



Water, sanitation and hygiene in health care facilities

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**St Mary Ward House,
5-7 Tavistock Place,
London, United Kingdom**

**Global strategy, burden of disease, and evidence and action
priorities**

WORKSHOP REPORT

Table of Contents

Summary and key outcomes.....	3
Background	5
Workshop 1: Burden of Disease.....	6
Workshop 2: Evidence to support change	10
Workshop 3: Global strategic review and planning.....	13
Closing remarks	17

List of Appendices

Appendix 1: Agendas.....	18
Appendix 2: List of meeting participants	22
Appendix 3: Background report on global WASH in Health Care Facilities activities	25
Appendix 4: Summary of WASH and health care associated infections.....	35
Appendix 5: Review of care seeking behaviour and WASH services in health care facilities.....	56
Appendix 6: Low-cost assays for microbiological monitoring	75

Abbreviations

AMR	Antimicrobial resistance
BOD	Burden of disease
DALY	Disability-adjusted life year
EMEC	Every Mother, Every Child
HCAI	Health care associated infections
HIC	High-income country
HMIS	Health management information systems
IPC	Infection prevention and control
LMIC	Low- and middle-income country
LSHTM	London School of Hygiene and Tropical Medicine
NGO	Non-governmental organization
ROI	Return on investment
SDG	Sustainable Development Goal
SHARE	Sanitation and Hygiene Applied Research for Equity
SSI	Surgical site infection
UEA	University of East Anglia
UHC	Universal health coverage
UNICEF	United Nations' International Childrens' Fund
WASH	Water, sanitation and hygiene
WHO	World Health Organization

1. Summary and key outcomes

A series of three workshops on water, sanitation and hygiene (WASH) in health care facilities was convened by the World Health Organization (WHO), the United Nations Children's Fund (UNICEF) and Sanitation and Hygiene Applied Research for Equity consortium (SHARE), a programme at the London School of Hygiene and Tropical Medicine, from 21st to 24th March 2016 in London. The purpose of the workshops was to reflect on progress achieved over the past year (since the last global meeting in Geneva in March 2015) and strategize on how to maximize efforts, formulate the basis for developing a burden of disease framework associated with WASH in health care facilities, and update the global action plan accordingly. The meeting brought together approximately 50 stakeholders including WHO and UNICEF technical staff, health specialists (infection prevention and control, maternal and child health, universal health coverage), policy-makers, WASH experts and implementers, researchers and donors.

This report documents the meeting discussions and outcomes. Appendices to this report include: meeting agendas (Appendix 1), list of participants (Appendix 2), background report (Appendix 3), summary report of WASH and health care associated infections (Appendix 4), review of care-seeking behaviour (Appendix 5) and low-cost assays for microbiological monitoring (Appendix 6). The following section summarizes the main outcomes from the three workshops: key messages, next steps and commitments.

Key themes and consensus topics

The key themes and discussion topics included:

- **WASH is health.** WASH in health care facilities is critical many health areas including safe and resilient health systems, maternal, newborn and child health, infection prevention and control and antimicrobial resistance. Since the global meeting in 2015, progress has been made in engaging and catalysing the health sector to address this issue, but further efforts are needed to truly embed WASH within health, rather than it being an isolated issue. This must be achieved with a range of actors including technical, academic, donor, private sector and government stakeholders.
- **Accountability mechanisms and effective incentives are essential.** Strengthening existing health accountability systems is critical for ensuring WASH services are monitored. There needs to be incentives to encourage facilities, (including staff and managers), policy makers and leaders to take action. Hospitals and district administrators and managers have an important role to play and more needs to be done to engage with this stakeholder group.
- **Existing evidence needs to be systematically documented and reported; more evidence is needed on health impacts, and service delivery solutions.** Conducting a burden of disease on WASH in health care facilities is a priority and will support advocacy and awareness raising efforts. In addition, health researchers should be supported to include WASH aspects in field studies on care seeking, quality of care, and health impacts, especially relating to newborn and maternal health. Finally, an operational research focus is needed, especially on how to make and sustain WASH improvements.
- **Lessons learned from within the WASH sector should be examined and utilized.** The WASH sector has important tools and approaches that could be useful in the health care setting, including how to engage with and work across sectors (WASH in schools), examining costs and benefits, creating an enabling environment and supporting sustainable services.
- **Identifying and addressing major bottlenecks to strengthening policy, financing, accountability and delivery of WASH services is important to catalysing change.** Systematic assessments of bottlenecks and solutions at all levels (global, national, district, facility) are required to understand system- related challenges and how they can be overcome.

- **Greater engagement of communities.** Engaging and learning from local communities will provide opportunities to improve WASH services as well as address specific areas such as hygiene behaviour change.
- **Focusing on solutions.** “How to” solutions should be documented and shared to demonstrate proof of concept and support progress at all levels. This necessitates more operational research which is linked directly to fit-for-purpose advocacy materials and guidelines.
- **Cost assessments are needed to quantify the burden of lack of WASH services and encourage greater investments.** Inadequate WASH services have cost implications, not only on health care associated infections, but on the efficiency of care, care seeking, quality of care and retention of health care staff. Quantifying these cost implications will assist decision makers in better allocation of resources for WASH in health care facilities and generate savings within the health systems in the medium and long-term.

Next steps by global task teams

The four global task teams (established after the 2015 global meeting) agreed to undertake the following activities:

Advocacy: continue working with and supporting advocacy work with health actors, develop material that support national advocacy activities, promote WASH standards, and help campaign for better WASH services, through joint targeted activities with stakeholders.

Monitoring: finalise a set of harmonized indicators, implement and report back on their use in existing and new tools, surveys and health monitoring information systems (HMIS).

Research: conduct a burden of disease analysis and systematic reviews on health impacts of poor WASH in health care facilities, conduct costing analyses, undertake qualitative research on hygiene behaviour change, and perform an evaluation of tools and training. In relation to the burden of disease workshop specifically, participants agreed to contribute to systematic reviews and the development of protocols, models and papers as well as link with health initiatives in their respective fields to highlight the importance of this topic and area.

Facility improvements: revise Water and Sanitation for Health Facility Improvement Tool (WASH FIT), review technology options and associated costs, make suggestions for appropriate training and education approaches and review innovative financing options.

Commitments to drive action

To support these activities, the following commitments were made by partners:

- WHO to continue to work towards embedding WASH within health efforts, provide additional human resource support for AFRO, develop a support package for governments on addressing WASH in health care facilities, facilitate the burden of disease process and support the development of the new WHO health systems’ (quality and UHC) learning pod on WASH.
- WHO and UNICEF with support from partners will host a global learning event in India in November 2016 to capture, share and inspire the application of solutions to improve WASH in health care facilities.
- UNICEF will hire a new staff member focusing on institutional WASH and will produce an internal note on WASH for use within the quality of care work under their Every Mother Every Newborn initiative.
- SHARE/LSHTM will undertake a systematic review of WASH and health care associated infections and lead on the development of a burden of disease analysis.

- WaterAid with support from WHO will organize an event at the 69th World Health Assembly and a learning event at the WASH Futures conference in Brisbane, May 2016 and continue to contribute to each of the task teams through their program and policy experience on WASH in HCF.
- Infection Control Africa Network to support joint IPC and WASH training and education efforts and awareness raising at the national and facility level.
- University of North Carolina-Chapel Hill to continue to support national monitoring efforts and data syntheses and to contribute to research efforts.
- Governments, academia, NGOs, donors to work within their own institutions and health counterparts to realize the WASH in health care facilities vision.
- All partners to get involved in task team work and activities and to promote, advocate, encourage and inspire others.

All presentations from the meeting and a meeting report will be shared on the www.washinhcf.org knowledge portal¹. In addition, a work plan for 2016-2017 with a timeline and deliverables will be updated and shared.

2. Background

2.1. Basis of the meeting and objectives

Initial discussions on this topic took place during a global strategic meeting hosted by the Spanish Government and facilitated by WHO and UNICEF in April 2014². At that meeting, key challenges of WASH in health care facilities were discussed and it was agreed that work would focus on the following areas: national policies, targets and standards, monitoring, implementation and advocacy. In order to assess progress and develop a global action plan, WHO and UNICEF convened a second global meeting in Geneva in March 2015³. At the Geneva meeting a global action plan was drafted which includes five key change objectives to guide the realization of the long-term vision (to provide universal access to quality WASH services by 2030). Four task teams (comprised of health and WASH specialists) were established to address the change objectives, refine tasks and deliverables to demonstrate immediate progress and establish the foundation for longer-term change. The four task teams are: Advocacy; Monitoring; Research and Evidence; and Standards and Facility-based Improvements.

To follow on from these meetings, a targeted international meeting was convened. The meeting took place over three and half days (21st to 24th March 2016) and was comprised of three parts. Firstly, one and half days were devoted to developing and advancing a framework to estimate the burden of disease associated with inadequate WASH in health care facilities. Secondly, a more general, one day research meeting was held to discuss and prioritize operational research areas, including hygiene behaviour change, sustaining improvements, cost analyses and links with quality of care initiatives in health care facilities. Finally, one day was dedicated to reflecting on global progress and strategizing on the way forward.

The specific objectives of the meeting were three-fold:

- To develop the basis for estimating the burden of disease associated with inadequate WASH in health care facilities, including a modelling framework and assumptions;
- To present latest evidence on WASH in health care facilities especially concerning maternal and newborn health, health care associated infections, Universal Health Coverage and antimicrobial resistance and prioritize a research agenda;

¹ The website is currently being translated into French and will be ready in early May 2016.

² WHO/UNICEF, 2014. WASH in health care facilities global meeting. April 2014.

³ WHO/UNICEF, 2015. WASH in health care facilities global meeting. March 2015.

- To reflect on global progress and the work of the four task teams within specific regions and countries, consider resource needs and how to further embed efforts within the health sector, including quality of care initiatives.

3. Workshop 1: Burden of Disease

The objectives of the burden of disease (BOD) workshop were to discuss the evidence on BOD related to poor WASH in health care facilities and to develop a conceptual framework with which to carry out additional analyses. The aim was to generate parameters for modelling, decide some key assumptions and create a timeline of work.

3.1. Setting the scene: realities on the ground

During this session, representatives from four countries presented case studies on some of the practical challenges of WASH in health care facilities. Presentations were from Sudan, Liberia, Tanzania and Senegal.

Dr May Gamar Elabnya (National Infection Control Program, Sudan)

May Osman presented a case study from two hospitals in Khartoum. She described a number of problems, including an unreliable water supply with little or no water quality testing, a lack of hand washing facilities which typically suffered from a poor water supply, no procedures for waste management and limited treatment technologies (i.e. incinerators), and that vector control and environmental management inside the facility is largely ignored (i.e. after heavy rain, large amounts of standing water collect next to the waiting areas). Malaria and sepsis account for a significant proportion of the disease burden.

Dr J. Moses Soka (Ministry of Health, Liberia)

Moses Soka described his work at Redemption Hospital in Monrovia, the only hospital providing free services in Liberia. He explained that currently there are no health care facilities in Liberia which meet the minimum standards for WASH. There is a lack of power which prevents the hospital from pumping water, resulting in limited water supply. The main water supply is poorly located and many of the taps are non-functional. There are also concerns over waste management practices as bins are frequently overflowing and staff are inadequately trained and lack competence, which he attributed to high staff turnover. In addition, financing WASH in facilities can be a challenge, resulting in a trade-off based on the assessment of need; for example balancing the cost of fuel for incinerators or for generators to ensure power for lighting or medical devices. He finished by highlighting the uncertainty of who could, or should, pay for hygienists and cleaners after funding from aid organisations runs out.

Dr Hamisi Malebo (Ministry of Health, Tanzania)

Hamisi Malebo described the status of WASH in 96 health care facilities across seven districts in Tanzania, which receive funding from UNICEF. These facilities often lack municipal water connections so they rely on self-supply systems from boreholes, gravity-fed systems or water from off-site sources. Waste management is also a problem with poor segregation and no safe waste treatment and destruction in any of the facilities. Locally-made hand washing stations (made from buckets) are found in many of the facilities where they cannot rely on piped tap water. There are no routine surveillance systems for microbiological testing and surveillance of water so this is only available through specifically funded evaluations.

Dr Awar Ndir (Institut Pasteur de Dakar, Senegal)

Awar Ndir focused on a nationwide survey looking at antimicrobial resistance (AMR) in Senegal. The survey found that 80% of facilities did not have waste management systems and most had poor cleaning and decontamination practices. Environmental management and cleaning of health care facilities is largely carried out by external contractors, who are not appropriately trained so facilities find it difficult to verify quality control. She described an

infectious disease outbreak in an intensive care unit where a high concentration of antibiotic resistant bacteria was found on surfaces, which resulted in several patients dying. This was attributed to poor hand hygiene practices as well as insufficient cleaning and disinfection practices.

3.2. Existing evidence - what we know already and the evidence gaps

Health care associated infections: latest knowledge and global perspective (Dr Benedetta Allegranzi, WHO IPC)

There are clear differences in the prevalence of health care associated infections (HCAI) between high income countries (HICs) and low- and middle-income countries (LMICs): the endemic burden of disease related to HCAs is 4% in the United States and 40% in LMICs. It is difficult to establish WASH exposures as a source of HCAI in burden of disease studies due to the type of study designs used and infections investigated. It is also difficult to distinguish between the environmental components of these infections compared to the behavioural components. Most data on WASH exposure sources comes from epidemic data rather than endemic burden of disease data or surveillance systems. The amount of research being conducted has increased over the past five years but most research comes from middle income countries and the study quality is often low. The 2011 WHO report on the burden of disease of HCAI is currently being updated and will be extended to focus on surgical site infections (SSI). Benedetta indicated that while there is a strong plausibility of a link between WASH and HCAI, there is limited evidence that links WASH with IPC and HCAI. There are fewer than 100 papers with evidence on the effectiveness of IPC programs, and none of these specifically include WASH aspects.

WASH in health care facilities: maternal and neonatal implications (Presented by Dr Ollie Cumming on behalf of Professor Wendy Graham, University of Aberdeen & Soapbox Collective)

Globally, around one million deaths may be related to unclean births. At present there is a “perfect storm” of factors contributing to this disease burden as the number of facility births are increasing globally but without an associated improvement in quality of care standards, including WASH standards. Six elements contribute to the problem: epidemiological transition; increasing up-take of facility-based care; neglect of WASH in health facilities; poor IPC practices; weak HMIS and disease surveillance; and emerging AMR. If WASH services remain poor, the maternal and neonatal burden of disease will only increase. There are multiple high risk moments throughout pregnancy and the neonatal period when a lack of WASH and associated exposure to pathogens can result in negative health consequences. Research on environmental risk and hygiene behaviour has highlighted a number of ways of preventing healthcare-associated infections in maternity units. Soapbox are working on operational research in Tanzania, Malawi, Bangladesh, India, Ghana and Ethiopia to explore this further.

Health care associated waterborne infections (Professor Paul Hunter, University of East Anglia)

Health care facilities use water for many different purposes, many of which are overlooked by WASH experts. Waterborne infections can be spread by numerous pathways, for example through water in renal dialysis units, humidifiers, air filtration units, intravenous rehydration solutions, baby washing, autoclave steam water, unclean stethoscopes etc. Wastewater also carries exposure risks, both inside a facility and externally to the community. Nosocomial waterborne pathogens are more diverse than community waterborne pathogens. Outbreaks of Legionnaire’s disease and pseudomonas infections still occur in developed countries and are underreported in developing countries. In LMICs, microbiological surveillance and sampling is often limited so the vast majority of the evidence comes from high income countries. When asked if there was any evidence for plausible transmission of infections from sanitation, Paul replied that while plausible, there is a paucity of evidence for non-water transmission routes.

WASH and health care associated infections: a rapid exploratory review (Dr Oliver Cumming, LSHTM)

A rapid review of evidence of the burden of disease associated with WASH in health care facilities was conducted prior to this meeting. The summary document is found in Appendix 3. The objectives of the study were to review

HCAI literature to identify WASH as a risk factor, identify studies in health care facilities settings and/or effects on HCAI, assess the role and relative importance of WASH in the five HCAI domains and develop an example search strategy for a formal systematic review. The review concluded that it is plausible that a significant HCAI disease burden is associated with poor WASH and that this problem is most acute in LMICs, particularly in the most vulnerable populations. Secondly, there are a number of exposures and outcomes that warrant further, more systematic investigation and review. Finally, a burden of disease analysis for WASH in different types of health care facilities and HCAI domains would be a valuable addition to the evidence base and would help advocate for the role of WASH in achieving quality universal health coverage (UHC). There has so far been a disconnect between the HCAI and WASH communities: there are limited facility-based studies conducted by the WASH sector and HCAI researchers do not include WASH exposures in their work. The IPC, WASH and HCAI sectors need to work together to develop evidence on plausibility and conduct operational research on interventions that are effective in LMICs.

3.3. Conceptual framework: Elements of BoD framework and mapping pathways between WASH and health outcomes

BoD framework: elements, process and lessons learned from WASH and diarrhoeal disease analysis (Dr Annette Pruss-Ustun, WHO)

A summary of the burden of disease analysis methodology was presented and framed using the example of the burden of diarrhoea and WASH, previously produced and published⁴. Conducting a burden of disease analysis is useful for cost effectiveness analyses, raising awareness of the issues and policy making for program implementation. BoD estimates require established causality, exposure-response relationships to be systematically compiled and accepted by the scientific community, and to be matched with exposure data. The new WHO report *Preventing Disease through Healthy Environments*⁵ was highlighted, which estimates that 22% of the global burden of disease is attributable to the environment.

Mapping WASH exposure-response pathways and priority setting exercise: burden of disease envelope

Paul Hunter introduced the group exercise which was to brainstorm exposures and health outcomes for use in a BoD framework. A mind-map detailing exposures related to HCAI was shared with participants (see Appendix 3, review of WASH and health care associated infections). Participants were asked to discuss and elaborate the exposures identified in the preliminary rapid review and to identify additional WASH exposure-response pathways and group these pathways according to health outcome. Additional exposures that were suggested included the built environment (e.g. bed spacing, ventilation systems, sink location, plumbing systems, humidifiers and heating, vector control) and food hygiene and preparation areas.

The exposure-response pathways were then grouped into eleven disease envelope clusters: neonatal mortality; maternal mortality; general HCAI; Hepatitis A and E; Hepatitis B and C; surgical site infections (SSI); waterborne infections; enteric pathogens; vector borne diseases; psychosocial stress; and other specific diseases. Participants were then asked to vote on three areas they deemed to be most important. The votes were then collated to generate the priority areas for the BoD review (see Table 1). Maternal and neonatal mortality, waterborne infections and enteric pathogens, general HCAI and SSI, and psychosocial stress received the most votes. Participants were then assigned to groups to discuss WASH exposure pathways at different levels of facilities (primary, secondary and tertiary care) in relation to one of the four disease envelopes.

⁴ Pruss-Ustun et al. (2014) Burden of disease from inadequate water, sanitation and hygiene in low- and middle-income settings: a retrospective analysis of data from 145 countries. *Tropical Medicine and International Health* 19(8):894-905 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4255749/>

⁵ WHO, 2016. Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. World Health Organization, Geneva http://www.who.int/quantifying_ehimpacts/publications/preventing-disease/en/

Disease envelopes	Number of votes.
Neonatal mortality	25
Maternal mortality	11
Waterborne Infections	11
SSI	10
General HCAI	9
Enteric Pathogens	9
Psychosocial	6
Hepatitis B and C	5
Vector borne	4
Other diseases	3
Hepatitis A and E	0

Table 1: Burden of Disease priority setting

Maternal and neonatal mortality

The group considered possible risks throughout pregnancy and the neonatal period, with particular attention to preterm and the first 60 days of neonatal care. The following risks were identified: blood tests (exposure from poor hand hygiene and unclean instruments), vaginal exams (hand hygiene and unclean instruments), abortions (hand hygiene and unclean instruments), delivery (surfaces, laundry, environmental cleaning, hand hygiene and unclean instruments), episiotomy (hand hygiene and unclean instruments), ventilator use (maternal or neonatal use), catheterisation/urinary tract infections (UTI) (hand hygiene and unclean instruments), cord cutting and omphalitis (hand hygiene and unclean instruments), neonatal washing, post-natal care (washing, hand hygiene and unclean instruments) and maternal care (enemas and menstrual hygiene).

Waterborne infections and enteric pathogens

The group discussed the WHO 2008 Essential Environmental Health Standards and suggested improvements to ensure that implementation and adaptation of the standards would result in measures to reduce the burden of waterborne infections and enteric pathogens. For water, the standards should be on facility premises, continuous (i.e. whenever the facility is open), with sufficient storage available, using a proven treatment process to ensure water quality and safety needs are met, and be safely managed (including use of water safety plans). For sanitation, standards should be adapted to ensure safe excreta management (including waste from infants and other patients), sludge management and use of sanitation safety plans.

General HCAI and SSI (including caesarean sections)

The group identified six areas of WASH which carry a risk of HCAI and SSI: 1) water, including AMR, presence of heavy metals, biofilms and necessity of medical grade water quality; 2) waste, including waste handling, patient and staff exposure to sharps; 3) environment, including shortage of cleaning supplies (which affects quality of cleaning), availability of staff, services in operating theatres (water supply, cleaning, air condition and quality), the need to keep the environment dry; 4) sanitation, including flies and vectors, faecal matter on the floor, bed-ridden patients and transmission through bed linen; 5) medical devices, including non-sterilized equipment such as that used for dialysis and endoscopy; and 6) hand hygiene, relevant in all areas of health care provision.

Psychosocial stress

Within psychosocial stress, four areas were discussed: target groups, facility requirements to reduce psychosocial stress, standards of measuring, and standards and protocol improvements. Target groups to study include patients,

families of patients, health care workers, cleaners and hygienists, and women. To reduce psychosocial stress, facilities should be user-friendly, provide equitable access, be gender appropriate, enable privacy, have good lighting, be clean, provide access to personal washing areas, menstrual hygiene management and manage solid waste disposal appropriately. Measuring the BoD of psychosocial stress linked to WASH is not easy and may not be compatible with the analysis of other conditions. Protocol improvements that are needed include accessibility for disabled users and inclusion of vulnerable groups in facility designs. The group concluded that more studies of psychosocial stress generated in facilities are needed.

Conclusions from the BoD Workshop

It was agreed a BoD analysis is needed as policy and investments are driven by such analyses. It was further agreed to focus on the links with neonatal and maternal health given evidence in this area is strongest and the health implications are some of the most serious. All of the 40 participants agreed to contribute to the work, either directly or during the review process and/or dissemination of the report. WHO agreed to facilitate the development of the framework and LSHTM will lead on the systematic reviews.

4. Workshop 2: Evidence to support change

Maria Neira (Director of Public Health, Environmental and Social Determinants of Health, WHO) opened the meeting by stressing the importance of WASH for good health, highlighting the WHO report recently released that shows that 22% of the global burden of disease could be prevented through environmental interventions. She noted the progress on engaging with health on this important issue and encouraged participants to continue to advocate for, invest in and develop solution-oriented tools and approaches to improve WASH in health care facilities. Fabrice Fotso (UNICEF) said that the objectives of the workshop were to discuss existing evidence to effect and sustain change to improve WASH in health care settings and prioritize research to address key knowledge gaps. The aim of the workshop was to provide a summary of known evidence for rapid dissemination of advocacy and implementation efforts and a list of priority research areas which focus on operational and economic issues (see the full agenda in Appendix 1).

4.1. Key operational research areas

Evidence review: Focusing on care-seeking behavior and patient satisfaction (Dr Maha Bouzid, University of East Anglia [UEA])

Maha Bouzid presented a summary of the review carried out by UEA which sought to understand the effect of WASH services on care-seeking behaviour and patient and staff satisfaction. The review found that care seeking behaviour is a complex issue and barriers and delays to care seeking include inability to identify signs that warrant care seeking, cost, distance to facility, lack of skilled staff, inadequate health care facility infrastructure, dissatisfaction with quality of care, poor treatment by staff, lack of supervision of children at home and obstacles related to weather or social unrest. In the review, WASH was not identified as a main barrier to care seeking but several studies reported on dissatisfaction with WASH conditions at health care facilities in LMICs, particularly in maternity settings. Very few studies were identified that conducted WASH improvement interventions and recorded impact on patient satisfaction, service use and health outcomes.

Improving WASH facilities: the case for Return on Investment analyses (Professor Rick Fordham, UEA)

Rick Fordham described a series of models which measure the economics of WASH in health care facilities. Economic tools are useful for producing economic arguments for different situations, as long as they are evidence-based, adapted to the local context and take account of risk and uncertainty among key parameters. He highlighted that it is better to work with imperfect data to produce a best estimate rather than always seeking the best data

possible. At present, only minimal investments in WASH are made globally even though such investments have many economic benefits, for example lives and DALYs saved, improved effectiveness of care, using fewer medicines, and improving productivity and earnings. The Return on investment (ROI) metric can be used to advocate for increased investments.

Saving lives with clean safe care at birth: Tracking and improving environmental hygiene (Ms Giorgia Gon, Soapbox & LSHTM)

Giorgia Gon began by introducing Soapbox, a small NGO established three years ago which focuses on clean births in eight countries in sub-Saharan African and Asia. To get a better understanding of the coverage of WASH, she stressed the importance of capitalising on existing datasets as well as creating new tools that allow the generation of new data. Soapbox have developed a walk-through facility assessment tool, which includes a range of methods including image evidence. At present, there are currently no universally accepted risk-based standards to verify whether a facility is microbiologically clean and safe. Image evidence is a useful advocacy tool as well as a measurement tool: for example the Ministry of Health in Zanzibar found images of WASH services more powerful than traditional data such as bar charts. Participatory photography is also a means of empowerment. When the tool was used in Bangladesh, cleaners were empowered to change their behaviour because it showed them what they should do, not only what the status of the safety of their hospital was. Soapbox have also worked with NHS Scotland to develop a training manual for cleaners. The training manual uses face-to-face training, is very practical and explains what the consequences are of poor cleaning practices. The guide is designed to be flexible and adaptable to different contexts. A pilot of the manual will begin in The Gambia in April/May 2016.

The role of WASH in combatting Antimicrobial Resistance (Mr Bruce Gordon, WHO HQ)

Bruce Gordon gave a presentation highlighting the importance of WASH in tackling antimicrobial resistance (AMR). The problem of AMR is increasing globally and has been recognised in a 2014 World Health Assembly Resolution (67.25). The new global action plan on AMR (endorsed by WHO at the 2015 World Health Assembly) sets out five key objectives: improve awareness; strengthen knowledge; improve sanitation, hygiene and infection prevention; optimize use of antimicrobial medicines; and increase investments in medicines, diagnostics and vaccines. The first four objectives all have clear links with WASH. In order to combat AMR, an agreed approach for environmental surveillance in “hotspots” is needed as well as a strengthening of investments in WASH infrastructure and behaviours. Intersectoral cooperation of WASH and health sectors and calculations of cost-effectiveness for finance decision makers are also both important. The WASH in health care facility global effort would benefit by stronger links and greater alignment with AMR efforts.

4.2. Highlights from national/regional efforts

Motivating improvements: Learnings from Indian and Bangladeshi health care facilities study (Dr Deepak Saxena, Public Health Institute of India)

Deepak described some of the evidence on what motivates public health care providers to perform better and contribute to more sustainable WASH services. While the importance of WASH in health care facilities is recognised, too often the focus is on supplies and infrastructure, and behaviour and motivation is overlooked. Deepak highlighted the need for more operational research to better understand motivational factors. The Government of India has launched the Kayakalp Initiative which promotes cleanliness and IPC in health care facilities, recognises WASH champions and provides cash awards and citations to facilities which score highly on a specific, standard protocol. It has helped to highlight the importance of motivation as a key component of improving WASH services. It is a good example of evidence-led advocacy: the Minister of Health has acknowledged the importance of WASH across the country based on the results of this state-level project. Political buy-in of the initiative has been instrumental in raising the profile of WASH in health care facilities in India.

Facilitating Evidence-Based Solutions for WASH in health care facilities: Tools to assess and improve WASH conditions and sustainability of safe water provision (Dr Christine Moe, Emory University, USA)

The adoption of Goal 6 of the Sustainable Development Goals (SDGs) necessitates better tools to assess WASH conditions in health care facilities and to measure sustainability and track improvements. To meet this need, the Centre for Global Safe WASH at Emory have developed two assessment tools, the WASH Conditions Scorecard to assess WASH conditions, infrastructure and resources and the Sustainability Metric to evaluate sustainability of safe water provision in health care facilities. The WASH Conditions Scorecard includes modules on water supply, sanitation, handwashing, cleaning and waste management, based on the WHO core indicators for WASH in health care facilities. The tool, which is administered on an Android mobile device and takes two to three hours to complete by one assessor, includes a survey, facility observation checklist and water sampling and analysis for *E.Coli*. The tool can be used to identify priority areas for improvement and compare conditions within and across regions. Christine presented a summary of results from fieldwork in ten facilities in Cambodia and six in Uganda, which found that none of the facilities met WHO guidelines for safe drinking water. The Sustainability Metric includes four components: technical feasibility, on-site capacity, financial and operational accountability and institutional engagement. Data produced by the tool can be used to facilitate evidence-based solutions and drive investments in operation, maintenance and upgrades of WASH facilities. The tool was used in Ghana, where the results caused the Director of a major hospital to make a number of important improvements.

Monitoring for change: Environmental health conditions in health care facilities (Mr Ryan Cronk, University of North Carolina-Chapel Hill, USA)

Since the WHO/UNICEF 2015 report on the status of WASH in health care facilities⁶ was published, new data on WASH coverage has emerged. Sixty eight countries now have data, (compared to 54 in the 2015 report), due to some large surveys being conducted in the past year, namely the Service Availability and Readiness Assessment (SARA) and the Service Provision Assessment (SPA). Additional data have been extracted from studies used in the 2015 report, descriptive statistics and service levels analysed, and regression analyses conducted to explore determinants of inequalities in service coverage and a review of evidence to identify low-cost interventions to improve low coverage situations. Ryan highlighted the need to disaggregate data to show services levels, look at equity indicators (for example gender separated toilets) and environmental health indicators (for example standard precautions). Data show large inequalities in coverage, between sub-national regions (for example a 57% difference between the regions with the highest and lowest coverage of improved water sources in Tanzania) and between urban and rural areas (80% improved sanitation in urban areas of Tanzania compared to 30% in rural areas). While WASH is already included in the main global assessment instruments, efforts are underway to expand and harmonize these indicators and include them within ongoing national monitoring systems, i.e. HMIS.

WASH in HMIS: Limitations and opportunities (Dr Peter Harvey, UNICEF Eastern and Southern Africa Region, Kenya)

Peter Harvey began by sharing lessons learned from monitoring WASH in schools. Sixteen out of 21 countries in the UNICEF Eastern and Southern African Region (ESAR) include WASH indicators in Education Management Information Systems (EMIS), however only two countries consider conditions and functionality of services. In the region, on average 53% of schools have 'adequate' water supply, 45% have 'adequate' sanitation and 13% have 'adequate' handwashing facilities. For health care facilities, seven out of 21 countries included WASH in Health Management Information Systems (HMIS), although most countries did not consider facility conditions or provide data on handwashing facilities. With the exception of Uganda which included more sophisticated data collection on conditions of facilities, metrics are often binary (yes/no) and do not provide enough detail. Using existing HMIS, it

⁶ WHO/UNICEF, 2015. Water, sanitation and hygiene in health care facilities: status in low- and middle-income countries and way forward. http://www.who.int/water_sanitation_health/publications/wash-health-carefacilities/en/

will be difficult to report against the proposed new global indicators. Peter recommended the finalisation of core indicators and questions for WASH in health care facilities, advocating for inclusion of core indicators in national HMIS systems and application of operational research findings on the burden and causes of HCAI relating to WASH to identify key WASH indicators for HMIS.

Conclusion from the Evidence for Change workshop

Participants agreed that evidence is an important element for informing advocacy and improving the sustainability and impact of efforts in facilities. It was also discussed that more needs to be done to embed WASH within specific research efforts to enable for stronger analyses and conclusions regarding the contribution of WASH, to, for example, care seeking or performance of health care workers. Behaviour change was one area noted as particularly important with more research needed on what types of incentives, interventions and tools are effective in getting health care workers to perform safe hygiene hygiene and cleaning routines. It was agreed that all participants would reach out to health colleagues to jointly development and implement operational research activities and through the task team a more specific development and tracking of research priorities and knowledge would be undertaken.

5. Workshop 3: Global strategic review and planning

Lizette Burgers (UNICEF) provided opening remarks for the day. She noted that WASH in health care facilities is particularly important in light of the new Sustainable Development Goal on WASH, which moves beyond the household level to include all settings, of which health care facilities is one. She reminded participants of two key commitments from the previous day's workshop: the need to strengthen evidence, and the need for health specialists and the WASH sector to work together to achieve a common goal.

5.1. Progress on embedding within key health efforts

Quality Universal Health Coverage (Dr Shams Syed, WHO)

Shams Syed stressed the need to ensure quality in the Universal Health Coverage (UHC) equation: without quality, 'access' is an empty promise. Data show that increasing institutional births do not necessarily reduce mortality, in large part, because quality services are not provided. National quality policies and strategies should be informed by the front line. Global efforts will be meaningless unless country needs and specific areas that require action (for example outbreak preparedness and response) are taken into account. In Liberia for example, the recovery and resilience plan emphasises quality UHC. Demonstrating the cost-effectiveness of WASH interventions is also important. At WHO, the new quality UHC unit is developing a Global Learning Laboratory which will cover the five stages of care: preventative, promotive, curative, rehabilitative and palliative. One of the first learning pods will focus on the triangulation of UHC, quality and WASH.

Quality of care in Maternal and Newborn Health (Dr Wilson Were, WHO)

Quality was missing from the Millennium Development Goals (MDGs) but has been built into the SDGs and is also an essential component of the new *Global Strategy on Women's, Children's and Adolescent Health - Survive, Thrive, Transform*. Many countries are not making sufficient progress on maternal mortality because quality is a major roadblock. Currently, a high proportion of avoidable maternal and neonatal deaths occur in facilities. In facility assessments, WASH is consistently noted as a major gap. WASH improvements must be built into health systems and considered as part of the umbrella of quality care. Countries need help with effective intervention strategies to improve quality of care and implementation guidance to institutionalise change, rather than quick wins. A new WHO Quality of Care framework around the time of childbirth has been developed which includes eight standards that focus on both the quality and experience of care. The framework includes a specific section devoted to infrastructure with a strong emphasis on WASH. The next steps will be to publish the standards, work with

countries to support their implementation and create a platform for systematic sharing of learning and examples between countries.

Quality work at the country level: maternal and child health perspective (Dr Kim Dickson, UNICEF)

Kim Dickson presented a summary of practical work implementing quality improvements. She shared a summary of the Every Mother Every Newborn (EMEN) Quality Improvement Initiative, started in 2014, which is aimed at improving the quality of obstetric and newborn care. Two million lives could be saved each year by closing the quality gap around time of birth, by reducing stillbirths, neonatal and maternal deaths. EMEN implementation efforts, focusing on mother- and baby-friendly hospitals and facilities, have taken place in Bangladesh, Ghana and Tanzania. In Ghana, providers are incentivised to meet quality standards with reimbursements provided through the National Health Insurance Agency. In Bangladesh, EMEN has been integrated with the Baby Friendly Hospital Initiative (which focuses on breastfeeding), an example of piggybacking onto existing initiatives to make the work more sustainable. In Tanzania, a quality assurance star rating system with financial and other incentives for facilities has been introduced through the national insurance system.

Drivers for behaviour change (Professor Shaheen Mehtar, Infection Control Africa Network [ICAN])

Shaheen Mehtar shared learnings from ICAN's work with IPC practitioners across Africa and discussed a number of drivers for change. She began by highlighting that the link between outputs and financial reward is tangible. Practitioner payments and performance are often not directly linked where they should be to ensure high quality work is rewarded. Staff in permanent posts do not have any incentive to improve their performance. Empowerment and education are the biggest drivers of change. Face-to-face training, with demonstrations and discussions, has been much more effective than online training courses at introducing behaviour change. There is a tendency to rely on written guidelines to encourage change. This approach on its own has limited success due to the problem of language barriers, poor literacy and a lack of incentives and accountability. More exciting and innovative approaches, for example providing ongoing motivation and training through smartphones and other technology, are needed to transfer knowledge and to empower and educate staff. Other groups such as youth or the community can also help drive change: during the Ebola outbreak, traditional healers in Sierra Leone successfully introduced hand hygiene within their communities which resulted in reductions by 30% of respiratory infections, 30% of skin problems and 80% of diarrhoeal diseases.

Country perspective: building blocks of national effort to improve WASH in health care facilities (Mr Hilton Chibelesa, Ministry of Health, Zambia)

Hilton Chibelesa shared an update from an EU-funded pilot project in nine health facilities in Zambia, '*Accelerating Progress towards Maternal, Neonatal and Child Morbidity and Mortality Reduction*'. The project consists of a WASH package which emphasises integration with IPC. The package includes six interventions (cleaning and disinfection, drinking water, hand washing, rehabilitation and maintenance of sanitation facilities, provision of infrastructure for medical waste management and the development of standard operating procedures) and a cost-efficiency analysis of each intervention. Of the six interventions, cleaning and disinfection and hand hygiene were the most cost-efficient. The project is being scaled up to 51 additional facilities with direct implementation by districts and support from the ministry of health. Unfortunately there has been inadequate funding for impact research to generate evidence of direct benefit to patients and to institutionalise and sustain the interventions in all facilities. Hilton appealed to partners to leverage funds for country-wide scaling up and harmonisation of the WASH package.

5.2. Global action plan task teams

In the morning, a panel consisting of Alison Macintyre (WaterAid Australia), Rick Johnston (WHO HQ), Paul Hunter (UEA), Arabella Hayter (WHO HQ) presented updates on each of the four task teams. In the afternoon, participants were divided into groups to discuss the overall purpose and scope of, and propose activities for, each of the task

teams. The following section presents an update of each task team's work followed by suggestions made during the group work.

Advocacy (Ms Alison Macintyre, WaterAid)

Summary of activities to date

The momentum for improving WASH in health care facilities is growing globally. Since the launch of the global action plan last year, several events held by WASH and health actors across all WHO regions have included WASH in health care facilities activities. Global Universal Health Coverage experts discussed how WASH in health care facilities is core to achieving quality of care at the Prince Mahidol Award Conference in Bangkok. The Canadian Government (Global Affairs Canada) and WaterAid hosted a discussion on how maternal, newborn and child health (MNCH) and WASH experts must break down silos to achieve universal access to WASH and improve MNCH services. This was echoed at the Global Maternal Newborn Health conference where WASH in health care facilities was highlighted as a necessity for supporting quality MNCH care. WASH in health care facilities was highlighted as essential for ensuring health system resilience during high level Ebola-focused health systems discussions in Kobe, Japan. A Global Advocacy Plan is being finalised, which includes a set of key messages on WASH in health care facilities so that all advocates can align messages and action for maximum impact.

Group feedback

Advocacy activities should include public mobilisation and awareness raising, securing greater investment in and accountability for WASH in health initiatives, supporting leadership and integration of WASH in health care facilities in health priorities and securing high-level political buy-in and action. Advocacy should target all levels, i.e. global, national, regional and facility levels. 'Branding' WASH in health care facilities remains an issue because it causes non-WASH actors to switch off from the topic. While there may not be a robust and comprehensive evidence base, a few solid country examples are needed to share with politicians of what works and what is needed. The task team should consider how best to harvest these ideas. Creative processes for engaging with actors, including policy makers and the public are needed, for example influential people to act as champions who can drive political will and action. Finally, the advocacy plan needs targeted objectives to ensure that advocacy activities are meaningful, effective and amplify and harmonise efforts that are already underway.

Monitoring (Dr Rick Johnston, WHO)

Summary of activities to date

Although WASH in health care facilities is not specifically mentioned in SDG 6 (the WASH Goal), the WHO/UNICEF Joint Monitoring Programme have agreed to report regularly on access to WASH in health care facilities, along with access in households and schools as part of the formal SDG 6 monitoring mechanism. A set of core and expanded indicators for monitoring WASH in health care facilities was drafted in October 2015 and has since been revised. There are five draft core indicators, covering water, sanitation, hand hygiene, cleaning and disinfection routines and health care waste management. The indicators are currently for outpatient facilities only, but additional modules will be developed for inpatient facilities. In parallel, an expanded list of indicators addressing aspects of service not covered in the core list, such as water quality and organization and management, is being developed. A small monitoring meeting will be held in June 2016 to finalise the indicators and consider how to balance adherence to norms with the practical challenges posed in doing so, in particular in low resource settings. The final indicators will be field tested nationally in at least three countries by the end of 2016.

Group feedback

Monitoring is needed to strengthen the evidence base through the generation of globally comparable data to improve norms for WASH and environmental health for health care facilities. Having developed a set of core and expanded indicators for outpatient settings, indicators for other wards should be the next priority. Developing qualitative indicators and incorporating these into focus group discussions for patient satisfaction surveys may also

be useful. WASH in health care facilities should be considered with a rights-based approach and included in the human right to water and sanitation processes and accountability mechanisms.

Core indicators should be integrated into national assessments and country champions used to show the value of using core and expanded indicators in assessments, however new indicators won't be taken up in assessments if they are not seen as important. HMIS should be targeted, although because HMIS are done on a country-by-country basis, this will not be easy. To date, the task team has faced challenges in getting survey partners to include indicators. Reaching out to WHO and UNICEF country offices, civil society networks and other partners and holding webinars will increase the profile of monitoring and help encourage surveys to incorporate WASH indicators. The task team will measure its success through the uptake of core indicators by multiple survey instruments.

Research and Evidence (Professor Paul Hunter, UEA)

Summary of activities to date

Two research reviews have been conducted to inform the Burden of Disease and Evidence workshops. The first is on estimating the burden of disease associated with WASH in health care facilities and the second is on reviewing and prioritizing the evidence more generally, especially on the links between care seeking and WASH in health care facilities. The outcomes of the reviews and the research meetings will be used to inform key advocacy messages and the research agenda.

Group feedback

To date, there has been a lack of implementation research linking WASH with health, for example not recognising WASH as a source of HCAI. WASH research must be undertaken with a health-centred approach. Neglected areas that the task team will focus on include surveillance systems (specifically the need to evaluate current systems), staff retention, satisfaction and motivation, management systems and exposure pathways (specifically plausibility and evidence for disease control). Economic and business models, as well as anthropological, qualitative research should be explored. Systematic literature reviews, primary research (linking exposures and outcomes) and impact evaluations were all identified as priorities. Advocating for donors to fund impact evaluations is also needed. Other actors could be involved in the research agenda, for example engaging hospital managers and economists in research, and sharing results in different forums with other professional groups, e.g. midwives or obstetricians and gynaecologists.

Standards and Facility-based improvements (Ms Arabella Hayter, WHO)

Summary of activities to date

WHO/UNICEF's WASH FIT (Water and Sanitation for Health Facilities Improvement Tool) is a practical tool for improving water, sanitation and hygiene (WASH) services in health care facilities in order to ensure clean and safe facilities for staff and patients. WASH FIT was first developed for use in small, rural health facilities in cholera hotspot areas in Chad. It has also been used in Mali and as part of Ebola early recovery work in Liberia. A number of other countries have expressed interest at using and adapting the tool. A formal review of the tool is underway, comments will be incorporated in April and a final version will be ready later in 2016.

The team is also working on a compendium of technologies and has begun with health care waste technologies. Other domains will be covered later in the year and the compendium shared at the end of 2016. Budgeting and financing of facility improvements is a major knowledge gap. Collecting information on the cost of implementing and maintaining technologies is urgently needed to inform planning as well as cost recovery and cost benefit analyses.

Group feedback

The following suggestions for WASH FIT were made: Bruce Gordon suggested that accountability be built into the tool, Ulrike Pokorski urged to include water quality monitoring and implementation and Wilson Were stressed the importance of including measures of quality, including hygiene behaviour. A suggestion was made to rebrand WASH FIT to make it more appealing to the health sector. The facility-based improvements team identified five broad areas of work: Cost-effectiveness, financing, and sustainability; Education and capacity building; Accountability and rewards; Behaviour change and empowerment; and Health systems and scaling up.

- *Cost-effectiveness, financing, sustainability*

Innovative financing mechanisms for improvements are needed, for example business pay for performance models. In addition, innovative technologies, for example those that use less water, or that use waste as power (e.g. for lighting) should be considered. Communities need to be involved in managing services and helped to provide local, sustainable solutions.

- *Education and capacity building*

New approaches for education and staff capacity building are needed. Ideas included using formal education structures (e.g. degrees, diploma programs) for professional health training, peer-to-peer learning and support tools (e.g. apps) for staff. Findings ways to increase the standards of cleaners was also considered important.

- *Health systems and scaling up*

Health systems are complex and consist of many elements, all of which should be considered when making facility improvements. The task team could work with other professional groups (for example behavioural economics) and use more accessible language and terminology to facilitate change.

- *Behaviour change and empowerment*

Behavioural change needs to happen at many levels. Behaviour is context specific and it is important to document what works and what does not so that tools and approaches can be translated to other contexts and settings. Behavioural change needs to be enabled and incentivised. An example was shared where a picture of a pair of eyes were put over hand hygiene stations to encourage hand washing in a facility which improved hand washing rates.

- *Accountability and rewards*

Health care professionals, patients and community members should be empowered to demand better services. There are standards for facilities but there is still a lack of awareness that these exist. Improvements should be made within existing accountability mechanisms. In addition, including energy and building design experts would be useful for creating for more efficient WASH designs.

6. Closing remarks

In closing, Bruce Gordon and Lizette Burgers thanked participants for their contributions to the meeting and summarised the key actions for the next phase of work, namely that the four task teams will deliver tangible and relevant outcomes and continue to share knowledge and ideas within and between themselves. Further documentation of regional and national efforts and sharing information on the knowledge portal will be important. Specific recommendations and commitments are detailed at the beginning of the report. All of the agreed actions contribute to the realisation of the vision to provide universal access to WASH in health care facilities in all settings by 2030.

Appendix 1: Agendas

Workshop 1: Burden of Disease Workshop Water, sanitation and hygiene in health care facilities

Agenda

St Mary Ward House, 5-7 Tavistock Place, London

March 21 – 22

Objectives: Discuss the evidence regarding the disease burden associated with inadequate water, sanitation and hygiene services in health care facilities low and middle-income countries and develop a framework to quantify this burden.

Expected outcomes: Modelling framework including disease outcomes, modelling parameters and assumptions and timeline for completing work.

Day 1: Monday 21 March 2016

Speaker/ Moderator

Day 1: Monday 21 March 2016		Speaker/ Moderator
13h00-13h10	Opening remarks and framing of the issue	Oliver Cumming and Oona Campbell, LSHTM
13h10-13h30	Introductions and meeting objectives	Maggie Montgomery, WHO HQ, Chairperson for Day 1
13h30-14h30	Session 1: Setting the scene: realities on the ground <ul style="list-style-type: none"> Panel of country perspectives: key health and infection challenges with WASH in HCF <p><i>Discussion</i></p>	Moses Soka, Liberia; May Osman, Sudan; Hamisi Malebo, Tanzania; Awar Ndir, Senegal
14h30-15h30	Session 2: Existing evidence-what we know and evidence gaps <ul style="list-style-type: none"> Health care associated infections: latest knowledge and global perspective Maternal and neonatal implications Waterborne infections Research review on evidence <p><i>Discussion</i></p>	Benedetta Allegranzi, WHO HQ Wendy Graham, University of Aberdeen Paul Hunter, University of East Anglia Lauren D'Mello-Guyett/Oliver Cumming, LSHTM
15h30-15h45	Afternoon tea	
15h45-17h00	Session 3: Conceptual framework: elements of BoD framework and mapping pathways between WASH and health outcomes <ul style="list-style-type: none"> BoD framework: elements, process and lessons learned from WASH and diarrhoeal disease analysis Introduction to draft mapping Group work on updating mapping 	Annette Pruss-Ustun, WHO HQ Paul Hunter, University of East Anglia <i>Group leaders:</i> Paul Hunter, Oliver Cumming, Maggie Montgomery, Fabrice Fotso
17h00-17h15	Wrap-up	Alain Prual, UNICEF

Day 2: Tuesday 22 March 2016

Speaker/ Moderator

09h00-09h15	Re-cap of day 1	Lauren D'Mello-Guyett (LSHTM)
09h15-10h00	Session 4: Feedback from groups	Rick Johnston, WHO, morning chairperson
10h00-10h15	<i>Coffee break</i>	
10h15-11h30	Session 5: Priority setting exercise-burden of disease envelope <ul style="list-style-type: none">• Priorities generation• Priorities clustering• Priorities ranking <i>Discussion</i>	Introduction to exercise by Paul Hunter, University of East Anglia <i>Group leaders:</i> Paul Hunter, Oliver Cumming, Maggie Montgomery, Fabrice Fotso
11h30-12h30	Session 6: Development of protocols <ul style="list-style-type: none">• Exposure scenarios (WASH services level, facility types and health services)• Disease burden envelope• Relative risks (effect size estimates) <i>Discussion</i>	
12h30-13h30	<i>Lunch</i>	
13h30-14h30	Session 7: Protocols and priority setting <ul style="list-style-type: none">• Discussion	Oliver Cumming, LSHTM, afternoon chairperson
14h30-15h30	Session 8: Knowledge gaps <ul style="list-style-type: none">• Group discussion and brainstorm	
15h30-15h50	<i>Coffee break</i>	
15h50-16h30	Session 9: Next steps <ul style="list-style-type: none">• Deliverables• Outcomes and timelines• Resource needs	
16h30-17h00	Session 10: Conclusions <ul style="list-style-type: none">• Commitments from participants• Conclusion	

Workshop 2: Strategic Review and Planning March 23rd 2016

Objectives: Reflect on progress achieved, strategize on where more targeted efforts are needed and update the global action plan accordingly.

Expected Outcomes: Revised global action plan with measurable indicators of success and clear commitments from partners.

Wednesday 23 March 2016		Speaker/ Moderator
09h00-09h20	Opening remarks and context setting (e.g. 2015 global meeting outcomes and action plan development)	Lizette Burgers and Fabrice Fotso, UNICEF
09h20-09h30	Task team overview and introduction	Maggie Montgomery, WHO
09h30-10h30	<p>Session 1: Task Team Progress</p> <ul style="list-style-type: none"> • Advocacy • Monitoring • Research/evidence • Facility based improvements <p><i>Panel discussion:</i> What has been done? What has been learned? What are the proposed next steps?</p>	<p>Alison Macintyre, WaterAid Rick Johnston, WHO Paul Hunter, University of East Anglia Arabella Hayter, WHO</p> <p>Moderator: Maggie Montgomery, WHO</p>
10h30-11h00	Coffee break	
11h00-13h00	<p>Session 2: Progress on embedding within key health efforts</p> <ul style="list-style-type: none"> • Quality Universal Health Coverage • Quality of care in child and maternal health • Quality work at the country level: maternal and child health perspective • Country perspective: Engaging the private sector • Country perspective: Building blocks of national effort to improve WASH in HCF <p><i>Discussion:</i> What has been done? What has been learned? What are the proposed next steps?</p>	<p>Shams Syed, WHO Wilson Were, WHO Kim Dickson, UNICEF</p> <p>Markos Paulos, MoH Ethiopia Hilton Chibeleka, MoH Zambia</p> <p>Moderator: Fabrice Fotso, UNICEF</p>
13h00-14h00	Lunch	
14h00-15h30	<p>Session 3: Insights and reflections: shaping the global action plan</p> <ul style="list-style-type: none"> • Discussions in small groups on four key areas (Advocacy, monitoring, research/evidence and facility-based improvements) <p>Small group discussions</p>	<p>Small group leaders: Alison Macintyre, WaterAid Rick Johnston, WHO Paul Hunter, University of East Anglia Maggie Montgomery, WHO and Fabrice Fotso, UNICEF</p>
15h30-15h45	Afternoon tea	
15h45-16h45	<p>Session 4: Proposed way forward</p> <p><i>Discussion</i></p>	<p>Moderators: Maria Neira and Bruce Gordon, WHO</p>
16h45-17h00	Session 5: Commitments and Conclusion	Maria Neira, WHO
18h00-20h00	Cocktail Reception at LSHTM	All

Workshop 3: Evidence to support change March 24th 2016

Objectives: Discuss existing evidence to effect and sustain change to improve WASH in Health care settings and prioritize research to address key knowledge gaps.

Expected Outcomes: summary of known evidence for rapid dissemination of advocacy and implementation efforts and list of prioritized research areas with focus on operational and economic issues.

Thursday 24 March 2016

Speaker/ Moderator

09h00-09h15	Opening remarks	Maria Neira, WHO
09h10-09h30	Summary of BoD and strategic workshops and meeting objectives	Fabrice Fotso, UNICEF
09h30-10h30	<p>Session 1: Key operational research areas</p> <ul style="list-style-type: none"> • Evidence review: Focus on care-seeking • Economic arguments for improving WASH in health care facilities • Changing hygiene behaviour in health care facilities • Motivating improvements <p style="margin-left: 20px;"><i>Discussion</i></p>	<p>Maha Bouzid, University of East Anglia Richard Fordham, University of East Anglia</p> <p>Claire Kilpatrick, WHO HQ (IPC)</p> <p>Deepax Saxsena, Public Health Foundation of India Bruce Gordon, WHO</p> <p>Chairperson: Paul Hunter, University of East Anglia</p>
10h30-11h00	<i>Coffee break</i>	
11h00-12h00	<p>Session 2: Highlights from national/regional efforts</p> <ul style="list-style-type: none"> • Tracking and improving environmental hygiene • Rapid and Systematic Tools to Assess WASH Conditions and Sustainability of Safe Water Provision in Health care Facilities • Environmental health conditions in health care facilities • WASH in Health Management Information Systems: Limitations and opportunities <p style="margin-left: 20px;"><i>Discussion</i></p>	<p>Giorgia Gon, Soapbox/LSHTM</p> <p>Christine Moe, Emory</p> <p>Ryan Cronk, University of North Carolina</p> <p>Peter Harvey, UNICEF</p> <p>Chairperson: Lizette Burgers, UNICEF</p>
12h00-13h00	Lunch	
13h00-14h30	<p>Session 3: Knowledge and research areas; gaps and priorities</p>	<p><i>Group leaders:</i> Oliver Cumming Paul Hunter Fabrice Fotso Maggie Montgomery</p>
14h30-14h45	Afternoon tea	
14h45-16h00	<p>Session 4: Group feedback, prioritized knowledge and research development areas</p>	<p>Moderator: Alison Macintyre, WaterAid</p>
16h00-16h15	<p>Session 5: Workshop synthesis and conclusion</p> <ul style="list-style-type: none"> • Commitments from participants • Conclusion 	<p>Bruce Gordon, WHO</p>

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WASH in Health Care Facilities Global Action Plan Background report

March 2016

DRAFT

1. Introduction

The sustainable development goals (SDGs) have been agreed and it is the ambition of the global community to ensure universal access to water, sanitation and hygiene in all settings, including health care facilities. Such services are fundamental for providing safe, quality care which is recognized as a fundamental precondition to effective, safe health service delivery. Without it, all other global health-related goals, including those concerning quality universal health coverage (UHC), reducing maternal mortality and ending preventable newborn deaths will be compromised. Strengthening health systems and capacity to prevent and better manage all global health risks is imperative, as well as ensuring quality people-centered health care for all.

The provision of adequate water, sanitation and hygiene (WASH) services in all settings (e.g. households, communities, schools, health care facilities and workplaces) is critical to achieving all public health goals. Within health care facilities, WASH services and associated hygiene practices, are of particular importance for the provision of quality treatment and care. WASH services minimize the risk of infection for patients and their carers, health workers and surrounding communities. Clean and safe health care facilities can increase demand and trust in services, as well as reinforce the role of staff in setting societal hygiene norms. This can increase motivation and retention of health workers, resulting in cost savings from preventable infections and more efficient service delivery. Safely managed and reliable WASH services and the associated hygiene practices, such as hand hygiene at the right times, strengthen the resiliency of health systems to prevent disease outbreaks and allow effective response to emergencies, including natural disasters and outbreaks, and bring them under control when they occur. Alongside climate change, such threats are likely to increase in the future.

WHO and UNICEF, along with health and WASH partners across the globe have committed to implement a global action plan on WASH in health care facilities (HCF). A 2015 WHO/UNICEF report revealed that 38% of health care facilities in low and middle income countries have **no** source of water⁷. The provision of water and soap or alcohol-based hand rubs for hand hygiene was absent in over one third of facilities, and almost one fifth of facilities did not have toilets or basic latrines. Large disparities exist within and between countries, and primary health care facilities have significantly lower WASH coverage than hospitals. To achieve the vision, that by 2030, every health care facility, in every setting, has safely managed, reliable water, sanitation and hygiene facilities and practices to meet staff and patient needs will be challenging. Coordinated effort and action from WASH and health stakeholders is needed.

2. Progress to date

⁷ WHO/UNICEF. 2015. *Water, Sanitation and Hygiene in Health Care Facilities: status in low and middle income countries and way forward*. World Health Organization, Geneva.

http://www.who.int/water_sanitation_health/publications/wash-health-care-facilities/en/

The first global discussion on WASH in HCF took place in 2014 during a global strategic meeting hosted in Madrid by the Spanish Government and facilitated by WHO and UNICEF⁸. Building on the momentum initiated in Madrid, a second global meeting was held in 2015 in Geneva with a focus on engaging health actors, sharing national challenges and solutions and developing a global action plan⁹. The 2015 global meeting hosted a broad group of WASH and health stakeholders and included presentations on how WASH in HCF is critical to the following health agendas: infection prevention and control (IPC); patient safety; cholera; emergencies and responsiveness; maternal, newborn, child and adolescent health; and, neglected tropical diseases. At this meeting, the global vision and action plan were drafted¹⁰. To realize the action plan, WHO and UNICEF agreed to develop four task teams to ensure the active involvement of all stakeholders and establish a foundation for longer-term change.

3. Global Action Plan

Vision: To ensure that by 2030, every health care facility, in every setting, has safely managed, reliable water, sanitation and hygiene facilities and practices to meet staff and patient needs in order to provide quality, safe people-centered care, with particular attention to the needs of women, girls and children¹¹.

Five change objectives have been developed to realize this vision (Table 1). In the first phase of the work, four task teams (comprised of health and WASH specialists) are addressing the change objectives through concrete deliverables to demonstrate immediate progress and establish the foundation for longer-term change. Task teams include: Advocacy and Leadership; Monitoring; Evidence and Operational Research; and Policies, Standards and Facility-based Improvements.

Change Objectives

CO 1	WASH in health care facilities is prioritized as a necessary input to achieving all global and national health goals especially as those linked to Universal Health Coverage. Key decision makers and thought leaders champion WASH in health care facilities.
CO 2	All countries have national standards and policies on WASH in health care facilities and dedicated budgets to improving and maintaining services.
CO 3	Global and national monitoring efforts include harmonizing core and extended indicators to measure WASH in health care facilities.
CO 4	The existing evidence base is reviewed and strengthened to catalyze advocacy messages and improve implementation of WASH in health care facilities.
CO 5	Health care facility staff, management and patients advocate for and champion improved WASH services. Risk-based facility plans are implemented and support continuous WASH improvements, training and practices of health care staff.

The task teams are open to active participation from WASH and health experts across the globe.

Partners include: Canada Global Affairs, UK Department for International Development (DFID), Emory University, Global Health Council, Hilton Foundation, Infection Control African Network (ICAN), IRC WASH, Japan International Cooperation Agency (JICA), London School of Hygiene and Tropical Medicine (LSHTM), Médecins Sans Frontières (MSF), Indian Institute of Public Health (IIPH), SoapBox Collaborative, Swiss Federal Institute of Aquatic Science and Technology (EAWAG), Terre des Hommes, United Nations Children Fund (UNICEF; all regions), University of East Anglia, USAID, WASH Advocates, WaterAid, Water Institute-

⁸ WHO/UNICEF. 2014. Meeting the fundamental need for water, sanitation and hygiene in health care facilities. World Health Organization, Geneva. http://www.who.int/water_sanitation_health/facilities/wash-in-hcf-madrid.pdf?ua=1

⁹ WHO/UNICEF, 2015. Water, sanitation and hygiene in health care facilities: urgent needs and actions. Meeting Report. http://www.who.int/water_sanitation_health/en/

¹⁰ WHO/UNICEF, 2015. Water, sanitation and hygiene in health care facilities: urgent needs and actions. Meeting Report. http://www.who.int/water_sanitation_health/en/

¹¹ WHO/UNICEF, 2015. Global Action Plan on WASH in Health Care Facilities Summary.

http://www.who.int/water_sanitation_health/healthcare_waste/wash-in-healthcare-facilities-action-plan.pdf?ua=1

University of North Carolina (UNC), Water Supply and Sanitation Collaborative Council (WSSCC), World Bank, World Health Organization (WHO; all regions), World Vision.

Government representatives from: Cambodia, Chad, Ethiopia, India, Liberia, Mali, Sierra Leone, Zambia and Zanzibar.

Health priorities represented: Health systems, Infection prevention and control (IPC), Maternal and newborn health (MNCH), Outbreaks and emergencies, quality Universal Health Coverage (UHC).

4. Task team priorities, example targets and milestones

Task teams have been operational since June 2015. The aims, progress and upcoming activities for each task team are listed below alongside the example targets set in the drafting of the action plan in March 2015.

4.1 Advocacy and Leadership

Aim: To advocate for global, regional and national action to improve WASH in health care facilities and support leaders dedicated to this effort.

Example target: WASH in health care facilities is embedded as a fundamental element of achieving global health outcomes including Universal Health Coverage, Women's, Newborn, Child's and Adolescent's Health, reducing antimicrobial resistance and the Global Strategy on Cholera Control by Year 1; 40 countries "commit" to providing universal access to WASH in health care facilities.

Activities achieved

- Global Advocacy Plan to align messaging and provide a framework for collective global advocacy impact agreed
- WASH in HCF highlighted as core to maternal and newborn health, quality UHC, health system resilience, and IPC at events across all regions
- Advocacy briefs produced on WASH in HCF and quality UHC, MNCH, coordinated action for WASH and Health actors and the global action plan.

Areas for further work and development

- Hold a side event at the 69th World Health Assembly showcasing early adopting countries' progress and activities to date and encourage other member states to take action
- Document and share success stories from at least 5 early adopting countries to provide examples of how change occurs to drive improvement in WASH in HCF
- Develop materials for low and middle-income countries to commence and lead work on WASH in HCF

4.2 Monitoring

Aim: To develop, test and revise core and expanded indicators to track WASH in HCF.

Example targets: Harmonized indicators for WASH in health care facilities are finalised, used and reported on in global monitoring and national service delivery assessment and health specific assessments by Year 1; harmonized indicators are used and reported on in at least 5 HMIS by Year 2.

Activities achieved

- Revised set of core and expanded indicators produced. Review of indicators on-going

Areas for further work and development

- Define what constitutes a basic level of service for formal monitoring of the SDGs
- Implement core and expanded indicators in the Service Availability and Reliability Assessment (SARA) in 3 or more countries by the end of 2016 and support regions/countries in use of indicators in planned assessments (Peru, Kazakhstan, 10 countries in EMRO)
- Support adoption of core indicators in national health monitoring information systems and reporting

4.3 Research and Knowledge

Aim: To draw on and extend the evidence base to support increased investments, quality improvements and advocacy efforts.

Example target: Evidence is analysed and synthesized to inform key advocacy materials and health sector planning and budgeting discussions. Key operational research priorities are identified to inform improved implementation and uptake at the facility level in Year 1.

Activities achieved

- Conducting review and developing basis for conducting Burden of Disease analysis on WASH in health care facilities
- Conducted case studies and conducting review for summarizing key evidence on care seeking and WASH in health care facilities

Areas for further work and development

- Complete Burden of Disease analysis and use information to inform advocacy, further research and cost/benefit analyses
- Identify priority research and knowledge areas and develop plan for execution and application

4.4 Standards and Facility Improvements

Aim: To develop a suite of field-tested tools, training and reference materials for a variety of facilities and settings.

Example targets: Risk management and quality improvement tools are developed and implemented in 10 countries by Year 1. Training materials are integrated into training platforms, including IPC, for all health facility staff, including medical, cleaning and maintenance staff, in 5 countries by Year 2. WASH in health care facilities standards are considered and negotiated by 15 additional countries by in Year 1; 30 additional countries by Year 2; and 45 additional countries by Year 3.

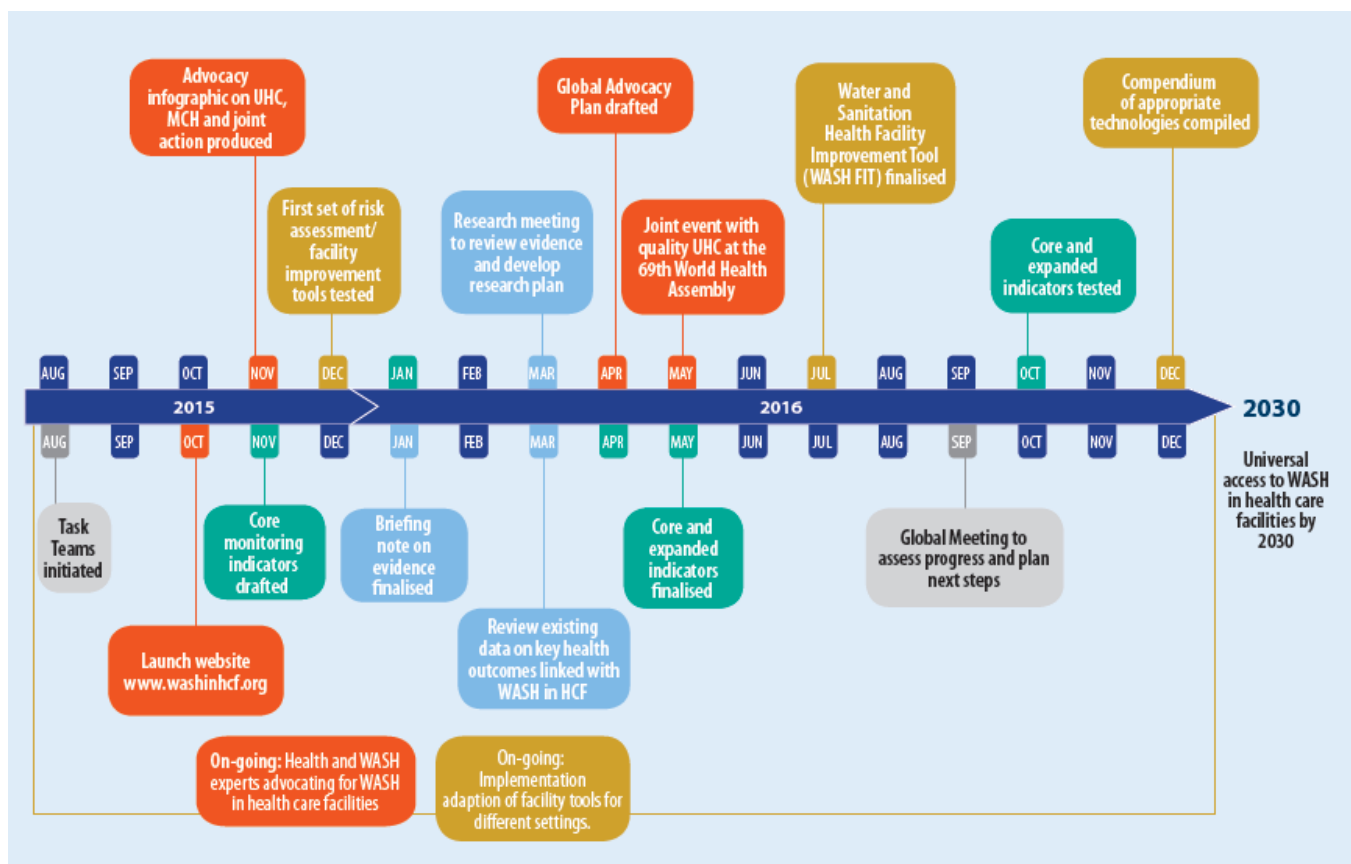
Activities achieved

- Developed and tested risk-based tool for improving and maintaining WASH services (WASH FIT - Water and Sanitation for Health Facility Improvement Tool) in Chad, Liberia and Mali; global review of tool and dissemination on-going
- Compiling and reflecting on country case studies (currently 10; target 30)

Areas for further work and development

- Develop compendium of technologies for a variety of settings on water, sanitation and health care waste technologies with a specific focus on low-cost, low-maintenance, environmentally friendly solutions
- Organize multi-country WASH FIT workshop to sensitize relevant ministries and WHO focal points on WASH FIT methodology and to share experiences of country capacity building, starting in West Africa
- Conduct costings of WASH improvements and operation to inform implementation as well as economic and cost benefit analyses

5. Planned timeline and deliverables



6. Knowledge portal

A knowledge portal (www.washinhcf.org) was developed and launched in October 2015 to share updates on the global action plan and provide an open-access source of information related to all global WASH in HCF work. The site provides a platform to share the latest knowledge and tools for improving WASH in HCF, share advocacy messages and materials for use by a wide group of stakeholders and to showcase global and national improvement initiatives and the lessons learned from such efforts.

An additional portal to help engage wider audiences will be provided through the WHO Global Learning Laboratory for Quality Universal Health Coverage to be launched in 2016. This learning lab will provide a venue for knowledge sharing, challenging ideas and sparking innovation towards advancing the journey towards quality UHC. One of the designated “learning pods” will focus on WASH, which will contribute to a wider understanding of improving quality UHC.

7. Regional engagement and leadership

There are many on-going regional and national efforts as part of the global action plan. A summary of regional updates is presented below.

7.1 Africa

WASH FIT (Water and Sanitation for Health Facility Improvement Tool) has been rolled out in three countries: Chad, Mali and Liberia. A number of other countries (Ghana, Guinea Bissau, Madagascar, Senegal) have shown interest to use WASH FIT. Two national workshops were recently held in Chad to mark the completion of a three-year project on WASH and Cholera to discuss how to integrate WASH into health initiatives. The 13 health care facilities involved in the project have begun to implement WASH FIT and several have already made simple, low-cost improvements to their WASH services. In Liberia, a WASH Package national training of trainers covering the whole country was held between November 2015 and February 2016. In addition, a meeting of the three Ebola countries was held in Monrovia in February to finalise a set of IPC and WASH indicators which will be

integrated into national assessments. Furthermore, UNICEF through a joint work plan with WAHO (West Africa Health Organization) is developing a regional WASH HCF strategy within the framework of health systems strengthening for ECOWAS.

7.2 Europe

WASH in HCF has been proposed to be included as part of an expanded priority on institutions under the 2017-2019 programme of work under the Protocol on Water and Health, a multilateral policy framework in the water, sanitation and health domain for the 53 Member States in the WHO European Region. The Protocol will serve to be a regional platform to support WASH in HCF national target setting, programming and assessments. Additionally, WHO is supporting a national survey of WASH in HCF in Kazakhstan for testing the draft WASH in HCF indicators.

7.3 Middle East

WHO is supporting assessments of WASH in HCFs in four countries. These assessments include aspects of governance and policies as well as monitoring services in facilities. A regional consultation meeting will be held in August 2016 to develop a road map for improving WSH in HCFs. Several countries have also expressed interest in piloting WASH FIT.

7.4 South and East Asia

WASH in HCF session was organised during the South-East Asia Regional Technical Advocacy Group and commitments were made to include WASH in HCF by all stakeholders and program managers at the meeting. WASH was assessed in 15 HCF in Kathmandu after the earthquake and services have been improved. Assessments have been made in Bhutan and there are plans to strengthen national standards and monitoring mechanisms. In India, an assessment of primary health care centres in Ganjam district in Orissa has been completed. Furthermore, there has been a revision of WASH assessment tool box and application in 20 urban HCF and a training video for health care waste management in rural HCF is being developed.

7.5 East Asia and the Pacific

In Cambodia, WHO has supported a pilot assessment to inform a large scale assessment in 2016 being designed to gain a thorough understanding of the status of WASH in HCF. This will inform future monitoring for JMP and the SDGs in Cambodia. With the Ministry of Health (MoH), they are exploring how WASH in HCF will be a core component of the MoH's Health Strategic Plan 3 through improving standards, monitoring, training and improving the minimum package of activities to include WASH in HCF. They plan to implement WASH FIT in facilities and identify key priorities for improvements and upgrades. UNICEF is supporting climate resilient solutions in Pacific Island Countries and also undertaking monitoring assessments for baseline information on WASH in HCF in Fiji and Solomon Islands.

7.6 Americas

PAHO will host a learning event on WASH in health care facilities to share lessons learned and support capacity building in the PAHO region at the Inter-American Congress of Environmental and Sanitary Engineering (Cartagena, Columbia; 20-24th August 2016). Furthermore, PAHO and AIDES are piloting a survey for WASH in HCF in Peru and undertaking water quality testing at facilities in Haiti using mobile-phone technology.

8. Health-driven action

The responsibility for ensuring that health care facilities have WASH services lies primarily with health authorities and within health systems. However, both WASH and health actors play a critical role in providing and maintaining WASH services, supporting hygiene practices by health staff, patients and their families, and practices in facilities are sustainably met and financed.

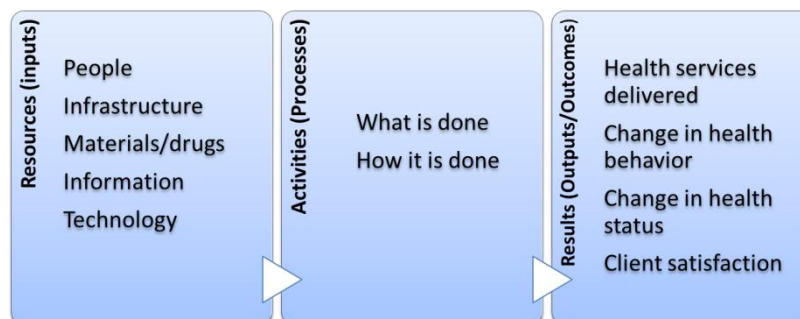
8.1 Universal Health Coverage, Quality & WASH

Universal Health Coverage is defined as ensuring that all people can use the promotive, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does

not expose the user to financial hardship. This has also been a concept with strong affirmation in its place within SDG target 3.8. However, a crucial part of the success of this target lies with the establishment and security of water, sanitation and hygiene (WASH) structures and practices in health care facilities as essential for providing people-centered health services.

Improving resources and activities to drive quality driven outcomes has been advocated for decades. In 1980, Avedis Donabedian highlighted the positive relationship between investments in inputs and processes to achieve desired health outcomes and improve client satisfaction. Such elements depicted in Figure 1 are crucial for quality within the context of the rapidly evolving landscape of universal health coverage (UHC) that will shape health systems across the world.

Figure 1: Donabedian Model for Inputs, Processes and Outcomes. 1980



Focused attention to the triangulation between quality, UHC and WASH can catalyse improvements in a number of areas. For example, a systematic review of 54 studies on quality and maternity services found that while the interpersonal behaviour of the care giver was the most highly correlated with satisfaction, cleanliness and availability of functioning toilets and drinking-water were also important factors influencing perceptions of quality.¹² These findings are supported by cross-section studies in India and Bangladesh where the patient rating of services was highly correlated with clean toilets, availability of drinking-water and hand hygiene facilities.^{13, 14} Patients who are satisfied with their experience are more likely to cooperate with their health care provider. Thus, WASH has a direct and indirect impact on both the perception of quality services from the perspective of people both receiving and delivering care, as well as the technical outcome of reduced health care-associated infection due to effective and efficient WASH practices.

At the national level, UHC driven reform processes open a window for the development of national quality policies and strategies thus providing an opportunity to embed WASH within long term sustained health systems efforts. The development of such policies and strategies need to be documented to articulate the clear linkage between quality universal health coverage and the important role of WASH in strengthening and driving local health systems to achieve UHC.

There is a clear need to co-develop thinking with countries to identify practical ways of improving quality of care through improvements in WASH. These in-depth country cooperation efforts will seek to address key barriers and potential levers for better WASH services in health care facilities all within the context of quality UHC. Lessons learned will contribute and inform the global knowledge and evidence base.

8.2 Infection, Prevention and Control & WASH

¹² Bleich SN, Özaltın E, Murray CJ. How does satisfaction with the health-care system relate to patient experience?. Bulletin of the World Health Organization. 2009 Apr;87(4):271-8.

¹³ Hasan A. Patient satisfaction with MCH services among mothers attending the MCH training institute in Dhaka, Bangladesh. Masters' Thesis. Mahidol University, Faculty of Graduate Studies; 2007

¹⁴ Ray SK, Basu SS, Basu AK. An assessment of rural health care delivery system in some areas of West Bengal-An overview. Indian journal of public health. 2011 Apr 1;55(2):70.

Globally hundreds of millions of people are affected every year by avoidable infections in health care and this does not take account of the additional harm caused by outbreaks of highly transmissible disease. In addition infections caused by multidrug-resistant organisms are increasing worldwide and action to address antimicrobial resistance (AMR) is a WHO priority. IPC forms one part of the solution to the problem of AMR and is highlighted as one of five strategic objectives within WHO's Global Action Plan¹⁵. By 2017 all WHO Member States must develop national action plans on AMR and this will provide up-to-date evidence of the state of IPC and WASH at the health care facility level.

IPC is of universal relevance across every level of the health system and is a central component of safe, high quality service delivery at the facility level within the context of UHC driven health systems. A significant percentage of health care-associated infections (HAI) are preventable through low cost interventions. Strategies to prevent HAI i.e. IPC interventions have been placed internationally within the "top 10 patient safety strategies ready for adoption now" - hand hygiene singled out as an intervention whose implementation should be widely adopted¹⁶. To maintain a global focus on IPC, each year WHO catalyses action on hand hygiene through its Save Lives Clean Your Hands 5 May campaign, positioning hand hygiene as the "entrance door" to safer health service delivery. The campaign ignites action across a network of 18,365 health care facilities in 174 countries to improve IPC in all countries and promotes targeted, appropriate and timely hand hygiene in support of both IPC and WASH (including addressing the lack of water). Working to a WHO recommendation and formulation over 30 countries have been noted as producing alcohol-based handrub at local level to facilitate hand hygiene at the point of patient care.

There is a clear synergistic relationship between IPC and WASH, particularly in LMICs, most recently demonstrated through the collaborative work between WASH and IPC teams in West Africa¹⁷ as the three Ebola-affected countries progress their national action plans. A central message emerging from Guinea, Liberia and Sierra Leone has been consensus on the need for WASH improvements as a prerequisite for achieving minimum standards for health care facilities and the community, to enable both higher levels of safety and the implementation of IPC programmes. The need for better coordination between WASH and IPC, including on the development of common approaches to monitoring has also been highlighted and is currently being addressed at the level of WHO through the development of "common indicators."

The WASH and IPC interface is further illustrated in both the recent and forthcoming IPC activities supporting surgical site infection prevention. The vulnerable surgical population requires water and sanitation for safe, quality care. Specifically the WHO IPC global unit has worked with 5 African countries to successfully implement a surgical-unit based safety programme. Finally, aligned to both the AMR agenda and the post-Ebola work to strengthen country capacity to prevent future outbreaks of highly transmissible diseases, 2016 will see the development and issue of country-level guidance on what constitutes the core elements of IPC programmes at the national and facility level and will have direct relevance to WASH in health care facilities. The guidance will support countries in their evidence based priority setting as they pursue UHC. In summary WASH and IPC are the foundation of safe and effective health services and the attainment of quality UHC. Strengthening IPC and WASH will require continued advocacy, resources and data-driven action at the policy level to prevent avoidable harm and death of vulnerable people accessing health services.

8.3 Maternal, Newborn, Child and Adolescent Health

The recent launch of the Global Strategy for Women's, Children's and Adolescents' Health (2016-2030)¹⁸ provides an opportune moment to strengthen engagement with and action on WASH in HCF as part of a wider movement to end preventable maternal, newborn, child and adolescent deaths. The strategy has three main objectives; survive, thrive and transform. WASH generally, is linked with all three and WASH in HCF has particular importance for both mortality and morbidity and achieving the related SDG 3 targets in this area.

¹⁵ http://www.who.int/drugresistance/global_action_plan/en/

¹⁶ Shekelle PG, Pronovost PJ, Wachter RM, et al. Top 10 Patient Safety Strategies that can be encouraged for adoption now *Ann Intern Med* 2013; 58(5 Pt 2):365-8.

<http://annals.org/article.aspx?articleid=1657884>

¹⁷ <http://www.who.int/csr/disease/ebola/ipc-meeting-liberia/en/>

¹⁸ The Global Strategy for Women's, Children's and Adolescents' Health. 2016.

http://globalstrategy.everywomaneverychild.org/pdf/EWEC_globalstrategyreport_200915_FINAL_WEB.pdf

Under this global umbrella, WHO, UNICEF and partners are actively working on improving quality of care in maternal and child health services. One particular effort is the development and implementation of a quality care package for facility-based maternal and newborn care around the time of child-birth. This is a period when both mother and child are especially vulnerable and where, if quality of health services is improved, significant gains could be made in reducing maternal and newborn mortality. The framework for this package is based on both the provision of care and the experience of care. There are eight core elements to this framework, one of which is essential physical resources, which includes WASH in HCF, energy and adequate stock of medicines and supplies. The WASH indicators in the framework are drawn from the core indicators developed by the monitoring task team and WHO essential environmental standards. WHO is currently in the process of identifying an initial set of 5-7 countries where the complete package, including providing quality care and the experience of care, will be delivered. A related activity is the Every Mother and Every Newborn Quality Improvement Initiative which is being conducted in Ghana, Tanzania and Bangladesh. This is a one year operational research study that includes a comparison of control and intervention facilities to test the effectiveness of a comprehensive quality improvement approach which includes WASH, as a means to improve the outcomes maternal and neonatal care.

Another area within maternal, newborn, child and adolescent health where WASH in HCF is embedded is the WHO/UNICEF Global action plan on ending childhood pneumonia and diarrhoea¹⁹. The action plan includes universal targets on WASH in HCF and provides an opportunity to address services alongside vaccine and child health programmes. GAPPD is currently being implemented in a number of countries and provides a platform for greater advocacy, action and learning and monitoring on WASH in HCF.

8.4 Additional target health priorities and topics for action

While UHC, MNCH and IPC remain the key priorities for mainstreaming WASH in HCF, other health priorities and topics are recognized as important. These include AMR and prioritizing WASH in HCF as part of the implementation the aforementioned Global Action Plan on AMR; emergency response, recovery and long term health system resilience; and, ensuring that all these areas prioritize the needs of women and girls and populations most in need.

9. Way Forward

The initiative on WASH in health care facilities has raised the profile of this important issue globally, regionally and nationally. In the short-term, demonstrating concrete progress on the ground and further mainstreaming WASH within health programming and financing will be important. Specific areas of further focus and additional work include:

- Broader engagement with countries. Seek concrete commitments and support ongoing improvements and action with clearly defined global knowledge exchange mechanisms.
- Addressing emergencies: how to engage effectively and work within the continuum of emergency response, recovery and long-term change.
- Financing: development of costing tools and assessments on the cost effectiveness and cost benefits of WASH in HCF.
- Further mainstreaming within health with a focus on the context provided by quality UHC. Continuing and expanding existing efforts and broadening to include public and private health actors.

WHO, UNICEF and partners look to the global community to provide feedback on these issues and further shape and refine the global action plan, with a focus on ensuring that those countries and facilities most in need will have the basic WASH services they need to provide safe, quality and people-centered care.

To address this, three targeted workshops to be hosted in March 2016 have been designed to develop a framework for estimating the burden of disease associated with WASH in health care facilities, review evidence more broadly and develop research priorities, and review progress on implementing the global action plan and agree on key strategic directions for the

¹⁹ WHO/UNICEF, 2013. Global action plan for prevention and control of pneumonia and diarrhoea (GAPPD). http://www.who.int/maternal_child_adolescent/documents/global_action_plan_pneumonia_diarrhoea/en/

action plan moving forward. These workshops will all help inform activities and serve as an important milestone before the third Global Meeting which is scheduled for September 2016. A strong focus will be on mainstreaming WASH in health care facilities as core to health efforts and initiatives, including but not limited to, maternal and child health, quality universal health coverage (qUHC), IPC, health systems resilience and emergencies and responsiveness.

Appendix 4: Summary of WASH and health care associated infections

Summary literature review Water, Sanitation and Hygiene in Health Facilities Burden of Disease Workshop

Convened by WHO, UNICEF, SHARE at LSHTM

(March 21-22, 2016)

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1. Background

The Director General of the World Health Organization (WHO) has declared that improving water, sanitation and hygiene (WASH) in health care facilities (HCF) is an urgent priority (WHO, 2013). Furthermore, there is an opportunity to highlight the essential role of WASH in achieving this universal health coverage and specifically providing quality, people-centered care (Action for Global Health and WaterAid, 2014; Figure 1). In 2015, WHO and UNICEF conducted the first ever global a review of data representing 66,101 facilities in 54 low- and middle-income countries (LMIC). This report concluded that 38% of facilities lack access to water source, 19% do not have improved sanitation facilities and 35% do not have access to soap and water or alcohol based handrubs for hand washing (WHO, 2015). These findings are consistent with other published estimates for the prevalence of WASH in health facilities where births occur (Benka *et al*, 2014; Velleman *et al*, 2014). Large disparities exist within countries and among types of facilities, for example major surveys counted a facility providing water services even if those services were more than 500m away; a contradiction to the WHO *Essential Environmental Health Standards in Health Care*, 2008) (WHO,

2015).

Similarly, policies to support WASH in HCF are lacking. According to the 2014 UN-Water Global Analysis and Assessment of Sanitation and Drinking-water (GLAAS) findings, only one quarter of countries have policies on WASH in HCF that are implemented with funding and regular review (WHO, 2014). The implications for health are severe: spread of infections in the very place in which patients are seeking care. In response to these urgent needs, WHO, UNICEF and partners committed to address the situation at a global meeting²⁰, with the aim of *achieving universal access in all facilities, in all settings by 2030*. The work on this global action plan focuses on four main areas: advocacy and leadership; monitoring; evidence and research; facility based improvements.

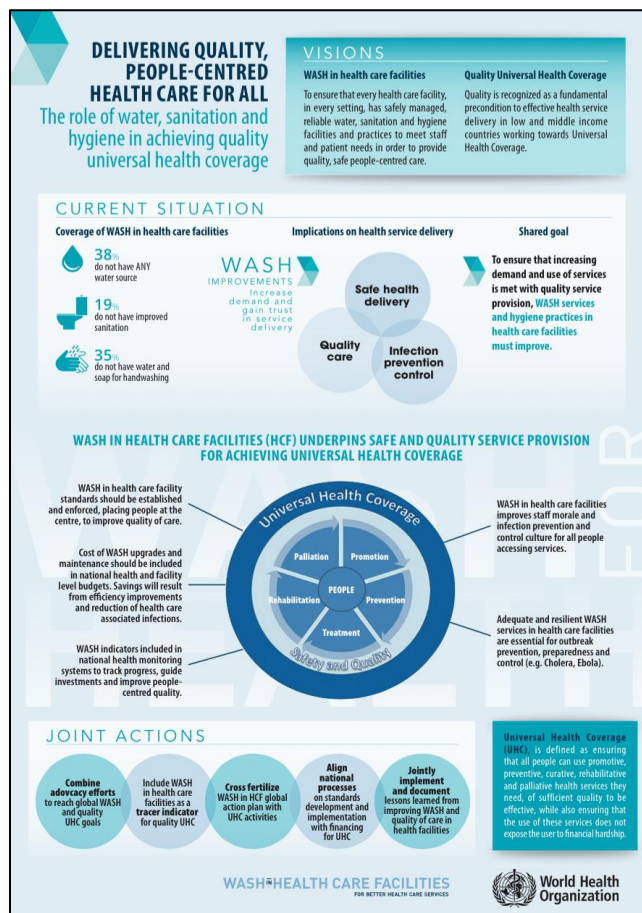
In contribution to the key areas of global work, three meetings will take place at the London School of Hygiene and Tropical Medicine (LSHTM) in March 2016 to advance work on both research and evidence and the global action plan to address WASH In HCF. One of these meetings will specifically convene relevant researchers to advance work on a burden of disease (BoD) framework for health care associated infections (HCAI) and their association with inadequate WASH in HCF in LMIC. In order to effectively address deficient WASH services in HCF, we will need to address the gap in research, monitoring data gained through national and sub-national surveys of services and policy reviews in HCF. To inform these discussions and expedite progress, an exploratory review was needed to assess the quality and extent of available evidence particularly with regard to the key parameters for a burden of disease of analysis (population exposure and disease burden estimates, and relative risk estimates).

2. Introduction – WASH in HCF and HCAI

An evaluation of if, how and to what extent WASH influences HCAI, will benefit a number of broader areas of work including advocacy and strengthening leadership and economic analyses on the costs of not providing sufficient WASH services. It will also help to identify entry points where WASH might support existing strategies such as the WHO ‘Clean Care is Safer Care’ Programme, which aims to protect patient safety and reduce HCAI through universal implementation of Infection, Prevention and Control (IPC) measures (WHO, 2015), the work being carried out WHO, UNICEF and partners to improve quality of care in maternity and paediatric care facilities by providing evidence-based standards, including for WASH and supporting WASH service improvements (WHO, 2011; WHO, 2016). Finally, a greater understanding of the evidence will support WASH improvements within broader health systems strengthening efforts, including the provision of people-centered care. Recent efforts to triangulate WASH in HCF, quality and universal health coverage (UHC) are promising first step in this work (WHO, 2016; Figure 2.1).

²⁰ WHO/UNICEF, 2015. *Water, sanitation and hygiene in health care facilities: urgent needs and actions*. Meeting Report. http://www.who.int/water_sanitation_health/en/

Figure 2.1: The role of WASH in achieving quality universal health coverage²¹



Improving WASH in HCF is attracting the attention of governments, donors and the international agencies. The WHO/UNICEF Joint Monitoring Programme has committed to reporting on access to WASH in HCF as part of monitoring the Sustainable Development Water and Sanitation Goal (Goal 6) and WASH in HCF has been proposed as a tracer indicator for UHC under Goal 3. Global health initiatives such as ‘Every Woman Every Child’, the integrated ‘Global Action Plan against Pneumonia and Diarrhoea’, and quality of care during childbirth highlight the importance of basic, universal WASH services in HCF (WHO, 2015).

2.1 Definitions of Water, Sanitation and Hygiene (WASH)

Water, sanitation and hygiene (WASH) services include water availability and quality, presence of sanitation facilities and availability of soap and water for hand washing. The WHO document *Essential Environmental Health Standards in Health Care* describes essential environmental health standards for health care in low resource settings (WHO, 2008). It also describes methods for supporting the development and implementation of national government policies. The standards cover: water quality, quantity, water facilities and access to water, excreta disposal, wastewater treatment and disposal, health care waste disposal as well as other environmental issues.

²¹ http://www.who.int/water_sanitation_health/facilities/wash-and-quality-uhc.pdf?ua=1. Last accessed 17.03.2016

2.2 Burden of Health Care-Associated Infections (HCAI)

Health care-associated infections (HCAI) are infections that patients acquire while receiving treatment for medical or surgical conditions. HCAI are separated into four categories: Urinary Tract Infections (UTI), Bloodstream Infections (BSI), Ventilator Associated Pneumonia (VAP) or Hospital Associated Pneumonia (HAP) and Surgical Site Infections (SSI). HCAI is a major problem for patient safety and its impact can result in prolonged hospital stay, long-term disability, increased resistance of microorganisms to antimicrobial agents, a massive additional financial burden for the health system, high costs for patients and their families, and excess deaths. The risk of acquiring HCAI is universal and pervades each of the five domains of health-care (home based, ambulatory, primary, secondary and tertiary care) worldwide.

The global burden of HCAI remains uncertain because of the difficulty in gathering reliable data, particularly in LMIC. Multiple systematic reviews of the literature do not provide a clear picture of the endemic burden of HCAI in LMIC (Zaidi *et al*, 2005; WHO, 2011; Allegranzi *et al*, 2011;); however, it is clear that the global HCAI burden is large and the HCAI burden is more acute in LMIC. Many studies conducted in HCF with limited resources report HCAI rates higher than in HIC (Figure 1). HCAI affect hundreds of millions of patients every year, with 15.5% of patients estimated to develop one or more infections during a hospital stay in LMIC compared to 7.6% of patients in HIC (WHO, 2011; Allegranzi *et al*, 2011). Zaidi *et al* (2005) found that this disparity was particularly high for newborns with 3-20 times higher rates of neonatal HCAI in LMIC compared to HIC (Zaidi *et al*, 2005) (Table 2.1).

The review by Zaidi *et al* (2005) found that 4-56% of neonatal mortality in hospital-born babies was attributable to HCAI and notably a higher 8-84% of neonatal mortality in community-born babies was attributable to the same source of infections (Zaidi *et al*, 2005). In addition, Ganatra and Zaidi (2010) noted that there are higher rates of omphalitis (cord infection) in community settings than facilities and this may indicate a high burden of HCAI that may be ignored with the exclusion of the home based care/domestic birth domains in the global disease estimates. In the case of domestic birth settings, 54% of births are in domestic birth settings in sub-Saharan Africa (Campbell *et al*, 2015). Neonates may, also, rarely come to seek medical attention for sepsis-related mortality diminishing the BoD for surveillance systems (Ganatra and Zaidi 2010). The risks associated with sepsis in neonates are 34 times greater in low resource settings (Oza *et al*, 2015). Drawing from data across 65 countries and 1,267,404 neonatal deaths, Oza *et al* found neonatal mortality was 15.6% due to sepsis, 4.9% pneumonia, 1.7% tetanus and 0.6% to diarrhoea (Oza *et al*, 2015)

Table 2.1: Summary table of data extracted from reviews comparing summary statistics for HCAI in LMIC and HIC. (Zaidi *et al*, 2005; Srivastava *et al*, 2007; Ganatra & Zaidi, 2010; Allegranzi *et al*, 2011; WHO, 2011; Oza *et al*, 2015;)

	LMIC	HIC
Pooled Prevalence	15.5 per 100 patients	7.6 per 100 patients
Incidence Density	4.1-91.7 episodes per 1000 patient days	13-20.3 episodes per 1000 patient days
Pooled Incidence Density	42.7 episodes per 1000 patient days	17.0 episodes per 1000 patient days
Surgical Site Infection (SSI)	11.8 per 100 patients	1.2-5.2 per 100 patients
Neonatal Mortality	3-20x higher rate of neonatal HCAI	1-5 per 1000 live births
Neonatal Mortality Attributable To HCAI	4-56% hospital-born deaths attributable to HCAI	*
	8-84% community-born deaths attributable to HCAI	
Neonatal Incidence Density	40.8 episodes per 100 patients	*

Neonatal Incidence Density	30.0 episodes per 1000 patient days	*
Prevalence in Intensive Care Unit (ICU)	2-3x higher rate of ICU patients acquire HCAI	30 per 100 ICU patients acquire HCAI
Device Associated Infection	13x higher rate of device associated HCAI	*

*missing data

2.3 Plausibility of WASH associated to HCAI

Adequate WASH is an essential component of providing basic health services, yet alone quality services (WHO, 2013). The provision of WASH in HCF serves to prevent infections and spread of disease, protect staff and patients, and uphold the dignity of vulnerable populations including pregnant women and the disabled. Yet, many HCF in low resource settings lack basic WASH services, lack basic equipment, inadequate infrastructures, compromising the ability to provide safe care and presenting serious health risks to those seeking treatment. These factors are much more inherent in to the situation and reality of LMIC, in addition to the general determinants of HCAI similar to HIC.

The biological plausibility of HCAI pathogens coming from facilities with sub-standard WASH services is very strong (Table 2.2) (Allegranzi *et al*, 2011; Zaidi *et al*, 2005; WHO, 2011). The majority of organisms are directly linked to the environmental contamination of HCF, for example through low quality water or poor hand hygiene or contaminated equipment and surfaces. Many have been isolated in such locations in studies (Allegranzi *et al*, 2011; WHO, 2011).

During the review process, a lack of data on other potential HCAI particular to LMIC was noted. These HCAI may have included other pathogen-causing agents of diarrhoea, cholera, Ebola, typhoid, Hepatitis E Virus, typhus, etc.

Table 2.2: Summary of pathogens associated to HCAI and their biological association to WASH standards in HCF

	Common Aetiological Agents/Isolates found in LMIC	Location found and biological plausibility to WASH standards	Examples of infections/disease
>1.0% culture confirmed infections	<i>Staphylococcus aureus (inc. MRSA);</i> <i>Coagulase-negative staphylococci;</i> <i>Klebsiella spp (inc. ESBL);</i> <i>Escherichia coli;</i> <i>Pseudomonas spp (inc. MDR);</i> <i>Acinetobacter spp;</i> <i>Enterobacter spp;</i> <i>Enterococci;</i> <i>Candida spp</i>	Contaminated water, unimproved sanitation, hand hygiene practices, colonised patient skin, naturally occurring in the gastrointestinal tract, direct from soil, biofilms on surfaces and equipment	Pneumonia; Meningitis; Blood stream infections (BSI); Osteomyelitis; Endocarditis; Toxic shock syndrome; Bacteremia; Sepsis/septicaemia; Diarrhoea; Enterocolitis; Necrotizing enterocolitis; Gastroenteritis; Omphalitis; Phlebitis.
<1.0% culture confirmed infections	<i>Others include: S. pneumoniae, Listeria spp, Citrobacter, Salmonella spp., Proteus spp, Serratia spp, N. meningitidis, Haemophilus spp, Flavobacterium meningosepticum etc.</i>		

Lack of access to water and sanitation in HCF may also discourage women from giving birth in these facilities or cause delays in care-seeking (Velleman *et al.*, 2014) although we did not identify rigorous studies that document this. In addition, pregnant women are at high risk from HCAI themselves and the global maternal mortality estimates found

a 9.7% prevalence of sepsis-related deaths, independently of the place of birth, (and other related infections) in 2013 (Kassebaum *et al*, 2014).

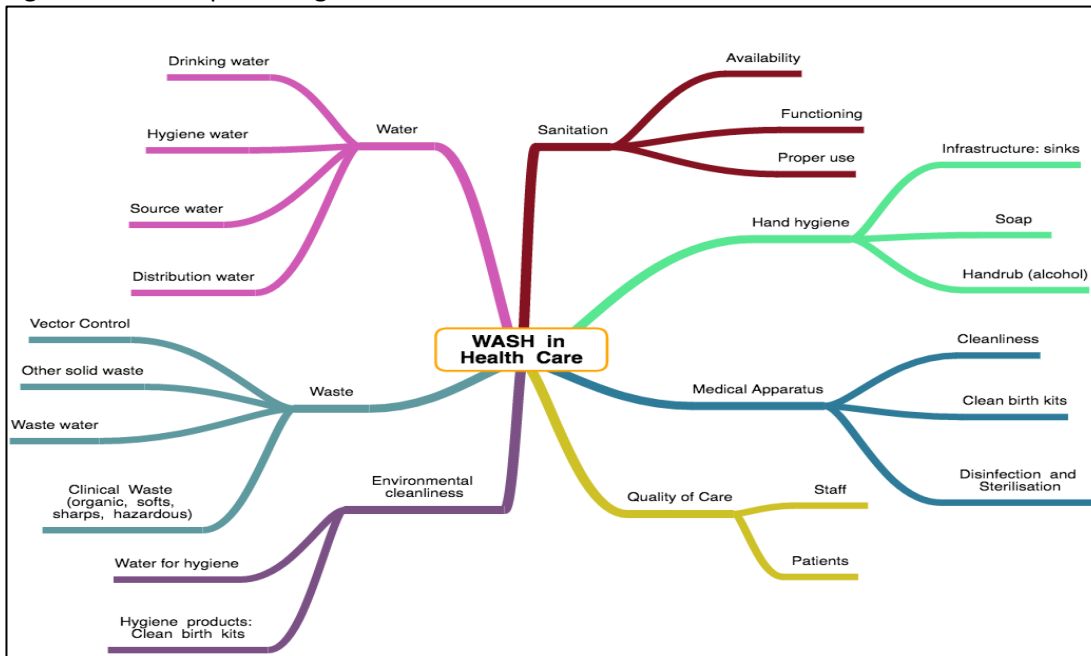
3 Aims and approach

Within the limited timeframe available for this summary review, we agreed four objectives with the aim of assessing the WASH-related burden of disease (BoD):

1. Review HCAI published literature to assess the role of WASH risk factors
2. Review WASH epidemiological literature to identify studies in HCF settings and/or effects on HCAI
3. Assess the role and relative importance of WASH in the five HCAI domains
4. Develop an example search strategy for a formal systematic review

Our approach was rapid and pragmatic, making efficient use of existing review articles and contacting lead authors where appropriate/feasible. The methods are described below, but in brief summary, for objectives 1 and 2 we used identified reference lists from existing systematic reviews for re-review, and, for objective 3, we conducted a limited exploratory review. Before conducting this work, we first defined the key terms (WASH, HCF, HCAI) and using a broad conceptual diagram to guide the reviews (Figure 3.1) and identify areas of interest.

Figure 3.1: Conceptual diagram for WASH in HCF



4. Methods

Objective 1: Existing reviews on the burden of HCAI

We identified two recent systematic HCAI burden of disease reviews, by WHO (2011) and Allegranzi *et al* (2011) and re-reviewed the titles and abstracts of included studies (n=2313, n=220 respectively) for WASH related associations and/or aetiologies of HCAI and assessed effects for sub-groups of interest [pregnant women, neonates, children, PLWHA/immunocompromised, chronic ill and elderly] (Table 4.1).

From the WHO (2011) report, we received an Endnote library of 2313 papers from the research team. We conducted a rapid review of titles and any available abstracts for associations to WASH for key search terms “water” AND/OR “sanitation” AND/OR “waste” AND/OR “environment” AND/OR “contamination”. We attempted to differentiate if the paper was from a LMIC or HIC.

From the Allegranzi *et al* (2011) paper, we received the extracted data sets from the research team on the final 220 papers included into the review. The same title and abstract search was repeated.

Table 4.1: Burden of disease reviews investigated

Type of assessment	Author	Title	# papers	Population
Systematic review and meta-analysis	WHO, 2011	Report on the Burden of Endemic Health Care-Associated Infection Worldwide: A systematic review of the literature	2312 (276 reported LMIC papers)	Adult and child
Systematic review and meta-analysis	Allegranzi <i>et al</i> , 2011	Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis	220	Adult and child

Objective 2: Existing reviews on disease reduction from WASH interventions

We firstly identified, by expert opinion, a number of recent WASH systematic reviews (Table 4.2) for the effect of WASH interventions on different health outcomes through an exploratory review. We extracted the included studies, as reference lists, and re-reviewed these to identify WASH intervention studies conducted in HCF and/or relevant health outcomes (HCAI, maternal mortality, neonatal mortality and diarrhoeal disease in HCF)

Table 4.2: WASH systematic reviews re-reviewed

Author, Year	Title	# of studies	Outcome	Intervention
Included				
Benova <i>et al</i> , 2014	Systematic review and meta analysis: association between water and sanitation environment and maternal mortality	14	Maternal mortality	W, S
Kwok, 2014 (LSHTM MSc thesis)	Association between water, sanitation and hygiene in birth settings and neonatal infections and mortality in low and middle income countries: a systematic review and meta-analysis	19	Neonatal mortality	WASH
Ejemot-Nwadiaro <i>et al</i> , 2015	Hand washing promotion for preventing diarrhoea	22	Diarrhoea (1 facility based)	H
Blencowe <i>et al</i> , 2011	Clean birth and postnatal care practices to reduce neonatal deaths from sepsis and tetanus: a systematic review and Delphi estimation of mortality effect	38	Neonatal mortality	H
Brito <i>et al</i> , 2007	Effect of neonatal intensive care unit environment on the incidence of hospital-associated infection in neonates	1	Neonatal mortality	H
Excluded				
Clasen <i>et al</i> , 2015	Interventions to improve water quality for preventing diarrhea (Cochrane)	55	Diarrhoea	W
Clasen <i>et al</i> , 2010	Interventions to improve disposal of human excreta for preventing diarrhea (Cochrane)	13	Diarrhoea	S
Peletz <i>et al</i> , 2013	Water, sanitation, and hygiene interventions to improve health among people living with HIV/AIDS: a systematic review	10	Diarrhoea morbidity and mortality	W, H
Stelmach <i>et al</i> , 2015	Household water quantity and health: a systematic review	21	Diarrhoea, trachoma and growth	W

3.1 Objective 3: What is the role and importance of WASH in different HCAI domains?

The appropriate level of WASH access and the associated disease burden nature and magnitude likely varies by the five domains of HCAI – primary, secondary, tertiary, ambulatory and home-based – and by HIC and LMIC settings. To strengthen our conceptual approach, we have rapidly reviewed the aforementioned (Objective 1 and 2) literature on the five domains (home based care, ambulatory, primary, secondary and tertiary care) of HCF and considered their relative BoD importance in LMIC and the potential importance of WASH as a risk factor.

3.2 Objective 4: Develop potential search string for a through systematic review

In addition to the original three more pragmatic search strategies, we have developed a search strings for a full systematic review (Annex 2) and ran these strings to assess the volume of results.

4 Results

4.1 Objective 1 - WASH in HCAI literature

We first reviewed the WHO (2011) report on the burden of endemic HCAI worldwide which identified 276 articles (126/276 high quality papers) on the burden of HCAI in LMIC. We received a database of 2313 papers but not a

defined list of the 276, a rapid title search was undertaken to narrow the search. The second review of Allegranzi *et al* (2011) identified 220 articles (180 in adult and 40 in paediatric and child populations) (Table 4.1). From a brief review, neither review examined in detail the associations to WASH or included this in their risk factor analysis.

From the 2313 papers received from WHO, a title search returned only 12 papers which directly assessed associations of HCAI to contaminated water source (n = 1), potable water (n= 2), distribution water (n= 3), hygiene water (n=5) or water used for sterilization (n= 4) (Table 5.1). The conceptual map has been used to (Annex 1) to depict the evidence available (Annex 1).

We were unable to differentiate the HIC papers from the LMIC in our title search of the 2313 papers. We would need full access to the abstracts in order to denote study site and relevance for inclusion of our review of only LMIC papers.

From the Allegranzi *et al* (2011) paper, we assessed all the titles included in the review and the risk factors for HCAI identified by the review team in their data extraction process. We found that none of 220 papers included WASH characteristics in the titles of their papers nor in the authors' examination of HCAI risk factors. The review team had included risk factors such as length of stay, age, prematurity and presence of underlying disease. The environmental source of the outbreaks was not identified in the objectives of the study.

4.2 Objective 2: HCAI in WASH literature

We have identified 8 published relevant systematic reviews and 1 unpublished (MSc thesis from LSHTM). From the 9 reviews we were able to extract data from facility-based outcomes in only 5 of the systematic reviews. We created a single reference list by searching and extracting articles with HCF-based WASH interventions and effects on HCAI (and other outcomes including neonatal mortality, maternal mortality and diarrhoea) from the identified systematic reviews (Figure 4). Associations found in the papers have been noted and collated. In addition, we are still searching for more reviews to cover missing topics (Table 5.2). The conceptual map has been used to (Annex 1) to depict the evidence available (Annex 1).

4.3 Objective 3: WASH in the five HCAI domains

The focus of health care provision varies between LMIC and HIC and we needed to consider the extent to which WASH is more or less important across the five health care facility domains, as defined by WHO (WHO, 2011). Of the five HCAI domains 'home-based care' and 'ambulatory care' may be of much greater importance in LMIC versus HIC and there may be important implications for WASH in HCF (WHO, 2011; Benova *et al*, 2014).

In particular, the literature on 'home-based care' and HCAI focuses mainly on home visits, palliative care and elderly residential homes of HIC whereas in LMIC there persists a major gap in this literature (WHO, 2011). Home-based care in LMIC may specifically include domestic births and community health workers. In the case of domestic birth settings, 54% of births are in domestic birth settings in sub-Saharan Africa (Campbell *et al*, 2015). There is a suggestion that there is limited exposure or access to WASH facilities in home-based care and may alter the HCAI estimates entirely (Campbell *et al*, 2015; Ganatra and Zaidi, 2010; Zaidi *et al*, 2005).

Ambulatory care can be defined as outpatient care services, HCF waiting rooms and mobile centres. In many settings, ambulatory care appears to be hidden in the HCAI estimates (WHO, 2011). An example given by the WHO (2011) report suggested that patients seeking care in waiting rooms might acquire respiratory infections, especially in overcrowded facilities in LMIC. This example is not limited to the patient but may extend to those accompanying patients, waiting homes, mobile clinics or visiting.

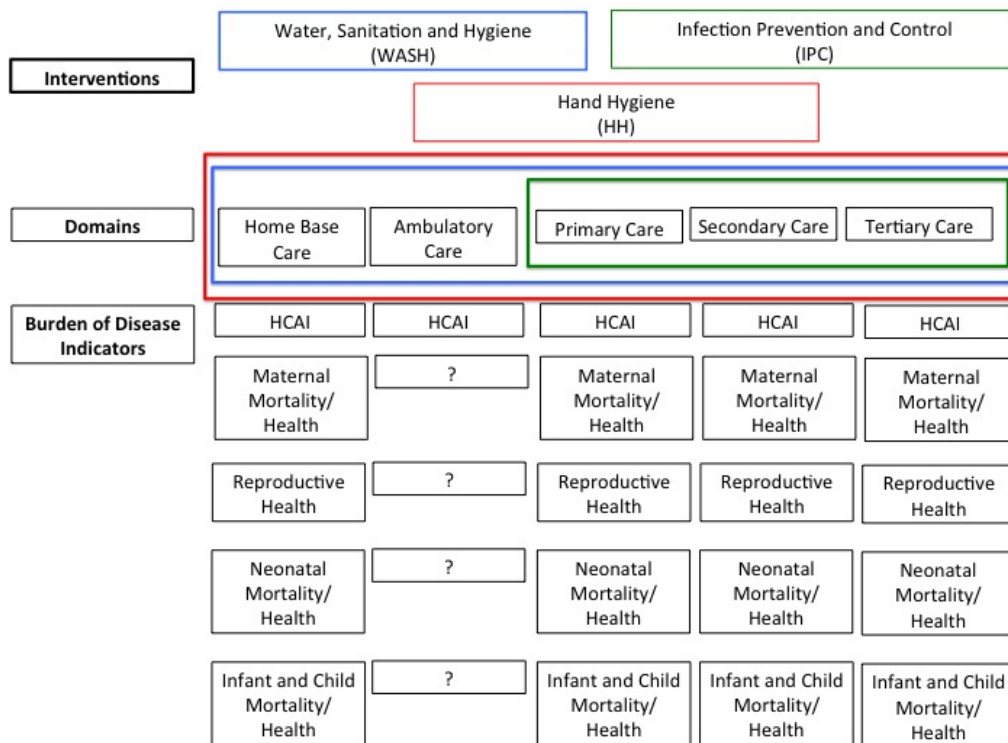
Primary, secondary and tertiary care are more traditionally used and known in both LMIC and HIC, however there are still significant differences in environmental standards and provision of care in these facilities compared to those in HIC. All reviews on the burden of HCAI have indicated that the majority of HCAI studies in LMIC come from tertiary facilities and thereby biasing global estimates towards a higher level of facility in more wealthy settings (Allegranzi *et al*, 2011; WHO, 2011; Zaidi *et al*, 2005).

We put the five domains into a diagram for analysis of how the WASH, IPC and HH **should** all interplay across the domains. This was paired to potential outcomes of each domain and how this fits into BoD estimation (Figure 5.1). Here we could see how each sector would work together or highlight areas of concern.

With limited data on the realistic burden in different HCF domains, we used three main reviews by Campbell *et al* (2015); Benova *et al* (2014) and Blencowe *et al* (2011). All three papers were able to discuss the limitation of not including home-based care into surveillance systems. Blencowe *et al* (2011) reported four studies with a reduced risk of neonatal tetanus in facilities compared to domestic birth settings indicating higher levels of HCAI in home based care settings. Through the maternal health framework developed by Campbell *et al* (2014), the authors also noted that domestic birth settings increase the risk for both mother and child. However, Benova *et al* (2014) note that although facility-based births were on average better than home environments they were far from universally WASH-safe, particularly at the primary or secondary HCF level. The large variation in WASH services both in domestic and facilities in LMIC are vast and that any potential associated disease burden falls disproportionately on the poorest (Benova *et al*, 2014).

With household surveillance and data available in most settings, the reviews note the lack of cohesion between the HCAI, maternal and neonatal health and WASH sectors in highlighting WASH-related risks in home based care settings.

Figure 5.1: Diagram showing the 5 HCAI domains in relation to different interventions and disease outcomes



5 Conclusions

This review exercise was undertaken to assess the evidence linking improvements in water, sanitation and hygiene (WASH) in health care facility (HCF) settings to health care associated infections (HCAI) and other important aggregate health outcomes, such as maternal and neonatal mortality. The purpose of the review was to assess the existing evidence with regard to undertaking a burden of disease analysis to estimate the preventable fraction of disease for improvements in WASH in HCF, including all five domains of HCAI – home-based, ambulatory, primary, secondary, tertiary care. Throughout we maintained a deliberate focus on LMIC settings, due to fact that low HCF and domestic WASH coverage is concentrated in these countries as is the HCAI, and the broader attributable WASH disease burden.

With the limited time and resources available we adopted a rapid and pragmatic approach, focusing on re-reviewing published systematic reviews to identify where (1) WASH-related factors had been identified in studies of HCAI and where (2) WASH reviews have identified HCF-level interventions and/or reported HCAI outcomes. Lastly, (3) we considered the potential importance of WASH in the five HCAI domains and how this might vary between HIC and LMIC settings. Our review revealed a significant body of work supporting multiple plausible links between WASH conditions in each of the five HCAI domains and HCAI and other related health outcomes. Our review also suggests that these issues are likely more acute in LMIC due to co-distribution of poor WASH coverage in HCF settings and a high HCAI burden.

Given the rapid nature of this review, there are a number of limitations relating to both our methods and the literature identified and reviewed. In the time available we were not able to conduct systematic reviews but instead were confined to existing reviews, none of which explicitly addressed the main question posed ('What is the effect of WASH on HCAI?') although two did consider WASH (Benova et al 2014, Kwok 2014) and hygiene (Blencowe et al) in relation to related health outcomes (maternal mortality, neonatal morbidity, neonatal infections). A dedicated systematic review or reviews would no doubt reveal more relevant studies that might enable a meta-analysis for the effect of WASH interventions in the five domains on HCAI. The review of the two HCAI reviews (Allegranzi et al 2011; WHO 2011) was confined to titles, key words, and abstracts, and our view is that a full text review of all these shortlisted papers (n=496) would identify additional studies that assessed WASH as a potential risk factor for HCAI or for reported environmental contamination in HCF, enabling a more in-depth synthetic analysis.

The HCAI literature is skewed towards HIC settings due to the availability of reliable surveillance data and a far greater level of research investment. This presents two challenges for this review: (1) a potential bias towards HIC in terms of the prevalent exposures and outcomes described; (2); and, linked to this, the generalisability of findings may be limited with regard to LMIC. For those studies conducted in LMIC, the majority included were conducted in tertiary facilities, with few in secondary and primary facilities, where WASH coverage is lowest (WHO 2015; Benova 2014) and none for home-based or ambulatory care which may have greater importance in LMIC due to, for example, the high proportion of home births in LMIC. For these reasons, the burden of HCAI disease in LMIC may be under-reported and the role of WASH under-estimated in this literature.

In summary, we present three conclusions for discussion at the workshop:

1. It is plausible that a significant HCAI disease burden is associated with poor WASH, and that this problem is most acute in LMIC and may affect vulnerable groups more severely
2. There are a number of exposures (different WASH interventions in different domains) and outcomes (specific HCAI and aggregate outcomes) that warrant further, more systematic investigation

3. A burden of disease analysis for WASH in different HCF/HCAI domains would be an a valuable addition to the evidence base and would support international and national policy dialogue around the role of WASH in achieving quality UHC,

And a number of potential research questions for discussion;

1. What evidence is there of successful strategies in LMIC to reduce HCAI burden?
2. What are the environmental sources of HCAI in the BoD papers?
3. What are the WASH related HCAI risks of ambulatory care in LMIC?
4. To what extent does WASH-related HCAI vary by domain?
5. Which groups are most vulnerable to HCAI and how does WASH affect them?
6. How can community and facility surveillance data be merged to better understand the burden and causes of HCAI relating to WASH in LMIC?

6 Additional Tables

Table 5.1: WASH sources of contamination or association to HCAI

WASH	Def.	Type of assessment	Author	# papers	Pop.	Outcome	Crude or adjusted associations	
Water	Potable (drinking) water	Aetiology	Aronson <i>et al</i> , 1999	1	PLWHA	HCAI	Potable water as source in HIV and non HIV patients	
		Aetiology	von Reyn <i>et al</i> , 1994	1	PLWHA	HCAI	Potable water as source in HIV and non HIV patients	
	Source water	Aetiology	Anaissie <i>et al</i> , 2002	1		HCAI	43 HCAI outbreaks from water sources	
	Distribution water	Aetiology	Bert <i>et al</i> , 1998			ICU	HCAI	Contamination traces to tap water used in nutritional solutions, sinks and hands of HCW
		Aetiology	Lowry <i>et al</i> , 1991	1		ICU	HCAI	Topical post operative exposure to tap water
		Aetiology	Trautmann <i>et al</i> , 2001	1		ICU	HCAI	Contamination of faucets with HCAI
	Hygiene water	Aetiology	Basset <i>et al</i> , 1970	1			HCAI	HCAI linked to contaminated disinfectant solutions
		Aetiology	Heal <i>et al</i> , 2003	1		ICU	HCAI	Residual tap water on surgeon's arms and gloves linked to HCAI
		Aetiology	Kauppinen <i>et al</i> , 1999			ICU	HCAI	Shower water linked to HCAI in leukaemia patient
		Aetiology	Lowry <i>et al</i> , 1991	1			HCAI	Tap water used to disinfect apparatus linked to HCAI
		Aetiology	Rogues <i>et al</i> , 2007	1			HCAI	Tap water on equipment and hands linked to HCAI

Sanitation	Access						
	Contamination						
Hand washing	Soap						
	Alcohol						
	Infrastructure						
Waste	Clinical waste						
	Solid waste						
	Vector control						
	Wastewater						

Medical apparatus	Disinfection and Sterilisation	Aetiology	Heal <i>et al</i> , 2003	1	ICU	HCAI	Residual tap water on surgeon's arms and gloves linked to HCAI
		Aetiology	Rogues <i>et al</i> , 2007	1	ICU	HCAI	Tap water on equipment and hands linked to HCAI
		Aetiology	Lowry <i>et al</i> , 1991	1	Hospital	HCAI	Tap water used to disinfect apparatus linked to HCAI
		Aetiology	Basset <i>et al</i> , 1970	1	Hospital	HCAI	HCAI linked to contaminated disinfectant solutions
Quality of care	Equipment						
	Clean surface						
Quality of care	Staff						
	Patients						

Table 5.2: Associations of WASH criteria to HCAI, maternal mortality, neonatal mortality and diarrhoea in health care facilities

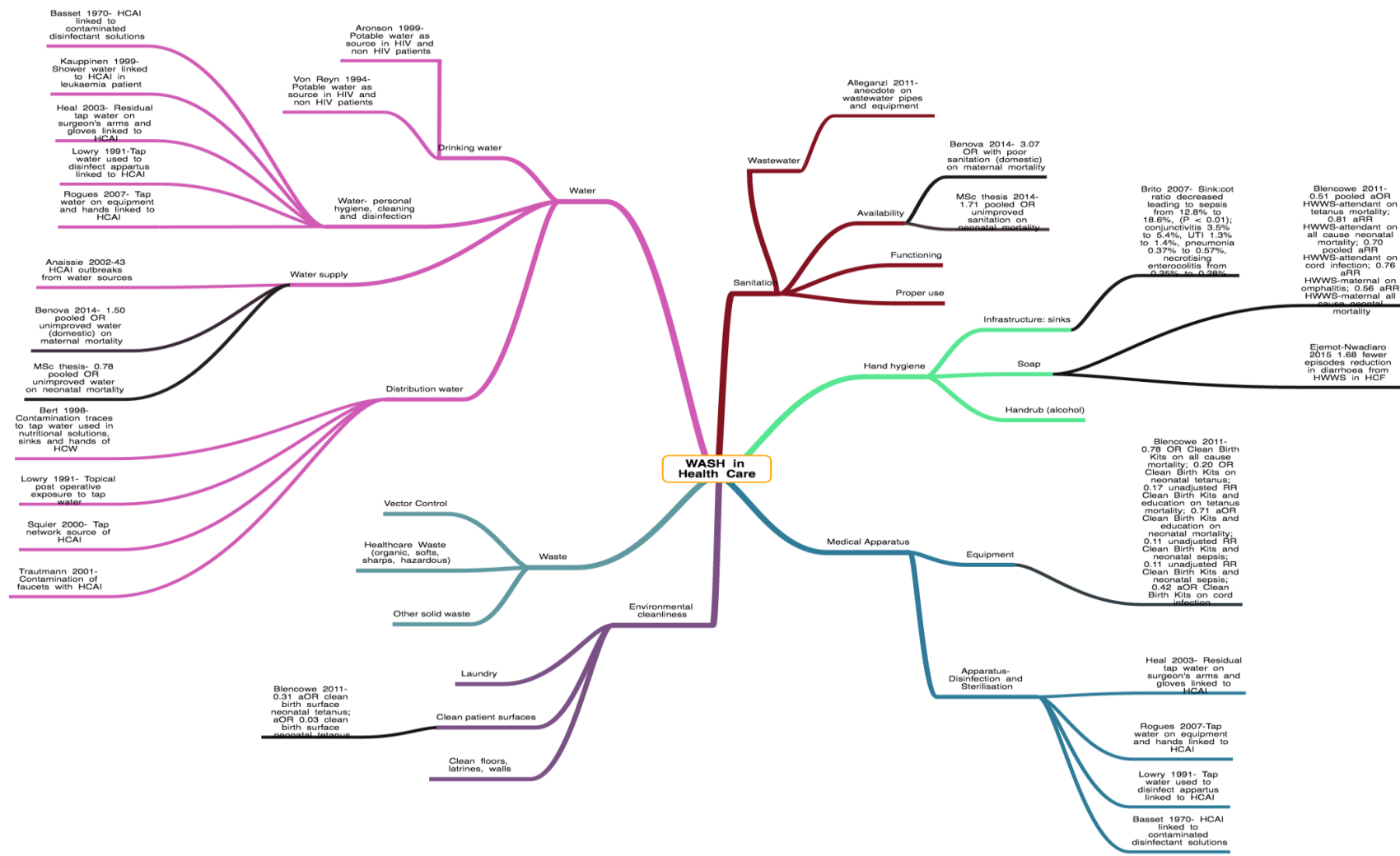
WASH	Def.	Author	# papers	Location	Pop.	Outcome	Crude or adjusted associations
Water	Potable (drinking) water	To find					
	Source water	Benova <i>et al</i> , 2014	14	Domestic	Pregnant women	Maternal mortality	1.50 pooled OR unimproved water (domestic) on maternal mortality
		MSc Student thesis, 2014	19	Birth settings	Neonates	Neonatal mortality	0.78 pooled OR unimproved water on neonatal mortality
	Distribution water	To find					
	Hygiene water	To find					
Sanitation	Access	MSc Student thesis, 2014	19	Birth settings	Neonates	Neonatal mortality	1.71 pooled OR unimproved sanitation on neonatal mortality
		Benova <i>et al</i> , 2014	14	Domestic	Pregnant women	Maternal mortality	3.07 OR with poor sanitation (domestic) on maternal mortality
Hand hygiene	Soap	Ejemot-Nwadiaro <i>et al</i> , 2015	22	1 Hospital	High risk PLWHA	Diarrhoea	1.68 fewer episodes

		Blencowe <i>et al</i> , 2011	38	Birth settings	Neonates	Neonatal mortality	0.51 pooled aOR HWWS-attendant on tetanus mortality; 0.81 aRR HWWS-attendant on all cause neonatal mortality; 0.70 pooled aRR HWWS-attendant on cord infection; 0.76 aRR HWWS-maternal on omphalitis; 0.56 aRR HWWS-maternal all cause neonatal mortality
	Alcohol	To find					
	Infrastructure	Brito <i>et al</i> , 2007	1	1 Hospital NICU	Neonates	Neonatal mortality	Sink: cot ratio decreased leading to sepsis from 12.8% to 18.6%, (P < 0.01); conjunctivitis 3.5% to 5.4%, UTI 1.3% to 1.4%, pneumonia 0.37% to 0.57%, necrotising enterocolitis from 0.25% to 0.28%
Waste	Clinical waste	To find					
	Solid waste	To find					
	Vector control	To find					
	Wastewater	To find					
Medical apparatus	Disinfection and Sterilization	To find					

	Equipment	Blencowe <i>et al</i> , 2011	38	Birth settings	Neonates	Neonatal mortality	0.78 OR Clean Birth Kits on all cause mortality; 0.20 OR Clean Birth Kits on neonatal tetanus; 0.17 unadjusted RR Clean Birth Kits and education on tetanus mortality; 0.71 aOR Clean Birth Kits and education on neonatal mortality; 0.11 unadjusted RR Clean Birth Kits and neonatal sepsis; 0.11 unadjusted RR Clean Birth Kits and neonatal sepsis; 0.42 aOR Clean Birth Kits on cord infection
Environmental cleanliness	Clean surface	Blencowe <i>et al</i> , 2011	38	Birth settings	Neonates	Neonatal mortality	0.31 aOR clean birth surface neonatal tetanus; aOR 0.03 clean birth surface neonatal tetanus
Quality of care	Staff	Blencowe <i>et al</i> , 2011	38	Birth settings	Neonates	Neonatal mortality	0.51 pooled aOR HWWS-attendant on tetanus mortality; 0.81 aRR HWWS-attendant on all cause neonatal mortality; 0.70 pooled aRR HWWS-attendant on cord infection; 0.76 aRR HWWS-maternal on omphalitis; 0.56 aRR HWWS-maternal all cause neonatal mortality
	Patients	Blencowe <i>et al</i> , 2011	38	Birth settings	Neonates	Neonatal mortality	0.76 aRR HWWS-maternal on omphalitis; 0.56 aRR HWWS-maternal all cause neonatal mortality

7 Annexes

Annex 1: Conceptual Map of WASH evidence base and HCAI



Annex 2: Search strings

1. Water Quality
(water adj3 (treatment or quality or cleaning or microbiology)) OR (water adj3 (purif* or chlor* or decontamination or filt* or disinfect* or floccul* or radiat* or irradiati* or sediment*)) OR (water adj3 (storage or recontamination or re-contamination)) OR (water adj3 (drinking or consumption)) OR MESH terms: Water Microbiology/ or Water Purification/ or Water Quality/ or Drinking Water/
2. Water Supply
(water adj3 (supply or availability or access or connect* or distance or improve* or distribut* or quantity or volume or piped or standpipe\$1 or handpump\$1)) MESH terms: exp Water Supply/
3. Sanitation
(toilet* or latrine* or pit or pits or sanita* or ecosan or "ecological sanita*" or privy or WC or "water closet") OR ((f\$eces or f\$ecal or excre* or waste or defecation) adj3 (disposal or manag* or service*)) OR (sewage or sewer\$1 or sewerage) OR "septic tank\$" OR "open defecation" MESH terms: Sanitation/ or Sanitary Engineering/ or Drainage, Sanitary/ or exp Waste Management/ or exp Waste Water/ or Toilet Facilities/
4. Hygiene
(hygiene or handwashing or hand-washing or (hand\$1 adj3 wash*) or (hand\$1 adj3 hygien*) or (hand\$1 adj3 clean) or (hand\$1 adj3 disinfect*) or (hand\$1 adj3 sterili*) or soap*) MESH terms: Hygiene/ or exp Hand Hygiene/ or Soaps/
5. Hospital settings
(hospital or ((health* or "health care" or medical or birth* or delivery) adj1 (centre* or center* or facilit* or institution* or setting*))) MESH terms:

Exp hospitals/ or exp health services
6. Maternal and Neonatal Mortality & Complications
<p>((maternal or pregnan* or labo?r or obstetric or postpartum or delivery or prenatal or antenatal or postnatal or neonatal or newborn or "new born" or infant or childbirth or puerper or abortion or miscarriage) adj3 (mortalit* or morbidit* or death* or fatal*))</p> <p>OR</p> <p>("still birth" or (preterm adj1 birth) or "low birth weight*" or "low-birth-weight*" or "pregnancy complication*" or "adverse pregnanc*")</p> <p>MESH terms: Maternal mortality/ or infant mortality/ or hospital mortality/ or fetal mortality/ or perinatal mortality/ or exp Pregnancy Complications, Infectious/ or Mortality, Premature/ or exp Infant, Premature/ or exp Infant, Low Birth Weight/</p>
7. Hospital-Associated Infections
<p>((hospital or ((health* or "health care" or medical or birth* or delivery) adj1 (centre* or center* or facilit* or institution* or setting*))) adj3 (associated or associated)) or nosocomial</p> <p>adj4</p> <p>(infection or disease or illness or sickness or bacteria or virus* or pathogen or parasite* or fung* or bacteraemia or sepsis or septic?emia or influenza* or "e. coli" or escherichia or Staphylococcus aureus or "S. aureus" or MRSA or pseudomonas or streptococc* or pneumon* or klebsiella or legionell* or "urinary tract infection" or tetanus or "clostridium difficile" or "c difficile" or enterococc* or enterobact* or enterovirus* proteus or "acinetobacter baumannii" or norovirus or "serratia marcescens" or chorioamnionitis or "intra-amniotic infection" or IAI or meningitis or endometritis or HIV or "human immunodeficiency virus" or cytomegalovirus or scabies or gastroenteritis)</p>
8. Hospital-Associated + MESH terms
<p>((hospital or ((health* or "health care" or medical or birth* or delivery) adj1 (centre* or center* or facilit* or institution* or setting*))) adj3 (associated or associated))</p> <p>AND</p> <p>MESH terms: Cross infection/ or exp Bacterial Infections/ or exp bacteria/ or exp Viruses/ or Surgical Wound Infection/ or exp Pneumonia/ or exp Escherichia coli/ or exp opportunistic infections/ or exp respiratory tract infections/ or exp sepsis/ or exp urinary tract infections/ or exp wound infection/ or exp Virus Diseases/ or exp Meningitis/ or exp Catheter-Related Infections/ or exp Skin Diseases, Infectious/ or exp Gastrointestinal Diseases/</p>
9. Epidemiological study
<p>(prevalence OR incidence OR risk OR exposure OR exposed OR outcome OR epidemiology OR epidemiological OR impact OR effect OR evaluation OR odds)</p>

Appendix 5: Review of care seeking behaviour and WASH services in health care facilities

Summary literature review to inform the Evidence to support change meeting Water, sanitation and hygiene in health care facilities

London, 24th March 2016

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Background

In 2015, for the first time, WHO and UNICEF assessed the status of WASH (Water, sanitation and hygiene) in health care facilities in low- and middle-income countries [1]. With nearly 40% of facilities lacking improved water, and nearly 20% without sanitation. In response to these urgent needs, WHO, UNICEF and partners committed to address the situation at a global meeting, with the aim of *achieving universal access in all facilities, in all settings by 2030*. Furthermore, the WHO/UNICEF Joint Monitoring Programme committed to reporting on access to WASH in health care facilities as part of monitoring the Sustainable Development Goal (SDG) of Water and Sanitation. WHO and UNICEF have established an action plan, along with task teams comprised of health and WASH professionals to drive forward progress in four main areas: advocacy and leadership; monitoring; evidence and research; facility based improvements.

In contribution to the key areas of global work, three meetings will take place in London in March 2016 to convene relevant researchers to discuss existing and needed evidence to effect and sustain change with the aim to improve WASH in Health care settings. In order to better inform and focus the discussions and action points, a review of the literature is needed to understand the quality and extent of evidence on a number of operational related issues. The review will not assess health impacts as that is being done in a separate review to inform the development of a burden of disease (BoD) framework.

Aims of the review

In the context of providing a comprehensive review of the evidence for discussion by experts attending the Evidence to Support Change meeting, five key areas should ideally be covered:

- **Costs and Economics:** Estimates of economic value of investments in WASH in health facility (e.g. cost-benefit, cost-effectiveness, cost-utility analyses) especially linked to efficiencies gained in service provision and infections averted
- **Care seeking:** Effect of improving WASH services on care-seeking behaviour and patient and staff satisfaction
- **Hygiene behaviour change:** approaches to improve hygiene practices and management of WASH facilities by health facility staff (medical and other staff), patients and their carers
- **WASH technology design:** links with health outcomes, end user and caregiver behaviours and needs, environmental impacts, cost and operation and maintenance requirements
- **Improving and maintaining WASH services:** key factors to facilitate (or thwart) ongoing improvements along with evidence on minimum and extended set of standards required to run an effective and efficient health facility

Approach

Due to the limited timeframe allocated to this review of the evidence, a pragmatic work plan was agreed with the coordinator. Firstly, focusing on the care seeking aspect as this was judged to be the most important and direct key area and secondly, define search strategies for the other four areas and possibly identify systematic reviews that would summarise the evidence.

Methodology/ search strategy

The initial search strategy was based on keyword search using Pubmed and Medline Ovid, combined and de-duplicated.

Cost and economics: “(Water OR Sanitation OR Hygiene) AND health care AND Cost AND developing country” → **1127 hits**

Care seeking: “(Water OR Sanitation OR Hygiene) AND health care AND (satisfaction OR acceptance) AND developing country” → **158**

Hygiene behaviour change: “(Water OR Sanitation OR Hygiene) AND health care AND (hygiene OR behaviour OR staff OR practice) AND developing country” → **2397**

WASH technology design: “(Water OR Sanitation OR Hygiene) AND health care AND (technolog* OR intervention) AND developing country” → **612**

Improving WASH services: “(Water OR Sanitation OR Hygiene) AND health care AND (improv* OR performance) AND developing country” → **1220**

Subsequently, search terms and strategy was refined using Mesh terms and searching Medline Ovid


Cost and economics: “WASH AND health care AND Cost”
(WASH OR Water OR Sanitation OR Hygiene) AND health care (Mesh: delivery of Health care) AND developing countries (Mesh) AND Cost → **149**

Care seeking: “WASH AND health care AND (satisfaction OR acceptance)”
(WASH OR Water OR Sanitation OR Hygiene) AND health care (Mesh: delivery of Health care) AND developing countries (Mesh) AND (satisfaction OR acceptance) → **86**

Hygiene behaviour change: “WASH AND health care AND (hygiene OR behaviour OR staff OR practice)”
(WASH OR Water OR Sanitation OR Hygiene) AND health care (Mesh: delivery of Health care) AND developing countries (Mesh) AND (hygiene OR behaviour OR staff OR practice) → **605**

WASH technology design: “WASH AND health care AND (technolog* OR intervention)”
(WASH OR Water OR Sanitation OR Hygiene) AND health care (Mesh: delivery of Health care) AND developing countries (Mesh) AND (technolog* OR intervention) → **152**

Improving WASH services: “WASH AND health care AND (improv* OR performance)”
(WASH OR Water OR Sanitation OR Hygiene) AND health care (Mesh: delivery of Health care) AND developing countries (Mesh) AND (improv* OR performance) → **382**

 Search results were combined and Endnote libraries are available

As the aim was to **focus on care seeking key area**, further search terms were trialled:

- (water OR hygiene OR sanitation) AND care seeking AND developing countries → **73**
- (water OR hygiene OR sanitation) AND health care AND developing countries → **2405**
- Health care AND (patient acceptance OR satisfaction) AND developing countries → **2070**
- health care AND (care seeking OR patient acceptance OR patient satisfaction) AND developing countries → **2393**
- (care seeking OR patient acceptance OR patient satisfaction) AND developing countries → **2532**

- (Patient acceptance of health care OR patient satisfaction) AND developing countries (all Mesh terms) → **1595** (adding delivery of health care did not change the final number)
- Health care facilities AND (patient acceptance OR satisfaction) AND developing countries → **515** apply a review filter → **20**
- Perceptions and care seeking AND developing countries → **91**
- Perceptions and care seeking → **2109**
- "Patient Acceptance of Health Care" AND (water OR sanitation OR hygiene) → **632**
- "Patient Acceptance of Health Care" AND (water OR sanitation OR hygiene) AND developing country → **58**
- Patients satisfaction AND developing countries → **507**
- "Patient satisfaction" plus review filter → **7506** several systematic reviews many not many relevant
- "Care seeking" plus review filter → **1872**
- Patient Acceptance of Health Care AND developing countries → **2439**
- Patient Acceptance of Health Care → **187910** (too high)
- (water OR hygiene OR sanitation) AND health care AND dignity → **23** many not relevant. There is no Mesh term for patient dignity, "exp Nurse-Patient Relations/ or exp Patient-Centered Care/" were selected based on suggestion

Additionally, very specific search terms were tested

- toilet AND (patient acceptance OR satisfaction) → **107**
- toilet AND (patient acceptance OR satisfaction) AND developing country → **2** (too low)

The issue is that each search combination produced a different set of papers. The final search strategy adopted is presented in Table 1. Additionally, reference lists were scanned for relevant papers about water, sanitation and hygiene, which were also assessed and included if relevant. Data was extracted using a standardised form.

Table 1: Combined search strategies for care seeking literature review

Search strategy	Number of papers retrieved	Number of papers examined
(WASH OR Water OR Sanitation OR Hygiene) AND health care (Mesh: delivery of Health care) AND developing countries (Mesh) AND (satisfaction OR acceptance)	86	32
(water OR hygiene OR sanitation) AND care seeking AND developing countries	73	37
"Patient Acceptance of Health Care" AND (water OR sanitation OR hygiene)	632	461
toilet AND (patient acceptance OR satisfaction)	107	87
patient satisfaction AND developing countries	507	367
Total	1405	984

Papers published 2000-2016 were examined

Results & Discussion

Search strategy

Five search combinations were used, this is because no single search strategy was deemed perfect to retrieve all relevant papers and there was a need to retrieve a reasonable number of papers to analyse during the allocated timeframe. A combination of specific and broad search words was adopted. For the search strategy number 5 "patient satisfaction AND developing countries", the majority of the papers were about oral health, vaccine acceptability and sexual health (including circumcision). Therefore, there is a need to discuss and

define optimal search strategy with experts (if this review is to evolve into traditional systematic review format).

Retrieved papers and relevant literature

The search strategy is far from perfect and consultations are welcomed to improve the relevance/effectiveness of the search strategy for all five key sectors. Therefore, the authors are well aware that the retrieved literature is incomplete and many papers are likely to be missing from this initial exploratory review. In addition, other limitations exist. These include publication in journals not indexed in widely used databases, which are likely to publish small scale studies relevant to Low and Middle Income Countries (LMICs). This limitation was highlighted when relevant papers from India were shared by an expert colleague working on WASH. In addition, grey literature and MSc and PhD theses were not considered. Another limitation was the difficulty to selectively retrieve studies from LMICs, because some of them were not categorised as such either using keywords or Mesh terms.

Care seeking behaviour/ patient satisfaction with health care and WASH

The literature about care seeking behaviour and patient acceptance of health care is rich in both High Income countries and LMICs. The issue is complex and has serious consequence on health and disease burden

Care seeking barriers are according to Nasrin and colleagues [2]

- The caretakers' inability to identify danger signs that should trigger appropriate care-seeking behaviour
- depending on local context: care seeking high in Pakistan and Mozambique and low in Mali and Bangladesh
- Cost, especially for medication
- Distance to the facility
- Impediments related to weather or social unrest,
- Dissatisfaction with the quality of care,
- Lack of supervision for other children at home
- Lack of transport

However, Afsana and colleagues [3] consider that "Barriers to using hospital care are not only related to socio-economic and cultural factors and geographic access but also to quality of services. Maternity services were found to be inadequate, unaffordable, insufficiently staffed and lacking medically trained professionals". In addition, Lack of skilled staff at primary health care level, complaints of abuse, neglect and poor treatment in hospital and poorly understood reasons for procedures, plus health workers' views that women were ignorant, also explain the unwillingness of women to deliver in health facilities and seek care for complications according to Kyomuhendo and colleagues [4]. Further details about barriers to care seeking and associated burden are extracted but not presented here. The barriers to care seeking could be characterised using the three delays model developed by Thaddeus and Maine [5]. The model comprises delay in deciding to seek care (delay 1), delay in reaching the health facility (delay 2) and delay in receiving quality care once at the health facility (delay 3) [6]. Delays in receiving care was responsible for 30% deaths in newborn babies in Uganda [6], 45% childhood deaths from diarrhoea and acute respiratory infections in Mexico [7] and increased the odds of intrauterine foetal death by 6.6 (95% CI 1.6, 26.3) for over an hour delays (compared to less than one hour) in "near-miss" Women in Afghanistan [8].

The WASH component was not predominant in the retrieved articles. In fact, 24 papers out of 984 had a WASH component warranting inclusion. The details of the papers and extracted data are presented in Table 2. The papers included cover various countries, settings and health care delivery systems. There is a strong evidence that health care facilities' infrastructure, amenities and cleanliness are one of the major components of patient satisfaction and care seeking behaviour. Indeed, unavailability of WASH facilities in delivery rooms were frequently cited as a major reason for women to prefer home delivery. Women expect - and rightly so - that health care facilities have adequate WASH, this is pivotal for their human right, dignity and infection prevention, however, this is not the case in many LMICs.

Table 2: Data extracted for WASH in health care settings and patient satisfaction/ care seeking behaviour

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
Gabrysch 2009 [9]	Still too far to walk: Literature review of the determinants of delivery service use	Low or middle income countries	Literature review (of review articles)	Identification of various factors related to delivery service use		Shortcomings in personal care at facilities are often coupled with shortcomings in hygiene and medical care. Women criticise dirty toilet facilities, lack of water and aseptic practices as well as lack of necessary drugs or too early Caesarean sections.	Perceived quality of care has an important influence on care-seeking behaviour. Perceived poor personal and medical quality of care, clash with culture and fear of procedures may decrease use.
Griffiths 2001 [10]	Understanding Users' Perspectives of Barriers to Maternal Health Care Use in Maharashtra, India	India	Cross sectional/ interviews	Identification of key social, economic and cultural factors influencing women's decisions to use maternal health care		Issues relating to safety and quality of care were reported as motivating factors in the decision to give birth at home: 'It was safe in the house and the nurse was present to do the delivery. In government hospital delivery room is not there. Toilet and water facilities are not there in public health centre properly. So I felt safe to give birth in house, (Taleghar, Pune).	Socioeconomic status was not found to be a barrier to service use when women perceived the benefits of the service to outweigh the cost, and when the service was within reasonable distance of the respondent's place of residence. Respondents identified the poor quality of services offered at government institutions to be a motivating factor for delivering at home.
MacKeith 2003 [11]	Zambian Women's Experiences of Urban Maternity Care: Results from a Community Survey	Zambia	Cross sectional/ community survey questionnaires	Examine access, coverage and quality of care in midwives run maternity service		74% would like to see improvements overall and 154/845 (18.23%) would like	

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
	in Lusaka					to see better hygiene in toilets and bathrooms at health facilities	
Caniza 2009 [12]	A practical guide to alcohol-based hand hygiene infrastructure in a resource-poor pediatric hospital	El Salvador	Observational study	Implementation of alcohol-based Hand Hygiene (HH) in five high-risk (of nosocomial infection) wards of a pediatric hospital	Installation of gel dispensers, and training nursing staff to maintain them. Evaluation of user acceptance, costs, and the practice and technique before and after installation.	Placement of 35 gel dispensers increased the ratio of HH stations to beds from 1:6.2 to 1:1.8. Alcohol gel was better tolerated than hand washing among 60 surveyed staff. HH practice increased from 33.8% to 40.5%; use of correct technique increased from 73.8% to 95.2%.	Alcohol gel can address some of the barriers to effective HH at resource-poor institutions, and its cost may be offset by reduction of nosocomial infection
Tessema 2015 [13]	Assessment of antiretroviral treatment (ART) care service provision in Tigray Region health centers, North Ethiopia	Ethiopia	Cross sectional study	Perceived levels of clients' satisfaction with health services at ART clinic level in health centres		Higher scores of satisfaction of services provisions were reported for courtesy and respect (95.80 %) followed by privacy (93.28 %). respondents' dissatisfaction with toilet cleanliness: 35.32 %	As for overall satisfaction, [AOR (adjusted odds ratio) for toilet cleanliness [AOR = 2.22 (95 % CI :1.62, 6.32)]]. Measures such as increasing access to ART service, availing clean toilet and ART drugs may further increase client satisfaction level clean toilets are required especially for HIV/AIDS patients to prevent different opportunistic and non-opportunistic co-infections
Gromulska 2014 [14]	Responsiveness to the hospital patient needs in Poland	Poland		describe the patients' opinions on treatment they received in hospital,		Availability of toilet paper (58% satisfied), cleanliness of toilet (47%), availability of soap (45%)	
Ezegwui 2014 [15]	Patients' satisfaction with eye care services in a Nigerian teaching hospital	Nigeria	cross-sectional study	evaluate patients' satisfaction with the care received		The majority, 220 (71.7%) were not satisfied with the	The main areas of dissatisfaction were the cost of service and toilet facilities

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
						toilet facilities, There is only one toilet for the patients and there is no running tap.	
Ray 2011 [16]	An assessment of rural health care delivery system in some areas of West Bengal-An overview	India	A cross sectional observational study	extent of utilization, strengths, weaknesses and gap as well as suggest recommendations in connection with health care delivery system		It was reported by 27% and 23% clients that toilets were 'not at all usable' and 'dirty needed cleaning' in the surveyed government institutions. Similarly only in 55% of the facilities safe drinking water was available for use. Restrooms were either of poor quality or the clients did not use it while it was not available only in 3% health facilities.	Cleanliness of the premises, face-lift (of public health centres), and clean toilet with privacy and availability of safe drinking water facilities could have an improved client satisfaction in rural health care delivery systems
Sudhan 2011 [17]	Patient satisfaction regarding eye care services at tertiary hospital of central India.	India	Descriptive study	To evaluate patients' satisfaction regarding eye care services		For clinic patients, majority were satisfied with toilet, water facilities and cleanliness (very high or high satisfaction) (0 judged these as average or poor but 27/160 did not answer the toilet and 1 each for water and cleanliness).	The participants expressed dissatisfaction for the long waiting period in clinics, poor cleanliness, and insufficient toilet facilities.
Kongnyuy 2009 [18]	Criteria-based audit to improve women-friendly care in maternity units in Malawi	Malawi	Cross sectional/ interviews	To assess and improve women-friendly care in maternity units in	The audit results were presented, and recommendations	Significant improvement were recorded for cleanliness of	Each health facility should assess the availability and functioning of toilets and bathrooms for guardians. Where available, they

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
				Malawi. Guidelines/ recommendations were made and a second audit was conducted 3 months later	made and implemented. A re-audit (involving 367 women) was conducted 3 months later and performance compared.	maternity wards (89.6 vs 97.0%; $P < 0.001$). However, there were no significant changes provision of a clean bathroom and toilet (83.6 vs 80.4%; $P = 0.282$)	should be kept clean and ensure that they are functional. Where not available, they should be requested from the District Health Office or the responsible authority Kaluluma Health Centre requested and had a new toilet renovated but no report on improvement was reported by the authors
Westaway 2003 [19]	Interpersonal and organizational dimensions of patient satisfaction: the moderating effects of health status	South Africa	A cross-sectional analytical study design	to identify the underlying dimensions of patient satisfaction for diabetic patients and determine the effects of demographic characteristics and health status on these dimensions Diabetic clinics black patients (out patients)		The most important items for satisfaction were: availability of a seat in the waiting area (0.73), availability of a toilet in the waiting area (0.70), and cleanliness (0.70) . This is factor II (organisational dimension), part of Orthogonal (VARIMAX) two-factor rotational solution for patient satisfaction	Amenities and attributes of care were central to the organizational dimension of patient satisfaction. Given lengthy waiting times in South Africa's public health facilities, it is not surprising that the availability of a seat and toilet in the waiting area featured so prominently. Cleanliness, was also perceived as an important satisfaction areas. As cleanliness is a major problem in all South African health facilities, and in other developing countries, this focus on cleanliness was to be expected.
Galukande 2015 [20]	Developing hospital accreditation standards in Uganda	Uganda	Cross sectional	Whereas accreditation is widely used as a tool to improve quality of health care in the developed world, it is a concept not well adapted in most developing countries for a host of reasons, including insufficient incentives,	Describe refining, use and outcomes of a self-assessment hospital accreditation tool developed for a resource-limited context.	Among accreditation items i) physical infrastructure and ii) infection control and waste management are relevant to WASH. 31/ 40 hospital reported having an infection protocol in place, but only half was tracking needle stick injuries	Infection control: the lack of sterilization services is once again shown in this survey as a major non-compliance. Inadequate capacity to sterilize equipment undermines efforts to control nosocomial infections link to BoD review Good performance was measured in outreach programs, availability of some types of equipment and running water , 24-h staff calls

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
				insufficient training and a shortage of human and material resources.		to staff or vermin control. 11/40 hospitals were not tracking infection rates even for selected important procedures like caesarean sections. Only one-third had fully functional Central Sterile Supply Department equipment. Not a single hospital had a fully reliable autoclave or adequate storage for sterile instruments.	systems, clinical guidelines and waste segregation. Poor performance was measured in care for the vulnerable, staff living quarters, physician performance reviews, patient satisfaction surveys and sterilizing equipment.
Tumlinson 2015 [21]	Quality of Care and Contraceptive Use in Urban Kenya	Kenya	Cross sectional	In much of Sub-Saharan Africa, contraceptive prevalence remains low and unmet need for family planning remains high. It is hypothesized that the poor quality of family planning service provision is a barrier to contraceptive use		78.5 % of facilities (N=260) has running water Private exam rooms, running water, electricity and basic items often used in family planning provision were each available at most facilities (79–95%).	Facility infrastructure and most aspects of client satisfaction—including privacy issues, the amount of information given, waiting time and overall satisfaction—were unrelated to contraceptive use.
Woldeyohanes 2015 [22]	Perceived patient satisfaction with in-patient services at Jimma University Specialized Hospital, Southwest Ethiopia	Ethiopia	Cross sectional	This study aims to measure and describe the level of patient satisfaction within inpatient health care services		Toilet cleanliness: 18.5% were satisfied while 81.5% were dissatisfied However, 76.6% were satisfied with cleanliness of the ward	Patient satisfaction is critical to ensure how well patients do; many research clearly identified a link between patient outcomes and patient satisfaction scores
Srivastava 2015 [23]	Determinants of women's satisfaction with maternal	Developing countries	Systematic review	to identify determinants of		<u>Good physical environment</u> was	Determinants of maternal satisfaction covered all dimensions

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
	health care: a review of literature from developing countries			women's satisfaction with maternity care in developing countries While increasing service availability and maintaining acceptable quality standards, it is important to assess maternal satisfaction with care in order to make it more responsive and culturally acceptable, ultimately leading to enhanced utilization and improved outcomes.		significant in women's positive assessment of the health facility and maternal care services. In Bangladesh, mothers who rated the availability of services at the facility (a composite of waiting area, drinking water , clean toilet and waiting time) as 'good' were significantly more satisfied with care than those who rated the services as 'poor'. <u>Cleanliness</u> , good housekeeping services and <u>maintenance of hygiene</u> were reported as determinants of satisfaction in studies in Bangladesh, Gambia, Thailand, India and Iran.	of care across structure, process and outcome. Structural elements included good physical environment, cleanliness, and availability of adequate human resources, medicines and supplies. Process determinants included interpersonal behaviour, privacy, promptness, cognitive care, perceived provider competency and emotional support. Outcome related determinants were health status of the mother and newborn. Access, cost, socio-economic status and reproductive history also influenced perceived maternal satisfaction. Process of care dominated the determinants of maternal satisfaction. Interpersonal behaviour was the most widely reported determinant, with the largest body of evidence generated around provider behaviour in terms of courtesy and non-abuse. Other aspects of interpersonal behaviour included therapeutic communication, staff confidence and competence and encouragement to labouring women.
Khamis 2014 [24]	Patients' level of satisfaction on quality of health care at Mwananyamala hospital in Dar es Salaam, Tanzania	Tanzania	Cross sectional	to determine patients' level of satisfaction on the quality of health care delivered at the out-patient department		Patients' level of satisfaction mean gap score was (-2.88 ± 3.1) indicating overall dissatisfaction with the quality of care. respondents were dissatisfied with	Anonymous, structured SERVIQUAL questionnaire was adapted and then adopted to address the study objectives. The SERVIQUAL questionnaire is divided into five service dimensions (tangibles, reliability, responsiveness, assurance and

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
						<p>general cleanliness at (-0.50; SE =0.045; p < 0.001), and sufficient chairs and toilets at OPD (-0.67; SE = 0.047; p <0.001). (calculated as follows Mean perception Score (SE) 2.26(.035) and Mean score expectation (SE) 2.93(.034) → Mean gap score (SE) -0.67(.047)</p>	<p>empathy) to determine patients' level of satisfaction on quality of care. According to SERVIQUAL questionnaire, the questions to assess patients' level of satisfaction are in two categories: 1) expectation and 2) perception questions.</p>
Philibert 2014 [25]	No effect of user fee exemption on perceived quality of delivery care in Burkina Faso: a case-control study	Burkina Faso	A quasi-experimental design with both intervention and control groups	assessing whether women's satisfaction with delivery care is maintained with a total fee exemption	In the intervention group, delivery care is free of charge at health centres	<p>Women in both the intervention and control groups were satisfied or very satisfied in 90% of cases (in 31 of 34 items).</p> <p>The poorest women were more highly satisfied with delivery environment than the wealthiest ones (likelihood ratio test, p = 0.049 and 0.05 in intervention and groups respectively), especially concerning hygiene and comfort.</p>	<p>Patients are often inclined by courtesy to respond positively to questions on satisfaction with the quality of care received. This level of courtesy is even higher for satisfaction on interpersonal relationships between care providers and patients.</p> <p>Other biases: intimidation by the male interviewer and non-sampling of remote households due to limited access caused by the flood</p>
Mohammed 2013 [26]	Assessing responsiveness of health care services within a health insurance scheme in Nigeria: users' perspectives	Nigeria	retrospective, cross-sectional survey	examines the insured users' perspectives of their health care services' responsiveness		<p>Users were particularly contented with quality of facilities (42.8%), dignity (42.3%), and choice</p>	<p>The concept of responsiveness is multi-dimensional and can be measured across various domains including prompt attention, dignity, communication, autonomy, choice of provider,</p>

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
						<p>of provider (40.7%). Quality of facilities include having enough space, seating places and fresh air in the waiting and examination rooms as well as hospital wards as well as a clean facility and clean toilets in the hospital</p> <p>Low income IUs (insured users) reported better quality of facilities than high income IUs ($p < 0.001$; impact = 1.70).</p>	<p>quality of facilities, confidentiality and access to family support. Responsiveness is included in patient satisfaction and quality of care literature, but is a distinct entity that refers to the way individuals are treated and the environment in which they are treated when seeking health care</p> <p>Our study agrees with others in finding that “quality of basic facilities” (clean waiting rooms, toilet facilities, examination rooms and surroundings) is important to patients in their experience of responsiveness from health care services</p>
Mbwele 2013 [27]	Quality of neonatal health care in Kilimanjaro region, northeast Tanzania: learning from mothers' experiences	Tanzania	A cross sectional study using qualitative and quantitative approaches	assess mothers' experiences, perception and satisfaction of neonatal care in the hospitals		<p>The level of hygiene was assessed. Small proportion of mothers (2%) discussed issues in hygiene among the peripheral facilities. One mother 20 years old, mentioned that the facility should “increase the level of hygiene here.” Toilets at referral hospital were as expected (59%) while bathroom hygiene level was better than expected</p>	<p>27 mothers (33.8%) reported to face problems in making a decision to seek care at a health facility, while at the referral hospital, 4 mothers (12.5%) reported to face problems. 49 responses were collected from mothers who reported to face problems in making a decision to go to a facility (primary delay). The most common response was for quality of treatment at the facility reported 27 times (55.1%) followed by cost of medical care, reported 16 times (32.6%). Parameters for second delays were distance from home 5 times (11.1%) and combined distance and transport at a frequency of 3</p>

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
							times (7.4%) Complaints regarding unfriendliness including bad language, lack of routine examination, insufficient explanation, poor instructions and little opportunity to ask questions
Tetui 2012 [28]	Quality of Antenatal care services in eastern Uganda: implications for interventions	Uganda	Cross sectional	Assessment of quality of ANC (Antenatal Care) services in eastern Uganda with a goal of benchmarking implications for interventions		<p>Availability of infection control facilities was fair with the majority (11/15) of the facilities scoring a mid-way index value of either five or six (range 0-8: sum of all variables)</p> <p>Cleanliness was dissatisfactory for 4.1%, fairly satisfactory for 25.8% and satisfactory in 70.1</p>	Data on the existence of piped running water, other running water, water in a bucket or basin, hand washing soap, disposable hand drying towels, waste receptacle bins with lids and plastic liners, sharps containers, disposable latex gloves, already mixed disinfection solution and unmixed disinfectant were collected to gauge infection control. Most of the respondents (74.6%) rated the overall ANC service as satisfactory. The variables with the most satisfied percentage were provider's attitude (87.6%) and the examination room privacy (83.5%). However availability of medicines (32.3%) and waiting time (25.1%) had the highest percentages of unsatisfied clients.
Glick 2009 [29]	How reliable are surveys of client satisfaction with health care services? Evidence from matched facility and household data in Madagascar	Madagascar	Cross sectional	This study investigates the reliability of exit surveys about satisfaction with local health care centers by asking the same questions to population-based household survey, the latter being less		An appearance index (mean of binary indicators for dirtiness, humidity damage, decay of walls, floors and ceilings, and evidence of insects and condition of toilet facilities (presence and cleanliness)) was	Client satisfaction surveys in developing countries are increasingly being promoted as a means of understanding health care service quality and the demand for these services. However, concerns have been raised about the reliability of responses in such surveys: for example, 'courtesy bias' may lead clients, especially if interviewed

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
				contaminated by courtesy bias as well as changes in provider behaviour in response to being observed.		calculated. The appearance index was 0.84 in household surveys and 0.91 in exit surveys for the same facilities	upon exiting clinics, to provide misleadingly favourable responses The findings suggest that reported satisfaction in exit surveys is biased strongly upward for subjective questions regarding (for example) treatment by staff and consultation quality, but not for relatively objective questions about facility condition and supplies. The authors conclude that to obtain reliable estimates of consumer perceptions of health service quality, household-based sampling is strongly preferred.
Steinmann 2015 [30]	Availability and satisfactoriness of latrines and hand washing stations in health facilities, and role in health seeking behavior of women: evidence from rural Pune district, India	India	Cross sectional/questionnaire based	Investigation of the WASH infrastructure in small health facilities and survey of expectations and satisfactoriness among women		The mean number of latrines per health care facility was 2.4 (median 2; range 0–8) , but there were fewer in public (mean 1.3; median 1.5; range 0–2) than in private (mean 3.5; median 3; range 1–8) facilities. One facility had no latrine and one had an unimproved latrine. Generally, one hand washing station (tap) was available per latrine but two public facilities did not have any hand washing stations. The mean number of hand	WASH installations in health facilities are generally acceptable in private facilities while improvements are needed in some government facilities. Women expect WASH installations in health facilities, and view their quality in a broader framework of ‘cleanliness,’ which they consider when choosing facilities. Key features of WASH installations that are important to women: number of latrines, their cleanliness and availability of water and accessories (such as dustbins). Other factors, such as a good reputation of the facility, well-respected doctors and the ability to competently deal with

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
						washing stations was 0.8 (median: 1; range 0–2) in public facilities, 3.7 (median: 3; range: 1–8) in private facilities. Soap was often missing from hand washing stations (6/12). Dedicated latrines for women were rare.	complications were generally seen as being more important than the status of WASH installations when choosing which health facility to use. For ambulatory visits, including child birth, the status of WASH installations was seen as less critical than for prolonged hospitalization.
Okwaro 2015 [31]	Challenging logics of complex intervention trials: Community perspectives of a health care improvement intervention in rural Uganda	Uganda		In response to the high burden of malaria in Tororo and poor access to health care, with patients reluctant to attend health centers due to costs of service, negative health worker attitudes and persistent drug stock-outs, the PRIME intervention was designed to enhance quality of care at public health centres and by extension improve malaria-related health indicators in community children	The logic of the intervention was to attract patients to health centres through improved services and attitudes of staff, and to provide better management of fevers through the use of RDTs (rapid diagnostic test) and ACTs (artemisinin-based combination therapies)	At all care centres, improvements in antimalarial drug availability were noted. However, no other improvements were noted and community members reported being disappointed with the quality of care received. Patients continued to seek care at health centres they considered inadequate as well as positioning themselves and their children to access care through other sources such as research and nongovernmental organization (NGO) projects.	In 2009-2010, when the formative research was conducted, staff shortages were encountered in almost all health centres, shortages in all drugs (including first-line antimalarials) and equipment were common, and many health centres lacked running water and electricity For instance, the intervention targeted malaria control to the exclusion of other disease conditions or basic infrastructure such as in-patient facilities or clean water, which reflects the well-rehearsed politics of siloed funding Requests by patients for other facilities, such as to increase the number of health workers, expand buildings and space within facilities, provide clean water and electricity, in-patient services, and clean toilets. In this case, the PRIME intervention, though

Reference	Title	Location	Type of study	Context	Intervention	Findings	Further comments
							'complex', addressed only part of the needs of community members from their health facilities and was therefore 'not sufficient enough' to elicit a major change in the choice of the point of access to health care.
Kabatereine 2014 [32]	Community perceptions, attitude, practices and treatment seeking behaviour for schistosomiasis in L. Victoria islands in Uganda	Uganda	cross sectional descriptive study	to assess community awareness of the disease, its signs, symptoms, causes and transmission as well as attitude, practice and health seeking behaviour		Sanitation is appalling, no clean water and community knowledge about schistosomiasis is low even among biomedical staff.	

The focus on the key area of care seeking was decided because of the relevance to the SDG and the disease burden associated with delayed or no care seeking from qualified health care providers. The simplistic consideration of the link between perceived quality of care and attendance at health care facilities (patients who received quality care tend to return and recommend the facility to relatives) was supported by several studies and the WHO recommends the evaluation of patient' satisfaction for the improvement of health care facilities [33]. However, perceived quality of care is subjective. It includes satisfaction with the outcome, the interventions and the service received (staff friendliness, availability of supplies and waiting times) as well as objective measures of quality of care such as facility infrastructure, equipment and staffing [9]. However, even these measures are subjective because it depends on expectation versus reality, which were shown to be influenced by socioeconomic traits. Indeed, it was reported that wealthier women and patients with higher education were less satisfied with delivery environment and quality of care, respectively [25, 26]. It was noted, however, that other factors than WASH status are driving the selection of health facility to use (Table 2) [30]. Therefore, it is perhaps not surprising that patients continue to use health care facilities believed to be inadequate (Table 2) [31].

The evaluation of patient satisfaction is usually performed through questionnaires, administered either at health care facilities or households. It was shown that exit questionnaires tend to over-estimate the satisfaction level of patients due to courtesy bias (though this was mainly for subjective outcomes such as treatment by staff and consultation quality and not facility condition) [29]. Courtesy bias was also reported when interviewed females were intimidated by the male interviewer [25]. Therefore, it was stated that household surveys are preferred to get reliable estimates of consumer perceptions of health care quality [29]. However, it has been reported that household surveys are associated with substantial under-reporting of health care use, especially when the recall period was over one month [34].

In order to reduce maternal and newborn mortality, the availability of skilled birth attendants is crucial to provide emergency obstetric care [35]. Of major concern, a study that reported higher maternal and perinatal mortality among women who sought skilled obstetric care [36]. The authors' explanations were that women only seek help late and/ or when they are in a critical situation as well as lack of timely and adequate care once they reach the health facility. In addition, skilled birth attendants may not provide socio-culturally appropriate and respectful care leading to poor uptake [35]. For example, previous delivery by a male provider was the reason for choosing home delivery during the subsequent pregnancy (OR 3.90; 95% CI 2.30–6.65) [33]. Therefore, it was stated that "efforts aimed at improving maternal and child health in developing countries should take cognisance of the socio-demographic and cultural underpinnings of maternal health-seeking behaviour" [37].

It has been reported that women do not always receive the expected humane, professional, supportive and respectful treatment from skilled birth attendants [35]. Complaints of abuse, neglect and poor treatment are common in maternity services [4]. Therefore, in addition to improving facilities' infrastructure, care quality and cost-effectiveness, improvements in maternity services should also address providers' attitudes and interpersonal behaviours [35]. This is likely to increase public maternity care and service utilisation because of the importance women attach to being treated respectfully, irrespective of socio-cultural or economic context [23].

Conclusions

The disease burden associated with inadequate WASH is significant in LMICs [38]. The provision of adequate WASH in health care facilities is paramount to protect vulnerable populations and reduce health care associated infections. Unfortunately, many health care centres in LMICs still lack satisfactory WASH, but there is an intergovernmental determination to address this inequality. As an increasing number of health care centres in LMICs are equipped with adequate WASH facilities, research should be simultaneously implemented so that evidence is generated about the impact of WASH on improving patient satisfaction, increasing utilisation of health care services and decreasing health care associated infections.

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Appendix 6: Low-cost assays for microbiological monitoring

(Rick Johnston, WHO)

1 Culture methods

In recent years a number of new products have been developed for analysis of specific bacteria, which are based on culturing of bacteria either on surfaces or in suspension. Many of these take advantage of enzymes which are specific to certain bacteria, and react with a chemical substrate to produce a characteristic colour or fluorescence. These chromogenic or fluorogenic growth media can simplify analysis of faecal indicator or other bacteria. A number of products available for measurement of *E. coli* or coliform bacteria were catalogued by Bain et al. in 2012. (1) These products are increasingly used for monitoring drinking water quality in low-resource settings. Some could also have application in monitoring of environmental contamination levels, for example in households or in health care facilities.

1.1 Presence-absence tests

Presence-absence tests are normally conducted in liquid suspensions, with a positive result being indicated by development of a colour change, or production of gas or fluorogenic compounds. Presence-absence tests don't give quantitative information on the degree of contamination, but the volume used can give an indication on contamination levels: presence of target bacteria in small volumes indicates a high level of contamination. Typically presence-absence tests are conducted on volumes from 10 to 100 mL. A broad, but not comprehensive, list of products is provided by Bain et al. (1).

A number of products come in 'Snap-Paks' suitable for 100 mL volumes. Some of the widely used products include IDEXX's Colilert and Colisure (www.idexx.com), Colitag (www.cpiinternational.com), and AquaCHROM (www.chromagar.com). Typically chromogenic media for a 100 mL test cost \$5-15. These can be used with either a sterile 100 mL sample bottle or a sterile bag (e.g. Whirlpak, www.enasco.com/whirlpak). IDEXX produces a 10 mL tube pre-filled with Colilert media, costing about \$2 each. This could be used for surface swabs, e.g. with sterile dilution liquid.



When multiple presence-absence tests are conducted on the same sample, the results can be jointly analysed with statistical formulas to calculate a Most Probable Number (2). When a larger number of samples are tested, the statistical estimate is more robust, and confidence intervals are narrower. IDEXX produces a Quantitray system which uses plastic trays with a large number of wells, and gives very robust results. The 10 mL IDEXX tubes can also be used in this way. A low-cost option is presented by the Aquagenx system (www.aquagenx.com), which uses a chromogenic media and a 100 mL Whirlpak bag divided into five compartments of different size (3). One test costs roughly \$7-10.

1.2 Ready-made chromogenic plates, films and pads

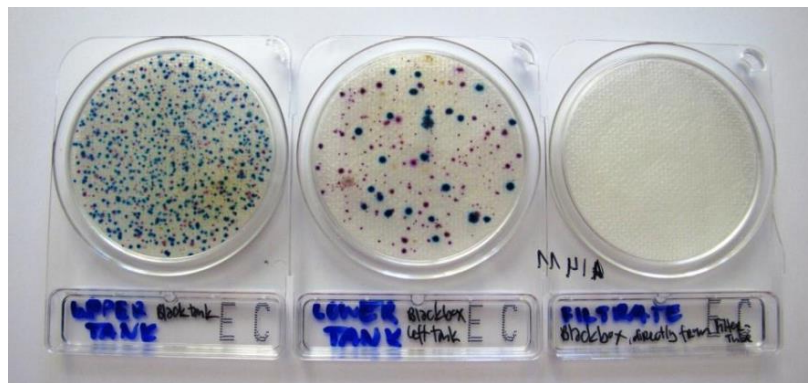
A variety of surfaces can be used for culturing of bacteria, which lead to development of colonies which can be enumerated.

1.2.1 Nissui Compact Dry Plates

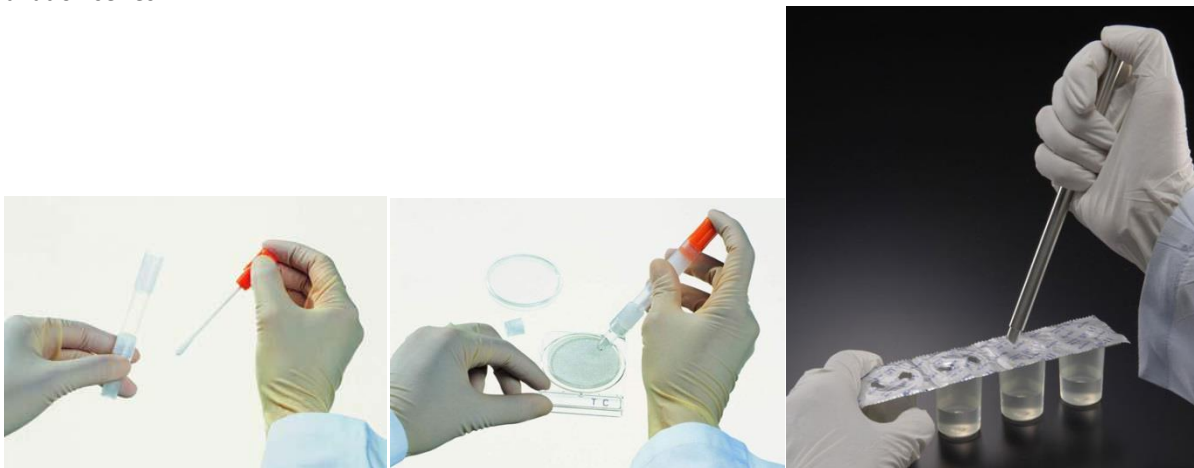
Nissui produces a variety of Compact Dry plates, which contain a gel layer of dehydrated chromogenic media, in a plastic single-use petri dish. The media can be rehydrated with 1 mL of sample, and can also be used in combination with membrane filtration.

The plastic plates come in aluminium foil packets which can be stored at room temperature for 1-2 years. One plate costs roughly \$1. Some plates of interest include:

Compact Dry Plate name	Target bacteria
EC	<i>E. coli</i> and coliforms
ETC	<i>Enterococci</i>
AQ	Heterotrophic bacteria
CF	Coliforms
ETB	<i>Enterobacteriaceae</i>
TC	Total count
X-BC	<i>Bacillus cereus</i>
LS	<i>Listeria sp.</i>
X-SA	<i>Staphylococcus aureus</i>
VP	<i>Vibrio parahaemolyticus</i>
PA	<i>Pseudomonas aeruginosa</i>



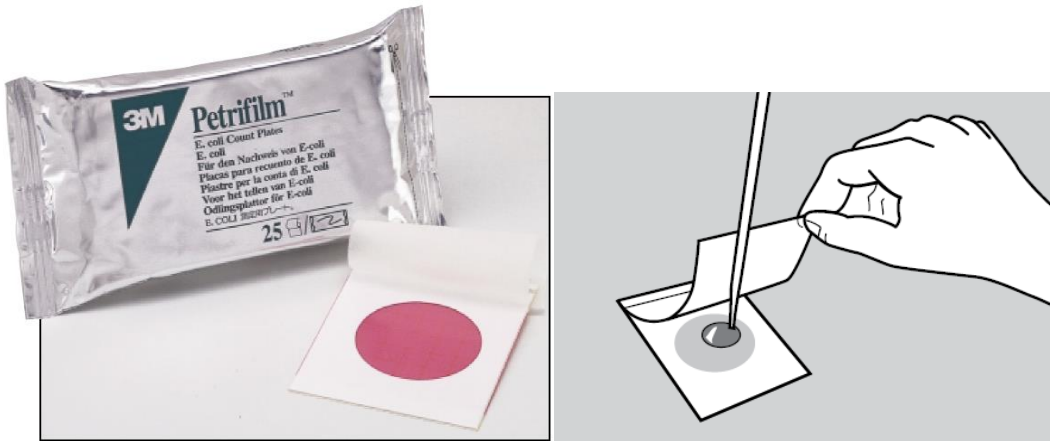
The Compact Dry EC plates have been widely used for surveillance of faecal contamination in drinking water, either as 1 mL direct samples or 100 mL samples using membrane filtration. The EC plates contain two chromogenic media, resulting in blue colonies from *E. coli*, and violet colonies from other coliform bacteria. The Compact Dry product line includes swabs and tubes with 1 mL of buffer solution, for taking samples from surfaces. There is also a single-use dilution rack, which uses 9 mL wells of sterile buffer solution to facilitate 10-fold dilution series.



Compact Dry products are distributed by HyServe GmbH in Germany. For more information: visit www.hyserve.com or write to info@hyserve.com for details.

1.2.2 3M Petrifilm

3M produces a line of 'Petrifilm' products which consist of a layer of dehydrated media fixed to a stiff paper backing. The media is rehydrated with 1 mL of sterile water or sample, and then covered with a plastic film, integrated with the media sheet.



Petrifilm products are available which use chromogenic media for culture of *E. coli*, coliforms, and other target bacteria. Petrifilm Aqua plates are optimized for testing of drinking water, and can be used in combination with membrane filtration. Aqua Heterotrophic Count Plates (AQHC) and Aqua Coliform Count Plates (AQCC) have been used for surveillance of bottled water, in combination with mixed cellulose ester filters.

For more information: visit www.3m.com.

1.2.3 Sartorius Nutrient Pad Sets

Nutrient pads are sterile, dehydrated culture media. They come in disposable plastic petri dishes, and require 3-3.5 mL of liquid for rehydration. A membrane can be placed on the rehydrated pad for incubation. Sets of 10 pads are available in aluminium sleeves, and can be stored at room temperature for 18-24 months.



Nutrient pad sets are available for total colony counts, *E. coli* and coliforms, Enterobacteria, *Pseudomonas aeruginosa*, *Staphylococci*, and other bacteria.

For more information: visit www.sartorius.com. This [brochure](#) describes the nutrient pad set line.

1.2.4 Dipslides and contact slides

Dipslides and contact slides are small-area plates which are inoculated either by pressing against a surface or by dipping into a liquid. Because of the low surface area, they have lower sensitivity than products which use 1 mL inoculation or support membrane filtration.

Some commercially available products include:

- 3M Dipslides (www.3m.com)
- Merck Millipore Envirocheck C (www.emdmillipore.com)
- Merck Millipore HYCON C contact slides, which can be stored at 2°C – 25°C (www.emdmillipore.com)



1.3 Membrane filtration

Millipore makes manifolds with sterile disposable funnels and membrane (the Microfil system). A single-station manifold can be used in field settings without electricity. A vacuum can be created with either a hand pump or a large syringe (e.g. 100 mL).

1.4 Incubation options

Since chromogenic growth media only produce the indicative colour in the presence of enzymes which are only produced by certain bacteria, there is much less risk of false positive results caused by non-target bacteria. Conventional methods (e.g. culture of thermotolerant coliforms) rely on strict temperature control to inhibit non-target bacteria. When chromogenic media are used, incubation temperatures do not need to be as strictly controlled. A variety of low-cost options are available for incubation outside of laboratories. These include small incubators which require electricity or batteries (e.g. Lynd's MX10, www.lyndproducts.co.uk), and incubation belts which take advantage of body heat to keep a small number of plates or 10 mL tubes close to 37 °C.

2 Non-culture methods

A number of non-culture methods can be used to identify specific pathogens or indicator organisms, or more generally the presence of bacteria. One advantage of these systems is the possibility of generating results rapidly, without waiting for an incubation period. These methods include sophisticated and expensive assays such as quantitative polymerase chain reaction or flow cytometry. However, a few low-cost assays also exist, which tend to be less specific but may still be valuable as a control on cleaning or disinfection processes.

2.1 ATP bioluminescence

All living cells contain adenosine triphosphate (ATP), which is used to store energy. The ATP bioluminescence assay measures the amount of ATP present, by addition of the luciferase enzyme (the same compound used by fireflies to generate light). ATP assays measure all organic matter, and is not specific to micro-organisms. It also does not distinguish between ATP in live and dead cells.

Commonly a swab is used to wipe a surface in a standardized way. The material collected on the swab is suspended in a liquid medium, reacted with the luciferase enzyme, and the resulting bioluminescence measured with a luminometer. The procedure is simple, highly sensitive, cost-efficient, and rapid, with results obtained within a few minutes. A number of studies have used this assay to evaluate the cleanliness of surfaces in health care settings, or the efficiency of cleaning regimes. Benchmarks of cleanliness are proposed (e.g. 500 or 250 relative light units (RLU)). (4, 5-8)

A number of commercial products are available for ATP measurement, with the cost per test of \$1-5, not counting a one-time cost for purchase of a luminometer:

- 3M Clean-Trace Surface ATP Test Swab UXL100 and Luminometer NG3 (www.3m.com)
- Nissui ATP Test Swab LuciPac W and Luminometer PD-30 (www.hyserve.com)
- Charm PocketSwab Plus and novaLUM Luminometer (www.charm.com)



2.2 Tryptophan-like fluorescence

Very recently, a novel fluorescent assay has been proposed which reportedly correlates with microbial contamination in drinking water. This assay has been used in monitoring wastewater, taking advantage of a correlation between tryptophan-like fluorescence and organic carbon and microbiological activity (9). The assay is conceptually similar to the ATP assay in that it indicates the presence of organic matter and is not specific to micro-organisms or pathogens. It offers the potential advantages of not requiring any reagents and taking very little time to implement. The assay is still emerging and has not been applied for tracking environmental cleanliness or assessing the effectiveness of cleaning procedures, but could potentially be used for these purposes.

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