline has never been proven and cannot be taken as fact. NHS GGC also advised that the reference laboratory analysed all patient samples from 2018 onwards and linked none of them to the positive water samples. The results of these patient samples have not been provided or reviewed during the course of constructing the timeline.

It should also be acknowledged that the HPS report dated October 2019 entitled "Review of NHSGG&C haemato-oncology data" stated that its review did not provide evidence of a single point of exposure causing the bloodstream infections. However, one of its recommendations was that consideration should be given to the epidemiological characterisation of cases in the context of environmental risks, e.g. water and ventilation testing results.

Certainly the 2015 and 2017 DMA reports and 2018 HPS report and results of the water testing performed by the TWG would indicate that there are, or were, issues with the water system. The tests performed by the TWG showed that contamination was wide spread and there was a build up of bio-film in the system. While this was a key milestone in confirming that there were issues with the water system, it is less clear whether these contributed to or were the cause of the incidents seen in the haemato-oncology population in Wards 2A and 6A.

Location of incidents

The table on page 40 shows that these are predominantly in Ward 2A until 2019 when Ward 6A starts to display the most organisms. It is noted that Ward 6A, prior to accommodating the patients from Ward 2A, was a general adult ward and therefore any incidents which occurred in that ward prior to the transfer have not been reviewed as part of this timeline.

It is noted from a review of the TWG minutes that initial water testing found that there were organisms located throughout both hospitals and this was consequently a widespread problem. The results from the water testing would therefore support the hypothesis around contamination of the water supply. The TWG minutes also record that issues with the ventilation system were also noted in this ward.

It is also noted that PICU had a number of GNB incidents during the period from 2015 to 2019 with 2019 having the most incidents. In this case, however, the type of GNB is much more restricted and is confined to either Ps/PsA, AB or SM bacteria.

Typing of organisms

It is noted throughout the timeline that the organisms were sent for typing to see if the strain of each positive sample was the same, thereby indicating either a common source, or cross transmission. In some cases this would be the same but in many instances these were unique both in terms of the cultures taken from patients but also from those taken from water outlets and drains.

While there may be sound epidemiological reasons for analysing bacteria by unique strain, the focus on this alone seems to have detracted from the investigation of the cause of these bacteria in the first place. It may also have been more helpful to look at the incidents as a whole rather than by individual strain. This was a suggestion made by SG in late 2019 when they advised that NHS GGC should investigate the last 3 incidents together.

This also appears to be advocated by the HPS 2019 report which recommends characterisation of cases in terms of "person" and "place" to support identification of times when there are more cases than normally expected, as well as its recommendation about considering the epidemiological characterisation of cases in the context of environmental risks (such as water and ventilation testing results). While it is important to know whether cross transmission has occurred, it should not detract from the overall question of why and what the cause is of multiple different strains of bacteria. This point is not meant to question, or indeed contradict the need for, the science of determining the type of organisms, but rather it should compliment it.

The need for national guidance

During the time period covered by the timeline there was no apparent guidance available around the management, control and investigation of GNB and water borne organisms. HPS is currently working on such guidance and produced an aide memoire on the "Prevention and management of healthcare water associated infection incidents/outbreaks". Another aide memoire for infections/outbreaks associated with ventilation was also produced. It is noted that both areas are to be covered in a new chapter of the Infection Control Manual but currently the aide memoires are the only guidance available on water and ventilation associated infections/outbreaks. This highlights the lack of expertise available to NHS GGC during the course of 2015 to 2019. Throughout this period NHS GGC drew on the expertise of HFS, HPS, water experts (Sarah Lees and Tom Makin), Public Health in England, and the experience of other health boards in Scotland and England, and even from hospitals abroad. Reviews of available literature were also performed to inform thinking and investigation. It is clear that from 2018 NHS GGC were seeking outside assistance in trying to resolve the issues they were facing.

The minutes of the TWG on 11 May 2018 record that one water expert noted that there are issues with new build hospitals and the method of their construction. These buildings are hermetically sealed and many are now showing water issues never previously seen in hospital buildings. On this basis it would seem clear that a further level of expertise is required to deal with such incidences and further guidance is needed.

The question arises as to whether further national research is required into these bacteria and how they develop and are transmitted in such environments, including both water and ventilation systems, particularly in new build hospitals. It is also necessary to know how these organisms should be monitored and, if detected, what appropriate action should be taken. The NIPCM is currently being extended to cover more organisms but it has not yet been issued and it is not clear whether it will take account of the experiences and actions taken by other new build hospitals in dealing with similar issues. Certainly the experience and lessons learned by NHS GGC from these incidents should be captured and inform the guidance to be issued by HPS.

In addition, the knowledge and experience related to these incidents gained by IPCT, MBs, LICD, ICDs and F&E staff at NHS GGC should not be lost. It is important to ensure that this knowledge and experience is retained and capitalised on. To that end consideration should be given to setting up an expert group that includes ICD and F&E staff so that, if further incidents occur at the RHC or QEUH for this patient cohort, they are referred to this group for investigation as the knowledge and expertise they have already gained can be utilised. This should quicken the process of investigation as the group will have a better idea of what to look for and what to consider in these circumstances.