

Water, Sanitation and Hygiene & Health Care Associated Infections - A rapid exploratory review

WHO/UNICEF/SHARE WASH & HCAI Workshop
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Oliver Cumming & Lauren D'Mello-Guyett
LSHTM, Faculty of Infectious and Tropical Diseases, Department of Disease
Control



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WASH & Universal Health Coverage

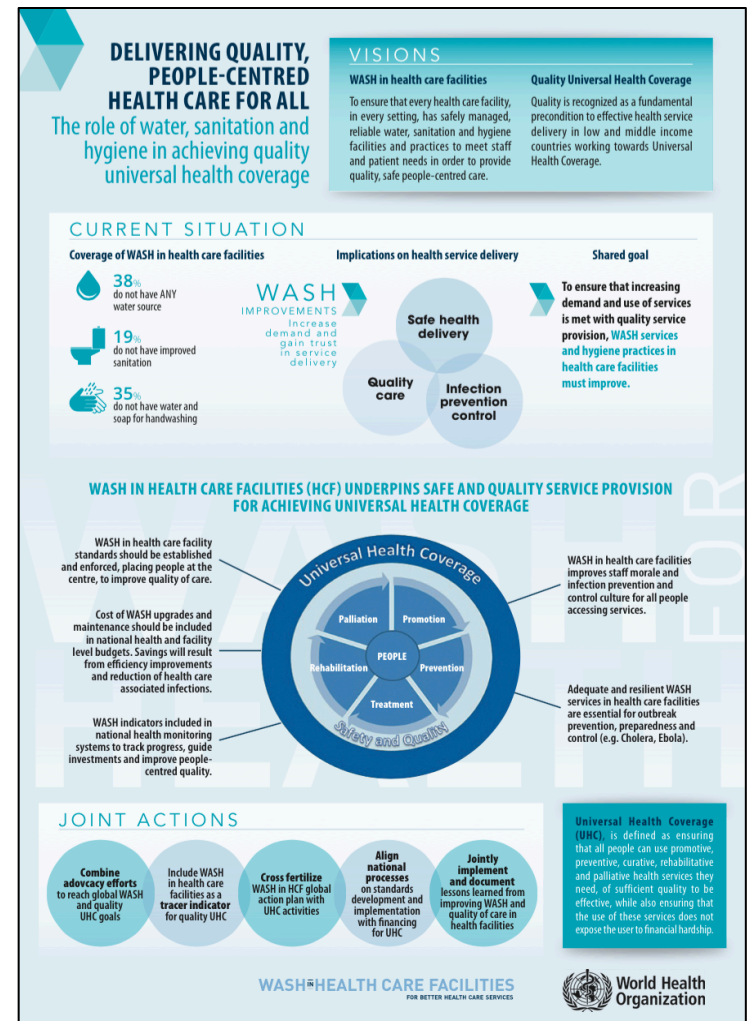
WASH in HCF covers:

- Water quality and quantity
- Water facilities and access
- Excreta disposal and access
- Wastewater treatment and disposal
- Solid and medical waste
- Hand washing with soap (and alcohol hand rub?)
- Other environmental issues (vector control, cleanliness)

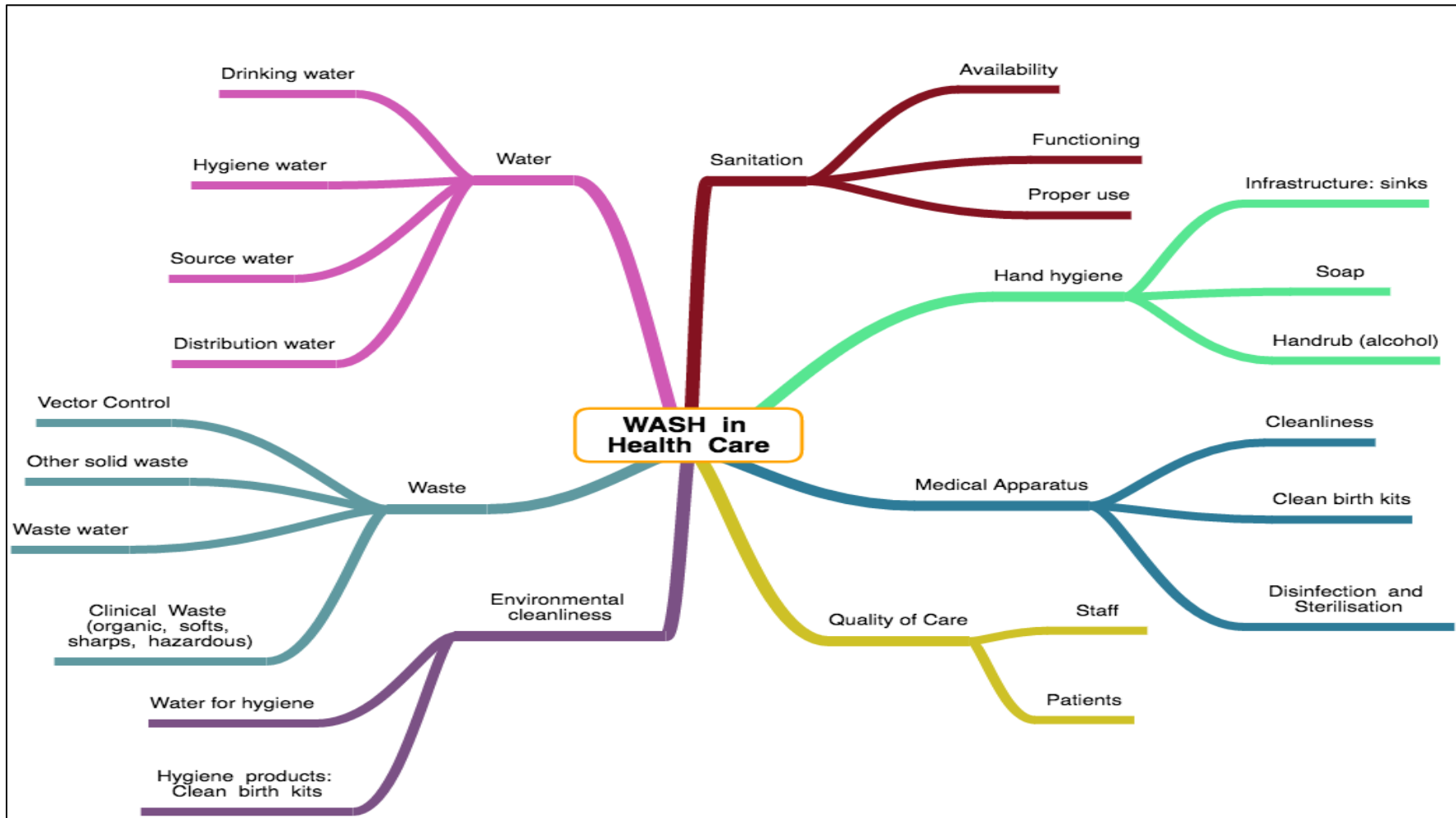
WHO (2015) reported that in LMIC 38% lack access to water sources, 19% are without sanitation and 35% without access to soap or alcohol based hand rubs

GLAAS (2014) found that only one quarter of countries had a policy on WASH in HCF

2030 SDG WASH Goal is *for universal access*



WASH in Health Care Facilities



Review Objectives

1. Review HCAI literature to identify WASH as a risk factor
2. Review WASH 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 and search to assess number of results

Objective 1: WASH in LMIC HCAI studies

Most HCAI organisms potentially linked to environmental contamination

	Common Aetiological Agents/Isolates found in LMIC	Location found and biological plausibility to standard	Examples of infections/disease
>1.0% culture confirmed infections	<i>Staphylococcus aureus</i> (inc. MRSA); Coagulase-negative staphylococci; <i>Klebsiella</i> spp (inc. <i>E. coli</i>); <i>Escherichia coli</i> ; <i>Pseudomonas</i> spp (inc. MDR); <i>Acinetobacter</i> spp; <i>Enterobacter</i> spp; Enterococci; <i>Candida</i> spp	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; Enterocolitis; Necrotizing enterocolitis; Gastroenteritis; Omphalitis; Phlebitis.
<1.0% culture confirmed infections	Others include: <i>Streptococcus pneumoniae</i> , <i>Listeria</i> spp, <i>Citrobacter</i> , <i>Salmonella</i> spp., <i>Vibrio</i> spp, <i>Serratia</i> spp, <i>N. meningitidis</i> , <i>Haemophilus</i> spp, <i>Flavobacterium meningosepticum</i> etc.		

Objective 1: WASH in LMIC HCAI studies

- The risk of acquiring HCAI is universal and runs across the five domains of health-care (home based, ambulatory, primary, secondary and tertiary care) worldwide.
- HCF in low income settings often lack sufficient infrastructure and capacity to ensure patient safety.
- Risk of HCAI greater in LMIC vs HIC
- WASH coverage in HCAI domains much lower in LMIC vs HIC

	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

Objective 1: WASH in LMIC HCAI studies

Rapid re-review of two key reviews for the LMIC HCAI BoD to identify:

- WASH-related associations
- Sub-group analysis for HCAI domains and vulnerable groups

Review of Allegranzi et al (2011) Lancet paper

- No WASH associations identified in title search
- No WASH associations or sources identified in risk factor analysis
- Review of full text may reveal more assessed WASH factors

Review of the WHO (2011) report on the burden of HCAI

- 12 papers naming “water” as the source of the HCAI
- 0 papers naming “sanitation” as the source of HCAI
- Continuing re-review to look for environmental sources of “contamination”
- Review of full text may reveal more assessed WASH factors

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 – HCAI in WASH studies

Identified 9 systematic reviews for the effect of WASH interventions on different health outcomes (neonatal mortality, maternal mortality, diarrhoea in health care facilities, HCAI)

Extracted data from 5/9 reviews for effects of WASH interventions on HCAI related outcomes

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-acquired 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

Objective 2 – HCAI in LMIC WASH studies

Number of relevant reviews for related outcomes but relatively few underlying studies.

Underlying studies observational and of low quality, with high risk of bias.

Supportive evidence: consistency, dose-response, strength of association, biological plausibility.

Magnitude of effect uncertain

WASH intervention *Domestic, ** Facility	Outcome	Author	Pooled effect (*single study)
Drinking water*	Maternal mortality	Benova et al 2014	1.50 OR* 'unimproved' vs 'improved'
Drinking water*	Neonatal mortality	Kwok 2014	0.78 OR 'improved' vs 'unimproved'
Sanitation*	Maternal mortality	Benova et al 2014	3.07 OR 'unimproved' vs 'improved'
Sanitation*	Neonatal Mortality	Kwok 2014	1.71 OR 'unimproved' vs 'improved'
HWWS** (Facility HWWS promotion)	Diarrhoea (PLWHA)	Ejemot et al 2015	1.68 MD episodes/year - HWWS vs + HWWS
HWWS* (Birth attendant HWWS)	Neonatal mortality	Blencowe et al 2011	0.81 RR* + HWWS vs - HWWS
HWWS* (Postnatal maternal HWWS)	Neonatal mortality	Blencowe et al 2011	0.56 RR* + HWWS vs - HWWS
Sinks** (Reduced sink:cot ratio)	HAI morbidity	Brito et al 2007	"higher rates of HAI" (conjunctivitis, pneumonia, n. enterocolitis)

Objective 3 – WASH in HCAI domains

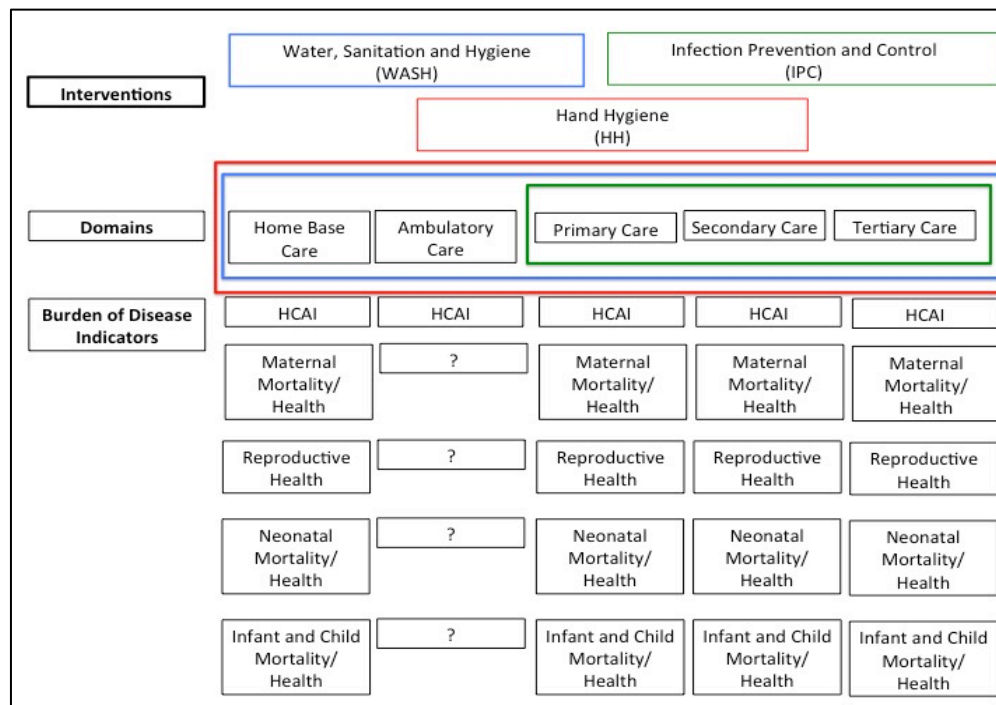
Decreasing levels of WASH coverage between tertiary and primary care (WHO, 2015; Benova et al 2014)

No studies identified estimating WASH coverage for ambulatory or home-based care domains

The scope of home-based care varies between HIC and LMIC; and therefore the fraction of HCAI burden attributable to WASH

In LIC, most births, and many neonatal and maternal deaths occur at home (Lawn et al 2005; Zaidi et al 2005; Campbell et al 2015)

Very few studies for WASH in home-based care settings (Rhee et al 2008)



Conclusions

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

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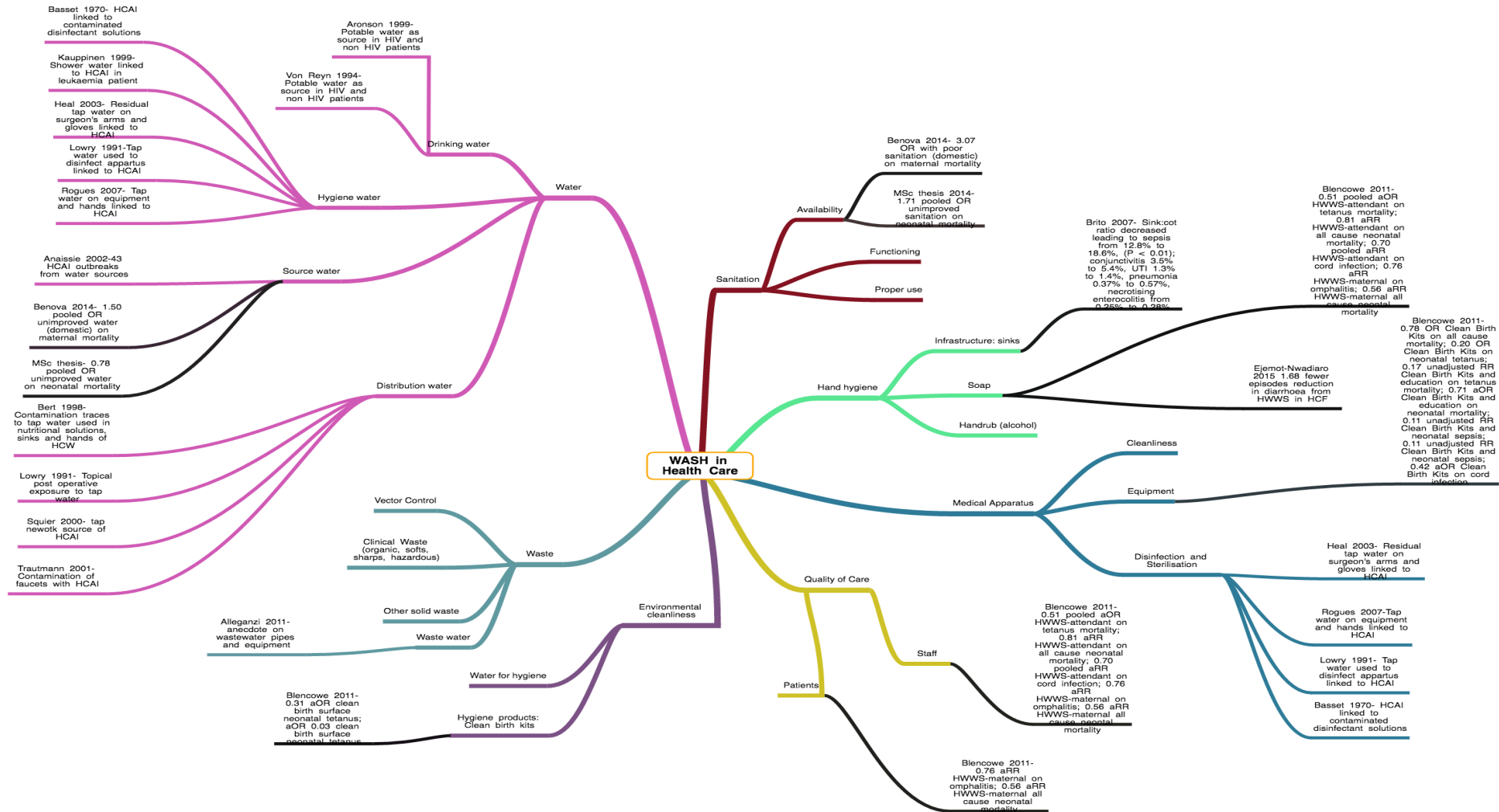
Thank you!

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Additional Slides

1. Evidence Map
2. Search strings



Approx. 1600 results

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
((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*)) OR ("still birth" or (preterm adj1 birth) or "low birth weight*" or "low-birth-weight*" or "pregnancy complication*" or "adverse pregnanc*") 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/
7. Hospital-Associated Infections
((((hospital or ((health* or "health care" or medical or birth* or delivery) adj1 (centre* or center* or facilit* or institution* or setting*))) adj3 (acquired or associated)) or nosocomial) adj4 (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)
8. Hospital-Associated + MESH terms
((hospital or ((health* or "health care" or medical or birth* or delivery) adj1 (centre* or center* or facilit* or institution* or setting*))) adj3 (acquired or associated)) AND 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/
9. Epidemiological study
(prevalence OR incidence OR risk OR exposure OR exposed OR outcome OR epidemiology OR epidemiological OR impact OR effect OR evaluation OR odds)