

Below is a literature review compiled of 110 published articles, reports, and case studies from both scientific journals and grey literature that specifically focus on water, sanitation, hygiene, cleaning, and waste management in healthcare facilities in low- and middle-income countries. They are organized by prevailing theme -- [conditions & infrastructure](#), [monitoring](#), [implementation](#), [health systems & enabling environment](#), [sustainability](#), [costing](#), [behaviors](#), [care-seeking behaviors & patient satisfaction](#), [healthcare-associated infections & antimicrobial resistance](#), [cleaners](#), [accessibility](#), [gender](#), and [enterprise](#). Each section has published articles by first author's last name and then grey literature by title. The majority of grey literature was drawn from the 'Resources' section of [WASHinHCF.org](#). We encourage the community to share any resource missing from this review that furthers the community's knowledge of WASH in HCF.

Because of the breadth of literature on hand hygiene and infection prevention and control (IPC), we have not included them in this review. In 2020, we plan to identify resources which provide a comprehensive look at both of these issues, as well as complementary issues that may be useful to the community of practice, like research on quality of care. We will also look into articles from high-income countries to see where there may be lessons to draw upon.

The USAID Water Currents [issue on WASH in Healthcare Facilities](#) is also a key compilation of resources.

Conditions & Infrastructure

1. [Health facility preparedness for cholera outbreak response in four cholera-prone districts in Cameroon: a cross sectional study](#). Ateudjieu et al. 2019. BMC Health Services Research, 19(1), 458.
2. [How health professionals can leverage health gains from improved water, sanitation and hygiene practices. Perspectives in Public Health](#). Bartram et al. 2010. Volume: 130 issue: 5, page(s): 215-221.
3. [Lack of toilets and safe water in health-care facilities](#). Bartram et al. 2015. Bulletin of the World Health Organization 93:210.
4. [Environmental factors and WASH practices in the perinatal period in Cambodia: implications for newborn health](#). Bazzano et al. 2015. International journal of environmental research and public health. 12(3): 2392–2410.
5. [Newborn Care in the Home and Health Facility: Formative Findings for Intervention Research in Cambodia](#). Bazzano et al. 2016. Healthcare (Basel, Switzerland), 4(4), 94.
6. [Assessment of health-care waste management in a humanitarian crisis: A case study of the Gaza Strip](#). Caniato et al. 2016. Waste Management. Waste Management. 58 386-396.
7. [Water availability at hospitals low- and middle-income countries: implications for improving access to safe surgical care](#). Chawla et al. 2016. J. Surg Research 205, 169-178.
8. [Environmental conditions in health care facilities in low- and middle-income countries: Coverage and inequalities](#). Cronk et al. 2018. Int J. Hyg. Environ. Health 221 (3), 409-422.

Conditions & Infrastructure Con.

9. [Hygiene on maternity units: lessons from a needs assessment in Bangladesh and India.](#) Cross et al. 2016. Global Health Action. 9: 32541.
10. [Formative research for the design of a scalable water, sanitation, and hygiene mobile health program: CHoBI7 mobile health program.](#) George et al. 2019. BMC public health, 19(1), 1028.
11. [Water, Sanitation, and Hygiene in Rural Health-Care Facilities: A Cross-Sectional Study in Ethiopia, Kenya, Mozambique, Rwanda, Uganda, and Zambia.](#) Guo et al. 2017. Am. J. Trop. Med. Hyg. 97(4), 1033–1042.
12. [Predictors of water quality in rural healthcare facilities in 14 low-and middle-income countries.](#) Guo et al. 2019. Journal of Cleaner Production, 237, 117836.
13. [Access to emergency and surgical care in sub-Saharan Africa: the infrastructure gap.](#) Hsia et al. 2012. Health Policy and Planning. 27(3), 234–244.
14. [Water Supply, Sanitation, and Medical Waste Treatment and Disposal at Commune Health Centers in Vietnam.](#) Huong et al. 2018. Asia Pacific Journal of Public Health. 30(7)644-654.
15. [Water, sanitation and hygiene infrastructure and quality in rural healthcare facilities in Rwanda.](#) Huttinger et al. 2017. BMC Health Serv. Res. 517.
16. [Water, sanitation and hygiene in Jordan's healthcare facilities.](#) Khader et al. 2017. Int J. Health Care Qual. Assur. 30 (7), 645-655.
17. [Association between infrastructure and observed quality of care in 4 healthcare services: A cross-sectional study of 4,300 facilities in 8 countries.](#) Leslie et al. 2017. PLoS Medicine, 14(12), e1002464.
18. [A systematic review of waterborne infections from nontuberculous mycobacteria in health care facility water systems.](#) Li et al. 2017. International Journal of Hygiene and Environmental Health. 220(3), 611-620.
19. [A cross-sectional assessment of primary healthcare facilities for provision of antenatal care: calling for improvements in Basic Health Units in Punjab, Pakistan.](#) Majrooh et al. 2016. Health research policy and systems. 13(Suppl 1): 59.
20. [Unpacking healthcare waste management at rural village health clinics in the Ntcheu District \(Malawi\).](#) Mmanga et al. 2019. Environmental Monitoring and Assessment. 191: 175.
21. [Water, Sanitation, and Hygiene Service Availability at Rural Health Care Facilities in Southwestern Uganda.](#) Mulogo et al. 2018. Journal of environmental and public health. 191:175.

Conditions & Infrastructure Cont.

22. [Energy access in Malawian healthcare facilities: consequences for health service delivery and environmental health conditions](#). Reuland et al. 2019. Health Policy and Planning. czz118.
23. [Infrastructure and contamination of the physical environment in three Bangladeshi hospitals: putting infection control into context](#). Rimi et al. 2014. PLoS ONE, 9(2), e8.
24. [Rapid assessment of infrastructure of primary health care facilities - a relevant instrument for health care systems management](#). Scholz et al. 2015. BMC Health Services Research. 15, 183.
25. [Health-Care Facility Water, Sanitation, and Health-Care Waste Management Basic Service Levels in Bangladesh: Results from a Nation-Wide Survey](#). Unicomb et al. 2018. The American Journal of Tropical Medicine and Hygiene. 99(4): 916–923.
26. [Investigation of antibiotics in health care wastewater in Ho Chi Minh City, Vietnam](#). Vo et al. 2016. Environ Monit Assess. 188(12):686.

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27. [A review of emergency obstetric and newborn care needs assessments in 14 western and central African countries](#) UNICEF, 2015
28. [Achieving quality universal health coverage through better water, sanitation and hygiene services in health care facilities: A focus on Ethiopia](#) WHO, 2017
29. [Achieving quality universal health coverage through better water, sanitation and hygiene services in health care facilities. A focus on Cambodia and Ethiopia](#) WHO, 2017
30. [Afghanistan WASH in healthcare facilities assessment summary](#) World Vision, 2019
31. [Cambodia: addressing the enabling environment: systems analysis and change](#) National Institute of Public Health, Cambodia, 2017
32. [Findings from SNV baseline on health care facilities in 5 countries](#) SNV, 2019
33. [Framework for water, sanitation and hygiene in health care facilities country case study](#) WaterAid, 2017
34. [Inadequate WASH in healthcare facilities: Realities in Senegal](#) ICAN, 2016
35. [Motivating improvements: Learning from health care facilities study in India and Bangladesh](#) IIPH-G, 2016
36. [Report on the deployment of the WASHCon Tool in Hoima District, Uganda](#) Emory/World Vision, 2017

Conditions & Infrastructure Cont.

37. [Safer health care facilities in Cambodia](#) WaterAid, 2015
38. [Situational analysis of WASH and quality in Ethiopia](#) Ministry of Health Ethiopia/WHO, 2019
39. [Situational analysis of WASH in HCF, Sierra Leone](#) WHO Sierra Leone, 2016
40. [Situational analysis of WASH in health care facilities, Mali](#) WHO, 2015
41. [Synopsis of WASH situational analysis in HCF in 7 UNICEF program districts in Tanzania](#) Ministry of Health, Tanzania, 2016
42. [The status of water, sanitation and hygiene in health care facilities in the WHO European region](#) Joca, 2018
43. [Towards safer and better quality health care services in Cambodia](#) WaterAid, 2015
44. [WASH in health care facilities in Bhutan – A scoping study](#) Ministry of Health, Bhutan, 2015
45. [WASH in health care facilities: UNICEF Scoping Study in Eastern and Southern Africa](#) UNICEF, 2019
46. [Water, Sanitation, and Hygiene at the Health Center: The Health System’s Unaccounted for Responsibility](#) Maternal and Child Survival Program, 2017

Monitoring

1. [Institutional WASH in the SDGs: data gaps and opportunities for national monitoring.](#) Chatterley et al. 2018. J Water, San, Hyg. for Dev. 8(4): 595-606.
 2. [Monitoring drinking water, sanitation, and hygiene in non-household settings: Priorities for policy and practice.](#) Cronk et al. 2015. International Journal of Hygiene and Environmental Health. 218(8) 694-703.
 3. [Water, Sanitation, and Hygiene Services in Public Health-Care Facilities in Indonesia: Adoption of World Health Organization/United Nations Children’s Fund Service Ladders to National Data Sets for a Sustainable Development Goal Baseline Assessment.](#) Odagiri et al. 2018. Am J Trop Med Hyg. 99(2), 546-551.
 4. [Assessment of water, sanitation and hygiene in HCFs: which tool to follow?](#) Patel et al. 2019. Rev Environ Health. 34(4):435-440.
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5. [Are data available to monitor the SDGs for WASH in schools and health care facilities in the Latin America and Caribbean Region?](#) JMP, 2017

Monitoring Cont.

6. [Facilitating evidence-based solutions for WASH in HCF](#) Emory, 2016
7. [Preparing for SDG reporting of WASH in health care facilities in the East Asia and Pacific region](#) JMP, 2017

Implementation

1. [Improving water, sanitation and hygiene in health-care facilities, Liberia](#). Abrampah et al. 2017. Bulletin of the World Health Organization. 95:526-530.
2. [Evaluation of a Water and Hygiene Project in Health Care Facilities in Siaya County, Kenya, 2016](#). Davis et al. 2019. The American Journal of Tropical Medicine and Hygiene. 1(3), 576-579.
3. [Evaluation of biomedical waste management practices in public and private sector of health care facilities in India](#). Devi et al. 2019. Environmental Science and Pollution Research. 26(25), 26082-26089.
4. [Randomized Controlled Trial of Hospital-Based Hygiene and Water Treatment Intervention \(CHoBI7\) to Reduce Cholera](#). George et al. 2016. Emerging infectious diseases, 22(2), 233–241.
5. [Assessing the management of healthcare waste in Hawassa city, Ethiopia](#). Haylamicheal et al. 2010. Waste Management and Research. 29(8), 854–862.
6. [Evaluation of Membrane Ultrafiltration and Residual Chlorination as a Decentralized Water Treatment Strategy for Ten Rural Healthcare Facilities in Rwanda](#). Huttinger et al. 2015. International journal of environmental research and public health. 12(10), 13602–13623.
7. [Evaluating the foundations that help avert antimicrobial resistance: Performance of essential water sanitation and hygiene functions in hospitals and requirements for action in Kenya](#). Maina et al. 2019. PLoS ONE. 14(10): e0222922.
8. [Extending the use of the World Health Organisations’ water sanitation and hygiene assessment tool for surveys in hospitals – from WASH-FIT to WASH-FAST](#). Maina et al. 2019. PLoS ONE 14(12): e0226548.
9. [Water treatment and handwashing practices in rural Kenyan health care facilities and households six years after the installation of portable water stations and hygiene training](#). Rajasingham et al, 2018. J Water Health 16(2), 263-274.
10. [Strengthening Healthcare Facilities Through Water, Sanitation, and Hygiene \(WASH\) Improvements: A Pilot Evaluation of “WASH FIT” in Togo](#). Weber et al. 2018. J Health Security 16(S1), S54-S65.
11. [A conceptual evaluation framework for the water and sanitation for health facility improvement tool \(WASH FIT\)](#). Weber et al. 2019. J Water, San, Hyg. for Dev. 9(2), 380-391.

Implementation Cont.

12. [Developing and implementing revised tool box for assessment of water sanitation and hygiene \(WASH\) in urban healthcare facilities beyond labour room](#) IIPH-G, 2017
13. [Ensuring mother and child health at the hospital with WASH in health care facilities: focus on autonomous chlorine production in Zambia](#) Voillat et al., 2018
14. [Ethiopia: Clean and Safe Health Facility \(CASH\) Initiative](#) Federal Ministry of Health, Ethiopia, 2017
15. [From outbreak to ABHR production: experience from Cameroon](#) ICAN, 2019
16. [From the frontlines: Christian health associations tackle WASH in healthcare facilities](#) Christian Health Associations, 2019
17. [Improving maternal health in Zanzibar through improved WASH](#) SHARE, 2015
18. [Lessons Learned Initiating WASH FIT in Malawi](#) Emory University, 2017
19. [MDGI ER2: The Zambian experience, from pilot to scale up](#) Ministry of Health, Zambia, 2016
20. [Portable Sinks for Healthcare Worker Hand Hygiene in Cambodia](#) Emory University, 2017
21. [The “Clean Clinic Approach” for WASH in the Democratic Republic of Congo](#) Maternal and Child Survival Program, 2019
22. [Water, sanitation and hygiene in health care facilities: action-oriented solutions and learning: 2017 case studies](#) Various authors, 2017
23. [WHO/UNICEF water and sanitation for health facilities improvement tool: A case study in Cambodia](#) WaterAid/WHO/UNICEF, 2018

Health Systems & Enabling Environment

1. [The implementation of environmental health policies in health care facilities: The case of Malawi](#). McCord et al. 2019. International Journal of Hygiene and Environmental Health. 222(4), 705-716.

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2. [Creating enabling environment for basic water, sanitation and waste management facilities in a primary health care facility in Bangladesh](#) UNICEF, 2017

Sustainability

1. [A systematic tool to assess sustainability of safe water provision in healthcare facilities in low-resource settings](#). Robb et al. 2019. Waterlines 38(3), 197–216.

Sustainability

2. [Accountability for sustainability report 2016 Liberia](#) Ministry of Health, Liberia/UNICEF, 2016
3. [Case study of water, sanitation, and hygiene \(WASH\) in healthcare facilities in Ethiopia and Keya: Key findings and recommendations](#) Millennium Water Alliance, 2018
4. [Fact Sheet: Analysis for accountability for WASH services sustainability in health in Liberia](#) Ministry of Health, Liberia/UNICEF, 2016

Costing

1. [Cost analysis of the implementation of portable handwashing and drinking water stations in rural Kenyan health facilities.](#) Freedman et al. 2017. J Water, San, Hyg. for Dev. 7(4), 659-664.

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2. [Cost analysis for Clean Clinic Approach Activities in Guatemala and implications for scale-up.](#) Maternal and Child Survival Program, 2019
3. [Improving WASH facilities: The case of return on investment \(ROI\) analysis](#) University of East Anglia, 2016

Behaviors

1. [Acceptability and use of portable drinking water and hand washing stations in health care facilities and their impact on patient hygiene practices, Western Kenya.](#) Bennett et al. 2015. PLoS ONE, 10(5), e0126916. doi:10.1371/journal.pone.0126916.
2. [Unpacking the enabling factors for hand, cord and birth-surface hygiene in Zanzibar maternity units.](#) Gon et al. 2016. Health Policy Plan. 32(8), 1220–1228.
3. [Evaluation of the impact of a simple hand-washing and water-treatment intervention in rural health facilities on hygiene knowledge and reported behaviours of health workers and their clients, Nyanza Province, Kenya, 2008.](#) Sreenivasan et al. 2015. Epidemiology and Infection. 143(4), 873-880.

Care-Seeking Behaviors & Patient Satisfaction

1. [What is the impact of water sanitation and hygiene in healthcare facilities on care seeking behaviour and patient satisfaction? A systematic review of the evidence from low-income and middle- income countries.](#) Bouzid et al. 2018. BMJ Global Health 3, e000648.
2. [Cross-sectional observational assessment of quality of newborn care immediately after birth in health facilities across six sub-Saharan African countries.](#) de Graft-Johnson et al. 2017. BMJ Open. 7:e014680.

Care-Seeking Behaviors & Patient Satisfaction Cont.

3. [Impact of the Integration of Water Treatment, Hygiene, Nutrition, and Clean Delivery Interventions on Maternal Health Service Use.](#) Fagerli et al. 2017. The American Journal of Tropical Medicine and Hygiene, 96(5), 1253–1260.
4. [Respectful care during childbirth in health facilities globally: a qualitative evidence synthesis.](#) Shakibazadeh et al. 2018. BJOG: An International Journal of Obstetrics and Gynaecology, 125(8), 932–942.
5. [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.](#) Steinmann et al. 2015. Journal of Water, Sanitation and Hygiene for Development. 5 (3): 474-482.

Healthcare-Associated Infections & Antimicrobial Resistance

1. [What's wrong in the control of antimicrobial resistance in critically ill patients from low- and middle-income countries?](#) Dondorp et al. 2017. Intensive care medicine, 44(1), 79–82.
2. [Prevention and control of health care–associated waterborne infections in health care facilities.](#) Exner et al. 2005. American Journal of Infection Control. 3(5) Supplement, S26–S40.
3. [What are the threats from antimicrobial resistance for maternity units in low- and middle-income countries?](#) Graham et al. 2016. Global health action. 9, 33381.
4. [A systematic review of nosocomial waterborne infections in neonates and mothers.](#) Moffa et al. 2017. International Journal of Hygiene and Environmental Health. 220, 1199–1206.
5. [Interventions to improve water supply and quality, sanitation and handwashing facilities in healthcare facilities, and their effect on healthcare- associated infections in low-income and middle-income countries: a systematic review and supplementary scoping.](#) Watson et al. 2019. BMJ Global Health 4, e001632.
6. [Quick fix for care, productivity, hygiene and inequality: reframing the entrenched problem of antibiotic overuse.](#) Willis et al. 2019. BMJ Global Health. 4:e001590.

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7. [Preventing health-care acquired infections in lower-level healthcare facilities \(maternities, health centers, health posts, MCH centers\): the role of WASH \(Water, Sanitation and Hygiene\) in Low- and Middle-Income Countries](#) Hai-Ryung, 2019

Cleaners

1. [An invisible workforce: the neglected role of cleaners in patient safety on maternity units.](#) Cross et al. 2019. Global Health Action. 12(1), 1480085.
2. [The role of environmental cleaning in the control of hospital-acquired infection.](#) Dancer. 2009. The Journal of Hospital Infection. 73(4), 378-385.
3. [Four Steps to Hospital Cleaning: Look, Plan, Clean and Dry.](#) Dancer et al. 2019. The Journal of Hospital Infection. 103(1), e1-e8.

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4. [WASH & Clean: A situational analysis of hygiene on maternity units in India](#) IIPH-G, 2015
5. [The Gambia: Soapbox Collaborative basic environmental hygiene training package pilot](#) Soapbox Collaborative, 2017

Accessibility

[Developing a participatory management tool for user-friendly water sanitation and hygiene facilities](#) WaterAid Cambodia, 2018

Gender

1. [WASH and gender in health care facilities: The uncharted territory.](#) Kohler et al. 2017. Health Care for Women Int. 40(1), 3-12.

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2. [Water, sanitation, hygiene, and reproductive health access barriers in rural Cambodia: Issues in gender and disability](#) Gelbard, 2018

Enterprise

1. [MBR technology: a promising approach for the \(pre-\)treatment of hospital wastewater.](#) Beier et al. 2012. Water Sci Technol. 65 (9): 1648-1653.
2. [Small Water Enterprise in Rural Rwanda: Business Development and Year-One Performance Evaluation of Nine Water Kiosks at Health Care Facilities.](#) Huttinger et al. 2017. Int J. Environ. Res. Public Health. 14, 1584.