Handwashing in healthcare settings in low- and middle-income countries:

Literature review on handwashing in maternal care

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Sammandrag:

Bakgrund: I många låg- och medelinkomstländer har man uppnått nivån på att över 50% av förlossningarna äger rum i hälsovårdsanläggningar. Men med en ökning av förlossningar på hälsoanläggningar tillkommer en ny utmaning - sjukvårdsrelaterade infektioner. Även om fler förlossningar sker i sjukhus med kvalificerad vårdpersonal har risken för infektion inte försvunnit. Många kvinnor och spädbarn drabbas fortfarande av förebyggbara sjukdomar och dör eller utvecklar livslånga funktionsnedsättningar på grund av infektioner. Detta inkluderar infektioner som beror på dålig handhygienpraxis, som t ex handtvätt. Därför utgör handtvätt en central del av förebyggandet av infektioner och utgör basen för kvalitetsvård.

Syfte: Syftet med denna studie är att kartlägga forskning om handtvätt inom mödravården i låg- och medelinkomstländer.

Metod: Denna studie genomfördes som litteraturstudier av både kvalitativ och kvantitativ forskning. Artiklarna hämtades från 16 utvalda databaser i Arcadas bibliotekssamling för hälsa samt från tre ytterligare källor.

Resultat: Totalt nio artiklar hittades. Handtvätt nämndes i titeln endast i få studier (n = 3), men handtvätt som utförts av sjukvårdspersonal var i fokus i endast en studie. Resten av studierna nämnde handtvätt endast abstrakt (n = 6). De flesta av dessa utgjorde bedömning av intrapartumvård eller rena förlossningsmetoder som inkluderade handtvätt som en faktor.

Slutsats: Det saknas studier som specifikt bedömer handtvätt inom mödravården i låg- och medelinkomstländer. Mer forskning och statistik inom området behövs för att stöda insatser för att minska mödradödlighet och -sjuklighet.

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Abstract:
Background: Many low- and middle-income countries have reached the level of over 50% of births taking place in health facilities. However, with an increase in health facility deliveries comes a new challenge - Healthcare associated infections. Even if more deliveries are taking place in facilities with skilled healthcare workers the risk of infection has not disappeared. Many women and newborns are still affected by preventable illnesses and die or develop lifelong disabilities because of infections. This includes infections that are due to poor hand hygiene practices, such as handwash. Therefore, handwashing has been listed as a central part of infection prevention and a base to quality care.

Aim: The aim with this study is to map research done on handwashing in maternity care in low- and middle-income countries.

Method: This study was conducted as a literature review of both qualitative and quantitative research. The articles were retrieved from 16 selected databases from Arcada's library collection for health and 3 additional sources.

Results: A total of nine articles were found. Handwashing was mentioned in title only in a few studies (n = 3), but handwashing performed by healthcare workers was the focus in only one study. The rest of the studies mentioned handwashing only in the abstract (n = 6). Most of them were assessments on intrapartum care or clean delivery practices that included handwashing as a factor.

Conclusion: There is a lack of studies assessing specifically handwashing in maternal care in low – and middle-income countries. More research and statistics in the area is therefore needed to support interventions for reduction of maternal mortality and morbidity. The future of maternal health outcomes lies on strengthening understanding of the problems in maternal healthcare.

Keywords:	Healthcare acquired infection, Maternal health, Nosocomial infection, Hygiene, Handwash
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GLOSSARY OF TERMS AND ABBREVIATIONS USED

HCAI - healthcare associated infections

NGO Non-Governmental Organization

UN United Nations

UNICEF United Nations' Children's Fund

USAID United States Agency for International Development

WASH Water, Sanitation and Hygiene

WHO World Health Organization

FOREWORD

This literature review has been requested by SCOPE (earlier known as M4ID) who creates creative services and product solutions for development and health. One of SCOPES's projects has been Lab.Our Ward which focused on improving products, services and spatial design in labour and postpartum facilities. The design focuses on finding new approaches to low-resource settings. The research will be in an open library of ideas and design proposals that can be implemented in facilities (Scope 2020a). The open library of ideas is the inspiration for this research which aims to give evidence-based support to future handwashing research and inventions in maternal units and maternal care in low resource settings.

Helsinki, May 2020

Aurora Robles

INTRODUCTION

> "Worldwide, 30 000 women and 400 000 babies die every year from infections, such as puerperal sepsis, often caused by lack of water, sanitation and poor hand-washing practices. In an era of antimicrobial resistance it is crucial that all midwives wash their hands at key moments – before and after touching a patient, before medical procedures, and after being exposed to bodily fluids" (WHO 2017).

Since the year 2000 the maternal mortality ratio has declined by 37 % and neonatal mortality rates fell by 41 % (United Nations 2019). This has been achieved through the increase in facility-based births, attendance of skilled health personnel, clean deliveries and good management (WHO 2018; Songa et al 2015). Many low- and middle-income countries have reached the level of over 50% of births taking place in health facilities (Graham et al 2016; Cross et al 2016; Montagu et al 2017). However, with an increase in health facility deliveries comes a new challenge - healthcare associated infections (Graham et al 2016). Even if more and more deliveries are taking place in facilities with skilled healthcare workers the risk of infection has not disappeared.

The vulnerable state of mothers and neonates has led to a growing worry about morbidity and mortality related to hospital infections. The WHO systematic analysis of global causes of maternal deaths (Say et al 2014) stated that there is strong evidence between poor hygiene practices and environment at the time of birth and its contribution to life-threatening infections in mothers and babies. WHO (2019) estimated that 11% of maternal deaths were due to infections related to unhygienic conditions during labor and poor hygiene practices during the six-week postpartum period**.**

The main mode of transmission of hospital-acquired infections have found to be through contact, in other word by hands. Therefore, the single most important and effective prevention and control measure in healthcare is hand hygiene (WHO 2018; USAID 2018; Bedoya 2017; Orji et al 2005). The Oxford Textbook of Global Health of Women, Newborns, Children, and Adolescents (Devakumar et al 2018: Pg 128) lists handwashing as one of the clean birth practices to reduce maternal and neonatal infections. The WHO systematic analysis of global causes of maternal deaths defined this as handwashing with soap in healthcare facilities (Say et al 2014).

1.1 Focus of the study

The 51st World Health Assembly stated and encouraged member states `to adopt an evidence-based approach to health promotion policy and practice' (Green 2000). In planning and implementation of interventions within the field of medicine and healthcare, best practice and research proven methods are a key especially in low resource settings. Therefore evidence-based practice is the core of this research and is used as the theoretical framework.

Within the fields of hospital hygiene, patient safety, hospital associated infections, infection prevention and maternal and child health there is a research gap. There is a lack of research in the area of handwashing in maternal health units and maternal care in low- and middle-income countries (Moffa et al 2017; Cross et al 2016; WHO 2015a; Songa et al 2015; Velleman et al., 2014). Despite evidence stating that the maternal and neonatal disease burden is greatest in these settings, infections and hygiene being one of the issues, research is limited in the area.

It has been found that even if supplies and appropriate infrastructure is available, average of 61% (in some up to 90%) of healthcare workers do not adhere to best handwashing practices (Global Handwashing partnership 2017). This has led to discussion about that enhancement of handwashing in hospital level needs to focus on both behavior and infrastructure (Bouzid et al 2018). WHO (2019) recognized in the rapport on water, sanitation and hygiene in healthcare facilities the lack of systematic assessments in low- and middle-income countries. The rapport found that focus was often on infrastructure and with lacking or no information on practices. Global Handwashing Partnership (2019 a) did a review on the last 10 years and the current situation in handwashing research. The study came back with 155 results with diverse programmatic areas, varying from urban design to maternal and child health. However, there were only two results for research that were done in healthcare settings with maternal and child health in the centre; one study was based in a neonatal intensive care unit and the other at a labour ward. This highlighted the lack of research on handwashing circumstances and practices during birth. WHO and studies (Graham et al 2016; Koblinsky et al 2016; WHO 2015c) call for research for quality care when it comes to maternal health.

The aim with this study is to map researches done on handwashing in maternity care in low- and middle-income countries. The focus is on handwashing hence washing hands with plain or antimicrobial soap and antiseptic handwashing which includes washing with other detergents containing an antiseptic agent (WHO 2009) Also, the focal point is on low- and middle-income countries excluding studies in high-income countries. For the definition of low- and middle-income countries the study uses the World Bank's (2020) income classifications and for the definition of healthcare facilities WHO (2015a) description. The burden of healthcare associated infections is high in all low-and middle-income countries, where pooled infection data suggest healthcare associated infections rates are at least three times as high as rates in resource-rich countries. (ISID 2018; Bouzid et al 2018). In the same time there has been a rapid increase in health facility births in low- and middle-income countries.

To support the evidence-based framework of the work, a literature review of peer-reviewed studies was found to be the best research method. The research goes through research in the field of handwashing in health facilities in low- and middle-income countries and international recommendation. Topics included in the research are hospital infections, challenges in healthcare facilities in low- and middle-income countries and the risks to maternal and newborn health.

The research was inspired and requested by SCOPE who are a social impact company. Their vision is a world where everyone, everywhere can experience a healthy, dignified, fulfilling life (SCOPE 2020b). The study supports this vision and hopes to inspire actors in and outside of the health sector to improve maternal health globally.

BACKGROUND

"Healthcare associated infections", also known as nosocomial infections, is relatively new term. It includes any disease acquired by patient under medical care (Khan et al 2015). American Academy of Pediatrics (2017 p.559) in their Guidelines for perinatal care define this in obstetric patients as:

> a health care-associated infection can be defined broadly as one that is not present or incubating when the patient is admitted to the hospital and occurs more than 48 hours after hospitalization.

It has been estimated that healthcare-associated infections affect 15.5% of patients in developing countries and causes 700 000 deaths due to antimicrobial resistance (WHO 2019; Say et al 2014; Global handwashing partnership 2017). They also increase the length of hospital stays from 5 to 30 days causing overcrowding, medical supply shortages, reduced staff productivity and cost some countries as much as $19 billion annually. Improved hand hygiene measures have shown to reduce hospital-acquired infections by 40% (Global Handwashing partnership 2017).

Viruses, bacteria and parasites can live on surfaces around the hospital environment and on skin. No part of the body is free of bacterial flora. Our skin due to its transient flora on the superficial layers and short-term persistence has high pathogenic potential (WHO 2009). We shred daily nearly 106 skin squames into our immediate environment which can contain infectious agents that then through touch can transmit from one person to another. The hospital environment has therefore a high rate of pathogenic microflora that is carried in by both workers and patients (Ataee et al 2017). This makes hospitals a high-risk place for infection and hands one of the main transition routes for infections, especially the hands of healthcare workers, who are in direct contact with patient and contaminated surfaces (American Academy of Pediatrics 2017). This is a major challenge in patient safety (Allegranzi et al 2011).

Many of the microorganisms causing the infections can survive on surfaces from hours to months even years (Tulchinsky 2018; ISID 2018; WHO 2009), for example a study on methicillin-resistant *S. aureus* (MRSA) showed how healthcare workers carried the organism on their hands up to 3 hours (Stone 2001) and that it can live on surfaces from seven days to seven months. Other examples are Norovirus surviving and moving from

one surface to another easily and living on surfaces from eight hours to seven days (Tulchinsky 2018; WHO 2009) and HCoV-19 and SARS-CoV-1 which can live up to 2-3 days on plastic and stainless steel (Van Doremalen et al 2020).

This can make “clean” activities such as lifting patients, taking the patient’s pulse, blood pressure or touching the shoulder of the patient or something in the patient’s immediate environment a risk for infection. Studies show how lack of infection controls measures such as handwashing increases prevalence of diarrhoea, pneumonia, parasitic infections, influenza, helminths, trachomae, sepsis, neonatal infections, HIV-associated infections and environmental enteropathies (Freeman 2014). The most common healthcare associated infections, include urinary tract infections, surgical and soft tissue infections, gastroenteritis, meningitis and respiratory infections, are caused my multiple different pathogens.

The organisms causing infections are a heterogeneous group that varies from bacteria, viruses to parasites. This can make it difficult to measure the infection rates in different healthcare settings. A study (Khan et al 2015) listed some of the most usual hospital-acquired infections and defined enterococci, P. aeruginosa, S. aureus and E. coli to have a major role in infection rates. A bacteriological research showed that hand's bacterial flora included bacteria from a fecal-oral origin for example Clostridium.

For prevention and control of healthcare associated infections it is important to understand the mode of transmission and the classic epidemiological triangle of host/agent/environment. The host can be a patient, neighboring patients, staff or visitors who are colonized with the pathogen (Tulchinsky 2018). Just because a patient is not showing signs of infection, does not mean that they do not carry organisms that could be transferred to another patient if proper hand hygiene and other infection control precautions are not taken. Different agents have different modes of transmission and different preferred environments. WHO (2009) in their guidelines on Hand Hygiene in Health Care go through the transmission of healthcare associated infections in detail (Table 1)

The two main categories of modes of transmission are direct contact (contact with body substances including blood, urine, stool, and respiratory tract secretions) and indirect contact (contaminated intermediate object such as a door handle, a person's contaminated

hands) (American Academy of Pediatrics 2017). Handwashing is a central part of infection control for both modes of transmission especially in healthcare settings which have been identified as a contributor to outbreaks (ISID 2018). According to American Academy of Pediatrics (2017) Guidelines for perinatal care, handwashing becomes especially significant when healthcare workers are in contact with body fluids.

Table 1: Transmission of healthcare-associated pathogens from one patient to another via healthcare workers (HCW) hands requires five sequential steps (WHO 2009 pp.12-14)

(i)	organisms are present on the patient's skin, or have been shed onto inanimate objects immediately surrounding the patient
(ii)	organisms must be transferred to the hands of HCWs
(iii)	organisms must be capable of surviving for at least several minutes on HCWs' hands
(iv)	handwashing or hand antisepsis by the HCW must be inadequate or entirely omitted, or the agent used for hand hygiene inappropriate
(v)	the contaminated hand or hands of the caregiver must come into direct contact with another patient or with an inanimate object that will come into direct contact with the patient

Healthcare-associated infections are at high rate and a challenge in low- and- middle income countries (Allegranzi et al 2011; Bouzid et al 2018) where the risk is 2–20 times higher than in developed countries (Bouzid et al 2018). Due to the increase of infections not only the extend of hospitalization increases (Moffa et al 2017) but also the use of antibiotics (Khan et al 2015). This leads to another global health issue: antimicrobial resistance. Organisms drug-resistant to available antibiotics are a looming public health and clinical disaster (Tulchinsky 2018). Evidence suggests that poor water, sanitation and hygiene (including handwash) in healthcare facilities also leads to increased prophylactic use of antibiotics before birth, which may be an important contributor to antimicrobial resistance. Antimicrobial resistance is a major factor determining clinical unresponsiveness to treatment and rapid evolution to sepsis and septic shock (WHO 2019). Therefore, effective prevention, such has handwash is needed in healthcare,

especially in low- and middle-income countries and in maternal health settings (Graham et al 2016; Graham et al 2015).

1.2 Infections risks at maternal units in low- and middle-income country settings

"The day of birth is the most dangerous for mothers and babies" (Devakumar et al 2018: Pg 128).

In under-resourced settings, deliveries often take place with limited resources and in unhygienic circumstances which are a major risk for maternal and newborn infection related morbidity and mortality (ISID 2018). For example, the risks associated with sepsis is 34 times greater in low resource settings (WHO 2019). The risk of infection could be reduced by simple infection control measures and "clean birth practices", including handwashing with soap (ISID 2018; Velleman et al 2014).

Sepsis and other infections account for a 22% of neonatal death globally (USAID, 2018) and up to 56% of neonatal deaths among babies born in hospitals are due to infection (Global Handwashing partnership 2017). Neonatal infections were reported to be 3–20 times higher among hospital-born babies in developing than in developed countries (WHO 2009) with poor infection prevention practices which put new born in high risk for healthcare associated infections and other infections (Global Handwashing partnership 2017). During neonatal care health workers hands are a major infection risk if contaminated from respiratory secretions, nappy/diaper change, and direct skin contact (WHO 2009) especially for babies who for example have a low birth weight (Oestergaard et al., 2011).

Studies on the effect of handwashing in infant care has shown strong evidence on reduced sepsis and infection rates. A study (Songa et al 2015) made a summary on how handwashing by birth attendants and mothers have shown results in increase new-born survival rates: reduction on mortality between 19%- 44% (Oestergaard et al., 2011; Rhee et al., 2008), decrease neonatal tetanus rates by 30% -56% (Stekelenburg 2004; Mikey 2006; Black et al. 2010) and reduced the risk of cord infection by 49% (Cavill 2012).

Many studies focus on the newborn however the mother is also at high risk, especially in low resource settings. Around 83·8% - 90% of the maternal deaths occur in Sub-Saharan Africa and South Asia. Maternal mortality is defined as the death of women during pregnancy, childbirth, or in the neonatal period up to four weeks after delivery (Songa et al 2015; Say et al 2014). Sepsis, bacterial infection in the bloodstream or body tissues, is globally one of the major causes of maternal death, estimated at 10.7% of maternal deaths (USAID, 2018; Say et al 2014). Sepsis is also one of the major complications after birth. The Global Burden of Disease Study (2013) notes that the magnitude of sepsis could be underestimated in countries with high maternal mortality due to difficulties in diagnosis. As a morbidity woman go on developing chronic pelvic pain, pelvic inflammatory disease, damage to reproductive organs and infertility (Cavill 2012). The main cause for sepsis and other infections is unhygienic practices and poor infection control in labour and delivery (Rudd et al 2020; Songa et al 2015). Multiple vaginal examinations during labour with unclean hands especially increase the risk for both mother and the child to get early onset neonatal sepsis (Usha et al 2019; Downe et al 2013). The handwashing of birth attendants has been associated with 49% reduction in maternal mortality (Bouzid et al 2018).

The birth canal of women after birth, especially after invasive procedures, traumatic delivery or obstructed labor or when placenta or placental fragments are retained in the uterus, is sensitive for infection (WHO 2015 a; USAID, 2014). WHO (2015a) developed recommendations for prevention and treatment of maternal peripartum infections. The recommendations defined puerperal sepsis as:

> "infection of the genital tract occurring at any time between the onset of rupture of membranes or labour and the 42nd day postpartum in which two or more of the following are present: pelvic pain, fever, abnormal vaginal discharge, abnormal smell/foul odour discharge or delay in uterine involution"

Also, a guideline to standard infection prevention and control measures were listed, this included handwashing. Same was included in WHOs (2016 b) Checklist for Safe Childbirth:

> On admin: Confirm supplies are available to clean hands and wear gloves for each vaginal exam
>
> Just Before Pushing (Or Before Caesarean): Confirm essential supplies are at bedside and prepare for delivery: For mother Gloves Alcohol-based handrub or soap and clean water

Standard infection control measures should be taken before, during and after labour (ISID 2018; American Academy of Pediatrics 2017). Best hygiene practice for delivery rooms is in detail described by many entities and should be a common practice as stated by WHO (2015 a). USAID (2014) talks about the standard infection prevention practices to reduce the risk of maternal and newborn infections through the concept of "6 cleans":

> clean hands, clean perineum, nothing unclean inserted into the vagina, clean birthing surface, clean cord cutting instrument and clean cord ties.

Hand hygiene of healthcare workers is the cornerstone of these practices (Blencowe et al 2011) but should be supported by provision of supplies, infrastructure, training, infection control practices such as protocols and training for ward cleaners. A study on India and Bangladesh (Cross et al 2016) found that S. aureus and other pathogens were most commonly found on delivery room door handles and maternity ward beds at the approximate location of patients' hands and feet which indicated poor environmental hygiene and lack of effective cleaning.

However low resource settings in low- and middle-income countries do not always have access to supplies, infrastructure, and recommended attire such as single-use non-sterile gloves. Nevertheless, studies show that even if infrastructure and soap is present handwashing compliance can still be low. An observational study showed how birth attendants had low rates of handwash before assisting with delivery. In the study in India 24% washed their hands prior to delivery and Nepal 32% while in Bangladesh 69% (Bouzid et al 2018). Infection control which includes handwashing should be a basic of healthcare especially in child delivery (WHO 2015c) and should be promoted and supported within the hospital environment. Water, soap and the information and knowledge about handwashing should be a bare minimum requirement for a healthcare facility especially at delivery rooms. It is the main way of reducing the exposure of the mother and new-borns to pathogens (Cavill, 2012).

The increasing trend of facility childbirths and the promotion of it should take in consideration also minimizing the infection risks that are present in a facility. If we motivate mothers to give birth at a facility with a trained professional, we must also ensure that this will not lead to a greater number of infections due to greater demand, lack of workforce and compromised hand hygiene practices (Cross et al 2016).

1.3 Handwashing

Handwashing is a central part of infection control and an important public health measure. During outbreaks it is often one of the first public health messages sent out to the public. During the COVID-19 pandemic the WHO Strategic and Technical Advisory Group for Infectious Hazards listed response measures of which promotion of personal protective hygiene and handwashing were on the top together with respiratory etiquette and social distancing (Bedford et al 2020).

Hand hygiene has been a major part of care and medicine since the mid- 1800s. The link between hand hygiene and the spread of disease was established as a result of studies by Ignaz Semmelweis in Austria, and Oliver Wendell Holmes in USA, who established that hospital-acquired diseases were transmitted via the hands of healthcare workers. Semmelweiss is considered the father of hand hygiene and infection prevention. In 1847 he observed the maternal mortality rates were mostly caused by puerperal fever at two obstetric clinics. He noted that that the significant difference in maternal mortality rates (16% versus 7%) was due to lack of hygiene practices. After the implementation of hygiene measures mortality dropped with 3% and remained low. (WHO 2009) Since then hand hygiene has become a central part of best practice in healthcare and a core skill of healthcare workers (Songa et al 2015). However over time it has become “too simple to matter” which has led to that it is often forgotten among all the other practices and procedures in healthcare, effecting on the consistency and making the hands of healthcare workers a main mode of transmission for infections (Watson 2019).
WHO Guidelines on Hand Hygiene in Health Care (2009) is the main global document on hand hygiene and describes the specifics and limitations of handwashing. The guideline gives clear definitions on handwash and all the related terms.

Hand hygiene is a general term that includes handwashing, antiseptic handwashing, and antiseptic handrubbing (or handrubbing) (WHO 2009; ISID 2018). WHO (2009) defines handwashing as the action of washing hands with plain (non-antimicrobial) soap and water and antiseptic handwashing as washing hands with water and soap or other detergents containing an antiseptic agent. The purpose of routine handwashing is to

remove mechanically and physically dirt, organic material, and microbial contamination from the skin.

Antiseptic handrubbing refers to the application of an antiseptic handrub (usually an alcohol-based formulation) to the hands to reduce or inhibit the growth of microorganisms (WHO 2009; WHO 2015a; ISID 2018). Other hand hygiene practices are hand antisepsis/decontamination/degerming, hand care and surgical hand preparation which are also an essential part of healthcare. (WHO 2009; WHO 2015a; ISID 2018).

The main guidance to hand hygiene timing has been the 5- steps model or 5 moments of hand hygiene which describes when hand hygiene should be performed. (ANNEX 2) The model was developed for hospital use to support quality care, patient safety and infection prevention measures. In a hospital environment this means that hands should be washed when: viewing dirt on the hands, after contact with contaminated objects, before and after patient's contact, before putting on gloves and after removing it, after the toilet, after smoking, after sneezing, after dragging the hands on the scalp, after entering the hands on the mouth and nose and after scratching the skin (Ataee et al 2017). Also, healthcare workers should wash their hands when entering or exiting healthcare the facility and before eating (Global Handwashing partnership 2017).

Handwashing is time consuming as it should take between 40-60 seconds when done with right technique. When done in the wrong technique or without the proper supplies it can be a source of infection. Therefore, there is a debate about if antiseptic handrubbing should take the main role in hospital hand hygiene. The fact that it evaporates rapid and that there is no need for exogenous source of water for rinsing or towels or other devices for drying has been its benefits. The infectious diseases expert Didier Pittet (2001) has highlighted time is a main issue that contributes to handwashing compliance. Healthcare workers might simply not have the time every time to do a sufficient handwash. This has led to the argument that alcohol-based hand rubs could be an effective transitional solution for institutions that cannot afford to install basic water services throughout the facility (Pittet 2001; Burki 2019; Pickering et al 2010). Alcohol-based hand rubs has been debated to provide a more expedient and efficient system for hand hygiene, particularly when it comes to the rapid paste of a healthcare settings and when changing gloves (Loftus et al 2019; WHO 2009). Also, it has been found to be effective against many

pathogens associated with maternal and neonatal infections (Buxton et al 2019) and has been said to be less irritant to healthcare worker's hands than soap and water (ISID 2018). This has made it a central part of hand hygiene in healthcare settings especially in high resource settings (Mushtaq & Walsh 2012). However, a study from 2019 found that there is a lack of high-quality studies in low- and middle-income countries when it comes to use of antiseptic handrubbing (Loftus et al 2019). Also, some viruses, spore of bacteria and protozoan oocysts (paracytes) are unaffected by handrub, which limits the promotion of it in tropical settings (WHO 2009). When it comes to maternal care and childbirth antiseptic handrubbing by itself is not efficient to remove organic material such as feces, blood and urine that are part of birth.

Gloves are another important topic when it comes to hand hygiene especially in maternal healthcare with internal examinations and birth. They are not a fully protective measure which means that handwashing or antiseptic handrubbing is still needed before and after use (Fuller et al 2011; American Academy of Pediatrics 2017) and when in contact with feaces, blood and body fluids handwashing is still needed in the side of glove use (American Academy of Pediatrics 2017). This is supported by clinical, epidemiological studies, theoretical rationale and a consensus by a panel of experts suggests that handwash is needed when hands are visibly dirty or visibly soiled with blood or other body fluids or after using the toilet (Pittet, Allegranzi, & Boyce 2009). Therefore, handwashing could not be replaced by only antiseptic handrubbing and gloves. Which makes it an important part of maternal care.

1.3.1 Handwashing technique, water and soap

The reasons for a high nosocomial infectious prevalence is often inadequate handwashing techniques by healthcare workers (Ataee et al 2017). The ideal technique for hand washing should be quick to perform at the point of care, reduce hand contamination to the lowest possible level, and be free from significant side effects on the healthcare worker's skin (ISID 2018). Handwashing needs three agents: clean water, soap or an antiseptic, and a clean towel to dry the hands (Ataee et al 2017). These are all an important part of proper handwashing technique, for example using only water is not

enough to dissolve fatty materials, dirt, soil, and various organic substances from the hands. WHO Clean Care is Safer Care (2020a) illustrated (figure 1) the 10 steps of hand washing which shows the correct technique.

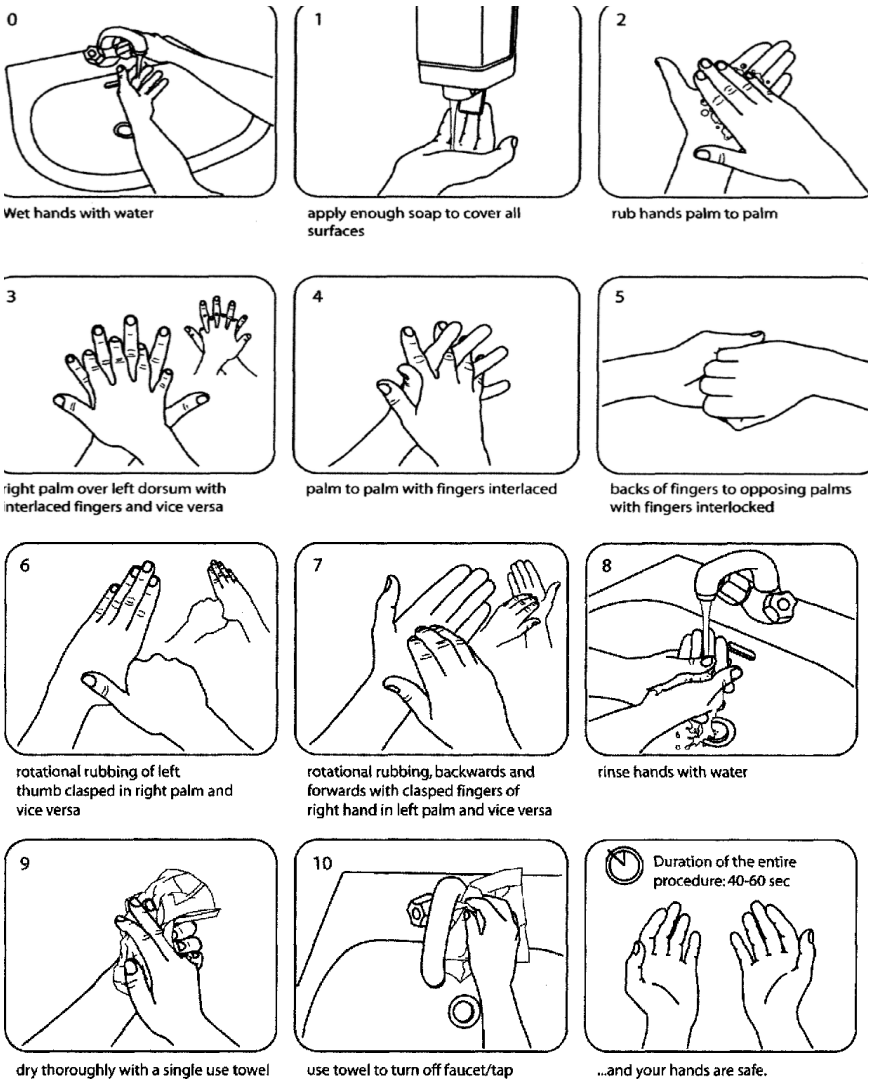

FIGURE 1: Handwashing technique with soap and water (WHO 2020a)

The primary step before step 0, is to ensure that the healthcare worker does not have jewellery, artificial acrylic fingernails or long nails, as all these result in that hands stay contaminated even after handwash (WHO 2012).

Proper handwashing must ensure that soap or detergent must be rubbed on all surfaces of both hands followed by thorough rinsing and drying. Step 1 in proper handwashing technique is to apply enough soap. Too little results in that hands remain contaminated. Studies found that 1ml of liquid soap lead to a greater number of bacteria remaining on

the hands than using 3 ml. This was found clinically relevant as healthcare worker could use as little as 0.4 ml of soap which would mean that hand remain contaminated (WHO 2009). Steps 2-7 are a central in the mechanical removal of pathogens from the transient flora. When jumping oversteps pathogens remain even after rinsing in step 8. Water temperature has not been found to be an issue with elimination or reducing for example bacteria, but it has been found to be an issue with skin irritation. Warmer temperatures have been found to cause damage to the skin (Ataee et al 2017). Step 9 drying through single use towel can be a limitation in low resource settings where there might not be a continues provision of paper towels. However, hand drying is a critical part of handwashing and a determinant of bacterial transfer. A study showed indicated that released amount of bacterial flora from wet hands is more than 10 times in compared to dry hands (Ataee et al 2017). When clean or disposable towels are used, it is important to pat the skin rather than rub it, to avoid cracking (WHO 2009).

Water will not by itself remove hydrophobic substances such as fats and oils often present on soiled hands, but it is needed for the rinsing of the hands. While drinkable water may also be ideal for handwashing, available evidence does not support the need for potable water for washing hands. However, water can also be the central source of infection and needs to therefore be safe to use (ISID 2018; Moffa et al 2017; WHO 2009). A research studied 43 outbreaks of which 69% were related to biofilm in in water storage tanks, tap water, and water from showers (WHO 2009). This means that even if hand hygiene practices were in place there would still be a high infection risk from hand transmission. Enough water for handwash is also important. Quantity of water can be for many facilities a main struggle, for example for an inpatient 40-60 litres/day is needed while an operating theatre or midwife obstetric unit would need 100 litres water/intervention and for an isolation patient this varies from 100- 400 litres/day (ISID 2018; WHO 2013).

As water is not enough to remove material from hands, soap is needed. The term “soap” is often used for various types of detergents that are composed of a hydrophilic and a lipophilic part that result in removal of contamination from hands together with water and adequate technique (WHO 2015).WHO (2009) defines handwashing as washing with plain (non-antimicrobial) soap and antiseptic handwashing with soap or other detergents containing an antiseptic agent. These can be found in different formats such as soap bars

and liquid preparations. Many studies mix these two or use the general term “soap” instead of defining as plain soap (non-antimicrobial) or a soap with an antiseptic agent. The effectiveness differs between these two.

Plain soap (non-antimicrobial) contains detergents that contain no added antimicrobial agents or may contain these solely as preservatives (WHO 2015). This results to that plain soap has minimal or no antimicrobial activity and only can remove transient flora. Many studies have shown that plain soap is not sufficient to remove pathogens of healthcare workers hands and that it could possibly result in a paradoxical increase in bacterial counts on the skin (WHO 2009). Antimicrobial (medicated) soap (detergent) containing an antiseptic agent at a concentration sufficient to inactivate microorganisms such as skin bacterial flora and viral population (Ataee et al 2017) and/or temporarily suppress their growth. The detergent activity of such soaps may also dislodge transient microorganisms or other contaminants from the skin to facilitate their subsequent removal by water (WHO 2015). Examples of antiseptic agents include alcohols, chlorhexidine gluconate, chlorine derivatives, iodine, chloroxylenol, quaternary ammonium compounds, and triclosan. These types of agents in soap, together with water and the right mechanical handwashing technique are the most efficient and safe option for healthcare use.

1.4 Healthcare facilities in low- and middle-income countries

There is a massive range in the public spending in healthcare and quality of facilities in low- and middle-income countries. This leads to a wide variation of maternal healthcare systems and qualities in care.

The world is moving towards elimination of maternal deaths, with countries and regions being in different stages. A study (Souza et al 2014) described five stages of obstetric transition through mortality, fertility, and services available:

> from level I with high mortality and fertility and no service or very little service to level V with low mortality and fertility and high service provision. In the obstetric transition, the tipping point occurs at Stage III. In this stage the mortality is still high (MMR 299–50 maternal deaths per 100 000 live births), fertility is variable and direct causes of mortality still predominate. This is a complex stage because access remains an issue for a much of the population, but as a greater proportion of pregnant women start reaching health facilities, quality of care becomes a major determinant of health out-comes, especially with regard to overloaded health facilities

The study on obstetric transition examines countries as whole but withing a proximity you can have both high- and low resource healthcare facilities with different services. There can be differences in healthcare infrastructure depending on the region, therefore one specific study from a single hospital is not representative for a country, region or even a city. There can be large disparities between general hospital, specialized hospital, district/first-level referral hospital and primary health-care centers when it comes to resources and infrastructure (WHO 2009 a). Also, there is a difference between public, private or not-for-profit run healthcare facilities. The difference between public and private can be seen in infrastructure, for example the mean number of handwashing stations in public health facilities is 0.8 while in private 3.7 per facility (Bouzid et al 2018). Therefore, you can within a country have different levels of obstetric transition because of the different levels of service provision. For example, there can be regions and populations on level IV while another region is at level II.

However, handwashing and healthcare associated infections remain an issue in all levels of transition. In leading high resource hospitals hand hygiene is as widespread of a problem as in low resource settings, with an average in compliance varying from 30 to

70% even after a decade of focus on the topic (Watson 2019). As handwashing in high resource settings can be compromised these challenges can be even greater in low resource settings that face multiple obstacles to adequate infection control (WHO 2009). In a low resourse settings obstacle for handwashing and risks for healthcare associated infections vary from inadequate infrastructure, water system management, governance, trained manpower, understaffing, intensity of workload, surveillance systems, overcrowding, bed sharing, shortage of basic equipment, regional and seasonal changes, patient groups and populations that have conditions that weaken their immune system (Mathur 2011; WHO 2009; Stone 2001).

The lack of studies in low resource settings makes it difficult to measure the infection rates in healthcare setting in low- and middle-income countries due to the lack of laboratory data, standardized information on medical records and infection control measures with surveillance systems (Bedoya 2017; Khan et al 2015; WHO 2009). Infection rates are often based on estimates that are based on exposure, for example self-reported data from healthcare providers, which tend to overestimate compliance to handwashing (Bedoya 2017) and on availability of soap and water or alcohol-based hand rubs at key points of care (WHO 2015) which are not always in continues supply. WHO and UNICEF (2019) published a Global Baseline Report on water, sanitation and hygiene (WASH) in healthcare facilities which stated that there were not enough countries with basic estimates to calculate global coverage of basic hygiene services in healthcare facilities.

The challenges with patient safety and healthcare associated infections are a major treat in low resource settings. Without proper or continues WASH, including handwashing, infection prevention and control cannot be done and there is a high risk for healthcare associated infections and outbreaks. (WHO 2015)

1.4.1 Factors affecting compliance to hand hygiene in healthcare

Low – and middle -income countries can have issues with infrastructure for water and sanitation and shortage of supplies for hand hygiene, which might limit handwashing practices. However, in many cases it has been observed that lack of infrastructure and supplies is not always the main problem when it comes to handwashing prevalence (WHO &UNICEF 2019). Studies (Buxton et al 2019; Bedoya et al. 2017) showed that there is a weak association between compliance and the availability of infrastructure, supplies, healthcare workers' knowledge, training in infection prevention and control and the availability of guidelines. Work culture, behavioural norms, beliefs and habits have a major role and are a handwashing limitation on a global level.

WHO (2009) highlighted in their guidelines that outbreaks could be linked to factors such as understaffing or overcrowding that was consistently linked with poor adherence to hand hygiene throughout the world. In low resource settings were staff is limited and resources might be scars this perpetuates the problem. However, handwashing practices are affected by a wide range of factors. A study from India (Mathur 2011) did a summary of the different factors affecting hand hygiene compliance; the healthcare staff related factors, clinical factors and environmental/institutional/behavioral and other factors (ANNEX:3). The summary supports other studies and highlights the problems with handwashing compliance which vary from time constraint, workload, indication, poor access to hand hygiene materials, absence of multimodal hand hygiene promotion but also includes the behavioral problems (Mathur 2011; ISID 2018).

Behaviour, that does not support handwashing, together with other factors can easily lead to increase in healthcare related infections. Therefore, it is important to recognize the factors that limit handwash especially in maternal care, where it can increase mortality and morbidity among mothers and newborns.

THEORETICAL FRAMEWORK

One of the main recommended approaches for improved healthcare in low resource settings is the implementation of an evidence-based approach (Bejoy et al. 2017). The concepts of evidence-based health promotion, that enhances patient safety in the context of handwashing and healthcare, is therefore in the core of this research and the theoretical framework. The concept is relevant to both individual behavior changes towards best praxis and system changes in healthcare.

Evidence is important in the selection and implementation of interventions on hospital level. When selecting an intervention to enhance handwashing in a health facility or in the process of building a new unit, the use of resources in the most effective way is a key specially in low resource settings where the budget is tight.

The concept of evidence-based is not new within health and medicine, it is an important component in modern medicine and public health. French physician Pierre Charles Alexandre Louis introduced a movement called Médecine d'observation in the 1830s, which stated that physicians "should not rely on speculation and theory about causes of disease, nor on single experiences, but they should make large series of observations and derive numerical summaries from which real truth about the actual treatment of patients will emerge" (Vandenbroucke, 1996, p. 1335). The approach has since then developed to be a central part in clinical decision making which is a core skill in healthcare (Patelarou et al 2017).

Historically public health has always been based on evidence especially in the areas of health protection and disease prevention (Jenicek 1997). Evidence-based public health was defined by Milos Jenicek (1997) as:

> "conscientious, explicit, and judicious use of the current best evidence in making decisions about the care of communities and populations in the domain of health protection, disease prevention, health maintenance and improvement (health promotion). It is the process of systematically finding, appraising, and using contemporaneous research findings as the basis for decisions in public health."

AIMS AND RESEARCH QUESTIONS

With the United Nations Sustainable Development Goals handwash has been highlighted as one of the interventions to decrease maternal and neonatal mortality. However, the area is lacking research specially in the area of handwashing in maternal care.

This research has been inspired by Scope who designs creative services and product solutions for development and health. Their special focus is on women and children in low- and middle-income countries.

The aim of the study is to map research done on handwashing and maternal health in low- and middle-income country healthcare facility settings. The results of the research can be used for future research, planning and implementation of hygiene related projects and interventions.

The Research question that this study will focus on is:

- What is the current situation in handwashing research in maternal healthcare in low- and middle-income countries?

METHODOLOGY

This study is a literature review that uses content analysis to map handwashing in maternal care in low- and middle-income countries. A literature review supports evidence-based practice (Liberati et al. 2009) as it surveys relevant material from scholarly articles and other sources relevant to the area of research, providing a description, summary and a critical evaluation of these undertakings in relation to the research problem being investigated (Fink 2014). The findings give a summary of the relevant research from the area and a picture of possible information gaps in the research field. Both qualitative and quantitative research is included and synthesised in the results which makes the research a mixed research study (Onwuegbuzie et al. 2010).

All the studies included in the research had to be published between 2009-2019, were available in full text in English and were peer-reviewed articles. These were used as the filters in the search engines. To ensure the relevancy of the articles the filtered results given by the databases were read through and assessed with the help of an inclusion and exclusion criteria (table 2). The criteria was formed to match the aim and purpose of the study.

Table 2: The inclusion and exclusion criteria

Inclusion	**Exclusion**
Study aimed on or done in a low- and/or middle-income country	Study not aimed on or done in a low- and/or middle-income country
Study set in a healthcare setting	Other than a healthcare setting
Handwashing was central part or important notion	Handwashing was not central or was not mentioned
Healthcare workers handwashing assessed	Healthcare workers handwashing not assessed
Maternal health specific	Study not aimed for maternal health

The inclusion and exclusion were done through reading the abstracts of the results and a fast skimming of the content. Academic studies and reviews were included based on that they were placed in a low- and /or middle-income country, that it is focused on hospitals

and healthcare settings and that handwashing and maternal health would be central topics. Besides the inclusion and exclusion criteria, the articles selected had all to be relevant to the research question.

1.5 Data collection

The search for relevant publications was done through 16 selected databases from Arcadas University of Applied Sciences library collection for health and three relevant sources outside of the Arcada collection. Databases for specific areas such as physiotherapy, sport and occupational therapy were also on the list of databases and were excluded from the study. The databases all shared the commonalities of filters on the search function that were utilized. The three sources included outside of the Arcada databases were: Lancet, the Global Handwashing Partnership and The International journal of Gynecology and Obstetrics. The International Confederation of Midwives page could not be included in the search due to the lack of a search function.

The articles were searched and retrieved using keywords that are relevant to the research question. The keywords used were: Handwashing AND maternal health. The keywords would be set as mentioned in title/abstract/keyword whenever that would be an option in the search engine. Synonyms to the key words were recognized and considered during the literature search and selection of articles. Some of the databases automatically included synonyms in the search. To control the number of articles when there would be a low number of results, synonyms would be used to check for results. Some of the synonyms or related words to the keywords used in the inclusion of articled include: maternal unit, delivery room, labour ward, antenatal care, post-partum care and hand hygiene.

To limit results the Boolean operator AND was used (Hart 2018). If search resulted in more than 100 findings in the database, AND hospital would be added to specify the search. In cases where that would not work AND healthcare worker would be added. If a search result would be zero found articles, AND hospital, synonyms or where the words appear (title, abstract, keyword) could be changed.

The filters helped with narrowing down the search and with finding specific research papers that matched the search terms. The three primary filters used were: that articles should be published between the years 2009 and 2019, that there was full access to the articles text and that the articles were in English. The relevant results given by the databases were then read through and the ones that matched the aim and purpose of the study were selected.

To support the validity of the study a template for the primary findings per database was used. The table presents the number of results, number of abstracts that were read and the number of articles that were included or excluded from the study.

The data collection differed only when results were low- or high in number. Below is the description of the steps that were taken in the search for the materials. The process for each database is described individually in table 3.

Process in databases with no or low number of results:

In Sage journals primary search found 0 results. When settings were changed to that handwashing AND maternal health could appear anywhere there were 1059 results. Adding AND hospital resulted in 608 hits. Then search was changed to Handwashing OR hand hygiene (title) AND maternal health (anywhere) AND hospital (anywhere), with this there were 3 results.

The first search in ProQuest led to 0 results, the system gave recommendations for other search terms. When adding AND hospital gave 26 results. Different synonyms were tried and different versions of the search.

Emerald Journals gave first 0 results. In ‘Abstract’ was then changed to ‘in all field’ which resulted to 70 search result of which 66 were articles.

Google scholar gave first 0 results when Handwashing AND Maternal health (found in title) was put. When changing ‘found in title’ to ‘wherever in in the text’ there were 15 100 results. AND "hospital" was added which limited results to 588. With help of modifying the search to "Handwashing" AND "maternal health" AND "hospital" AND "healthcare worker" results came down to 15 articles.

Process in databases with high number of results:

In Springer Link this first search round gave 6062 articles. Another search with “Handwashing AND Maternal health AND hospital” was done. This resulted in 3 results.

BioMed Central is a collection of journals. Primary search included all BMC articles: That showed 1471 search results. From the search two of their journals, BMC Infectious Diseases and BMC Pregnancy and Childbirth, came with the most relevant search result. Therefore, these journals were looked as separate searches. In BMC Infectious Diseases

"AND hospital" was added to specify the search, this resulted in 24 search results. The search in BMC Pregnancy and Childbirth resulted first in 129 results. "AND hospital" was added, this resulted in 116 search results.

The Lancet gave 2977 results but only 3 were articles. AND hospital was added, and synonyms were tested as a control, but results came back at 0.

Table 3: Data collection results from databases

Database and date of search	Keyword	Number of search results	Abstracts read (n)	Included in the study (n)	Excluded from the study (n)
ScienceDirect (Elsevier) 6.3.202	Handwashing AND maternal health	7	3	1	6
Sage 6.3.2020	Handwashing OR hand hygiene AND maternal health AND hospital	3	3	0	3
Medline (PubMed) 6.3.2020	Handwashing AND Maternal health	7	7	2	5
EBSCO 6.3.2020	Handwashing AND Maternal health	2	2	0	2
Cochrane Library 6.3.2020	Hand washing AND Maternal health	31	25	0	31
Ovid	Handwashing AND Maternal health	4	4	0	4

6.3.2020					
Springer Link 6.3.2020	Handwashing AND Maternal health AND hospital	3	3	0	3
ProQuest 7.3.2020	Handwashing AND Maternal health	26	7	0	26
BioMed Central: BMC Infectious Diseases 7.3.2020	Handwashing AND Maternal health AND hospital	24	15	0	24
BioMed Central: BMC Pregnancy and Childbirth 7.3.2020	Handwashing AND Maternal health AND hospital	116	51	4	112
Emerald Journals (Emerald) 7.3.2020	Handwashing AND Maternal health	66	23	1	65
Karolinska Institutets avhandlingar 7.3.2020	Handwashing AND Maternal health	1	0	0	1
Medic - hälsovetenskaplig referensdatabas	Handwashing AND Maternal health	32	1	0	32

7.3.2020 Julkari - Opensearch 7.3.2020	Handwashing AND Maternal health	64	2	0	64
Global library of women’s medicine 17.4.2020	Handwashing AND Maternal health	12	3	0	12
Google Scholar 17.4.2020	"Handwashing" AND "maternal health" AND "hospital" AND "healthcare worker"	15	9	0	15
Lancet 17.4.2020	Handwashing AND Maternal health	2977	3	0	3
The Global Handwashing Partnership 17.4.2020	Handwashing AND Maternal health	11	11	2	9
The International journal of Gynecology and Obstetrics 17.4.2020	Handwashing AND Maternal health	0	0	0	0

1.6 Description of material

The data collection found nine relevant articles from five different databases and sources. Most data, four articles, were found from BioMed Centrals journal for Pregnancy and Childbirth. PubMed and ScienceDirect had the same article which is marked as article 1 (table 4).

Most of the materials excluded was on the topic of general hospital hygiene without maternal health or low- or middle-income country focus. Also, there were WASH overviews of maternal and newborn health only looking at infrastructure and not mentioning handwash. There were a few interesting project descriptions, but they were not academic articles and were therefore excluded. Another group of excluded articles was based on homebirth, mother's handwashing practices or intense care units for newborns without looking at the maternal health aspect.

Table 4: Articles included in the study

Science Direct	1. Giorgia Gon, Marijn de Bruin, Mícheál de Barra, Said M. Ali, Oona M. Campbell, Wendy J. Graham, Mohammed Juma, Stephen Nash, Claire Kilpatrick, Loveday Penn-Kekana, Sandra Virgo, Susannah Woodd. 2019. Hands washing, glove use, and avoiding recontamination before aseptic procedures at birth: A multicenter time-and-motion study conducted in Zanzibar. American Journal of Infection Control, Volume 47: Issue 2. Pages 149-156,ISSN 0196-6553.
Pubmed	1. Gon G, de Bruin M, de Barra M, Ali SM, Campbell OM, Graham WJ, Juma M, Nash S, Kilpatrick C, Penn-Kekana L, Virgo S, Woodd S. Am J Hands washing, glove use, and avoiding recontamination before aseptic procedures at birth: A multicenter time-and-motion study conducted in Zanzibar. Infect Control. 2019 Feb;47(2):149-156. doi: 10.1016/j.ajic.2018.07.021. Epub 2018 Oct 4. 2. Changaee, F., Simbar, M., Irajpour, A., & Akbari, S. (2014). Quality assessment of peripartum care. Iranian Red Crescent medical journal, 16(6), e9069. https://doi.org/10.5812/ircmj.9069
BioMed Central:	3. Dhingra, U., Gittelsohn, J., Suleiman, A.M. et al. Delivery, immediate newborn and cord care practices in Pemba Tanzania: a qualitative study of community, hospital staff and community level care providers for knowledge, attitudes, belief systems and practices. BMC

BMC Pregnancy and Childbirth	Pregnancy Childbirth 14, 173 (2014). https://doi.org/10.1186/1471-2393-14-173 4. Moyer, C.A., Aborigo, R.A., Logonia, G. et al. Clean delivery practices in rural northern Ghana: a qualitative study of community and provider knowledge, attitudes, and beliefs. BMC Pregnancy Childbirth 12, 50 (2012). https://doi.org/10.1186/1471-2393-12-5 5. Iyengar, K., Jain, M., Thomas, S. et al. Adherence to evidence based care practices for childbirth before and after a quality improvement intervention in health facilities of Rajasthan, India. BMC Pregnancy Childbirth 14, 270 (2014). https://doi.org/10.1186/1471-2393-14-270 6. Hoogenboom, G., Thwin, M.M., Velink, K. et al. Quality of intrapartum care by skilled birth attendants in a refugee clinic on the Thai-Myanmar border: a survey using WHO Safe Motherhood Needs Assessment. BMC Pregnancy Childbirth 15, 17 (2015). https://doi.org/10.1186/s12884-015-0444-0
Emerald	7. Simbar M, Ghafari F, Zahrani ST, Majd HA. Assessment of quality of midwifery care in labour and delivery wards of selected Kordestan Medical Science University hospitals. Int J Health Care Qual Assur. 2009;22(3):266–277. doi:10.1108/09526860910953539
The Global Handwashing Partnership	8. Adekunle-Olarinde, I., Graham, W., Cross, S., & Moore, J. (2018). The Water@Birth Study: an exploratory study on the requirements of water for hand hygiene during labour and delivery in low-income countries. Journal of Obstetrics and Gynaecology. 38(5),725. https://doi.org/10.1080/01443615.2018.1444400 9. Pavani K. Ram, MD, and Swapna Kumar.2015. Handwashing in the Perinatal Period: Literature Review and Synthesis of Qualitative Research Studies from Bangladesh, Indonesia, and Kenya. From: https://globalhandwashing.org/wp-content/uploads/2015/03/Handwashing-in-the-perinatal-period-Synthesis-of-qualitative-studies-on-handwashing.pdf.

1.7 Data analysis

Due to the heterogeneous nature of the material, systematic content analysis with a framework was used to map and describe the studies (Paré & Kitsiou 2017). The information about handwashing and maternal health in low – and middle-income countries health facilities is fragmented, therefore an inductive approach was also used which meant that categories were created based on the results (Elo & Kynga 2008). Because the study aim was to map research, simple categorization without under categories was used to find similarities between the studies and to understand the type of research done in the area.

Content analysis is a systematic process where the researcher codes and recognizes themes and information from the text (Neuendorf, 2016) based on which valid conclusions can be drawn. It is content sensitive and therefore useful in the evaluation of secondary data (Hart, 2018). The study used only manifest content which is visible and obvious components from the studies. The direct content approach allowed the research to analyze emerging themes and patterns during the data analysis process together with the set framework. Content analysis can be labor intensive due to the quantity of material. Articles had to be read through independently and in detail so that relevant information would be found and that they could be coded correctly. As the study used both quantitative and qualitative studies there was a need for a systematic research structure to support the analysis. The structure was formed by the following questions:

- When was the study done? (Year of publication)
- Where was it done? (Location of study)
- What type of setting is described? (What type of healthcare setting)
- What is the purpose of the study? (Purpose of the study)
- What is the role of handwashing in the research?

Challenges with the defining location of the study was found in reviews that used multiple countries. Also, one study had Scotland and Ethiopia in a partnership research.

After the first few studies a pattern of the answers was starting to form. This led to creation of some of the categories that supported the purpose of the study. It was found that there were similar results from some of the studies which became a category.

ETHICAL CONSIDERATION

This study will follow the guidelines by the Finnish Advisory Board on Research Integrity specifically the responsible conduct of research (TENK 2018). The study will respect the work of others with systematic and correct referencing. The use of data and research will be used in the right context without misleading the reader on results.

Secondary data, documents, and reports are generally not prepared by the same people or institutions that do the primary data collection; hence the goals and purpose of primary and secondary data may not be the same (WFP 2009). This makes the use of secondary research done by other problematic. World Food Program has done a guideline for Comprehensive Food Security & Vulnerability Analysis which gives guideline to conducting literature reviews and how to minimize the problematic use of secondary data (WFP 2009). They have created a set of key questions to help assess data quality when doing a literature review. Even though the guideline is specific to food security and vulnerability analysis it can also be used for guidance of general research practice. These questions have been used as the base in the evaluation of the studies.

Another limitation and ethical consideration was the fact that due to the lack of research specific to low income settings this research has had to look at studies that have both low-income and middle- income countries. This means that there is a wide variation between the services that are provided, issues, data access and context. Many low- income countries struggle with collecting health metrics on births and deaths and there is variable reliability; data has been collected at small sentinel sites and might not be found in digital format (Wyber et al 2015). The main ethical issue in this is that when putting all these countries in the same study there is a risk for generalization of the current state in handwashing and a tendency of creating a picture of a homogeneous group, which is not the case. Also, the variation between healthcare contexts shows disparity in infrastructure. Therefore, the consideration of context, location and type of healthcare setting are important in this research and in the results.

This research attempts with the best measures possible to get an equal representation, highlight differences, use peer reviewed studies and material by multilateral institutions who prepare global and regional reports and guidelines.

RESULT

A total of nine articles relevant to the study were found (ANNEX 4). However, handwashing was mentioned in the title only in a few studies (n = 3) and was the central topic and assessed in detail only in one study. All the papers recognized that handwashing practices were inadequate (n = 9).

The articles were published between 2009 and 2019 and were evenly spread over the time period. The methods of the studies were varied, with observational (n = 3), interviews (n = 2), literature reviews (n =1), intervention-control study (n = 1) and with quality assessments with multiple different methods (n = 2).

Most of the studies (n = 7) took place in intrapartum care with some including post-partum care (n= 3). However, none of the studies assessed antenatal care. The studies took place in inpatient hospital settings (n =7), specifically in the labor wards (n=4), multiple different types of facilities (n= 1) and some had an unclear definition of the facility types (n = 4). This meant that the study could include for example home births and mother's handwashing practices together with healthcare specific results.

The researches were from 9 different countries. However, one of the researches studied 3 different countries, Kenya, Indonesia, and Bangladesh. The literature review which had multiple countries represented in their paper, was not counted in the number of countries. The spread between middle income countries (n = 3) and low-income country (n = 4) was close to even. One study was conducted on a border area which made the definition of one specific country and category hard. For example, the study (by Hoogenboom et al 2015) from the Thai-Myanmar border was hard to specify because Thailand is a upper-middle income country while Myanmar is a lower middle-income country according to the World Bank (2020) definition. Another study (by Adekunle-Olarinde et al 2018) had both a low – and a high- income country in their study but was still included because the focus was on low-income countries. Demographics such as urban or rural were not specified in most studies and therefore excluded in the analysis.

Handwashing was in main role (mentioned in title) in only in a few studies (n = 3). One of the studies, Handwashing in the Perinatal Period: Literature Review and Synthesis of Qualitative Research Studies from Bangladesh, Indonesia, and Kenya (by Pavani et al 2015) was in the results divided into two parts as the report included two studies that both were focused on handwash. Both parts were general studies on handwashing in the perinatal period which included home settings, mothers and caregiver's handwashing practices. Also, the study defined health effects as child mortality and infant mortality, which does not include maternal health and maternal mortality. Most healthcare settings were neonatal intense care units. The two other studies that were handwash specific were based in labor wards. However, the focus of one of the studies (by Adekunle-Olarinde et al 2018) was to assess quantity of water needed in labor wards. In the process of the study handwashing was observed, handwashing practices was therefore not the main aim of the study.

The rest of the studies had handwashing only in the abstract (n = 6). Most of them were assessments on intrapartum care or clean delivery practices that included handwashing as a factor. Handwashing behavior was evaluated in the assessments and other studies (n = 5) but only one study had handwashing behavior as a main topic.

DISCUSSION

The study was mapping handwashing research in maternal care in healthcare facilities in low- and – middle income countries. It aimed to see what is done from the health provider side. As mentioned in many studies low-and- middle income countries lack research in handwashing in maternal healthcare settings (Bedoya 2017), which was shown in the low level of handwashing specific results. The study found only three results that were handwash specific. However only one of the studies focused specific on handwash in maternal health settings.

Handwashing is often together with WASH studies and put in the shadow of water and sanitation. Also, focus is often on infrastructure and supplies instead of analyzing 'why they are not used?' Handwashing is not the only factor in healthcare associated infections and should not be seen as miracle solution that makes all healthcare associated infections go away but it is a major contributor. When a system is more developed and infrastructure and other variables are in place, behavior and factors effecting handwash should be assessed. There was only one study that was specific to handwashing behavior. The literature review on Handwashing in the Perinatal Period (Pavani et al 2015), one of the studies included, concludes that only a few studies have examined the practice of handwashing. Studies in maternal health in healthcare context are therefore needed, with an assessment on behavior when supplies and infrastructure are in place. This is an important part of evidence-based practice, infection prevention strategy and patient safety.

As healthcare systems develop in low- and middle-income countries and patient quantities grow, behavior of healthcare workers is essential in infection prevention, especially handwashing behavior. During the Covid-19 pandemic one of WHOs primary measures has been handwashing promotion. This might have a long-lasting effect on behavior and might change hygiene practices. Will this have effect on healthcare associated infections is still to be seen. A study from the Ebola outbreak showed that handwashing behavior improved in reproductive, maternal, newborn and child health services even dough some healthcare workers had not receive training in Ebola infection

control (Barden-O'Fallon et al 2015). Similar patterns could possibly be seen after the Covid-19 pandemic.

None of the results that were in intrapartum context where looking at the mother and her infections. All the studies focused on the risk of neonatal infection. The literature review on Handwashing in the Perinatal Period included mostly neonatal units. Neonatal mortality is an important topic when it comes to handwashing, however maternal health and mortality should not be forgotten. Infection are one of the major causes of maternal mortality, reproductive and maternal morbidity, and related disabilities (WHO 2015c).

Many articles that were excluded from the study were general health assessments such as the study on Global Burden of Diseases, studies focusing on household level and mother's handwashing behavior or intense care units for newborns. Also, some studies looked at the handwashing practices of birth attendants in a home birth setting. All these studies are of great importance to maternal health, however there is clearly a lack of maternal health specific studies on handwashing in healthcare settings. One of the questions that emerges is that if handwashing in maternal health is seen as such an unquestionable and "clear" process that it is not studied or is there simply no interest? As handwashing practices in healthcare have been developed over hundred years ago by Semmelweis with the aim to reduce maternal mortality, it is surprising that it has become a "forgotten" topic in maternal care. This is a major challenge in evidence-based practice and health promotion. The absence of research especially in low resource settings has been highlighted as health systems are drained by ineffective interventions (Siddiqi & Newell 2005) that lack understanding of the actual problem.

With the indication that there is a global push for facility births and care, followed by an increase in facility births, there is a need for accessing the patient safety behavior in these facilities together with improvement strategies based on evidence-based practice (Koblinsky et al 2016; Miller et al 2016). "If we want more evidence-based practice, we need more practice-based evidence." (Green 2008) This can only be done if there is knowledge on what the situation is (limitations, strengths, knowledge gaps, behavior) together with studies and assessments on specific issues and skills such as handwashing in these settings.

1.8 Limitations with the study

The main limitation of the study is the lack of research on the topic which resulted in only nine articles. The small number of results that were included in the study is not representative to all different contexts (regions, countries, types of facilities ect.). However, with the inclusion of literature reviews, the scope of representation of the current handwashing situation in maternal healthcare in low- and middle-income country context was wider.

Most of the studies that were included and clearly stated the type of facility, defined it as a hospital. Primary healthcare facilities are often the main health facility for rural areas and the first point of care, also for women in labor. Their role has been found to be significant in for example responding to outbreaks such as cholera or ebola (WHO 2015). However, a systematic review (Watson et al 2019) on 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 highlighted the research gap between WASH, healthcares associated infections and primary healthcare facilities and rural settings. None of the studies that were included stated that they were set in primary healthcare context, which shows similar results to the review.

Another limitation was that handwashing or relevant synonyms could be cut out from the title and abstract but still be a major part of the article. The wide possibility of different synonyms is one of the limitations of the study. Some of the results were assessments that included the word handwash in the abstract only as factor of the assessment. Other assessments could use the word infection prevention method or other similar terms, that would have handwash as a main component, this would not show in the search or was not included due to the restriction of having handwash mentioned in the title or abstract. However, as the main aim was to map research that had handwashing as a central topic or highlighted it in the abstract, relevant synonyms such as hand hygiene should have showed in the results. Hand hygiene was used as a control term to check if the low levels of results was true. The method of confirming results with help of synonyms helped to validate the results and give credibility.

The direct content approach allowed to analyze emerging themes and patterns during the data analysis process with the help of a set framework. This could have been done with a larger set of questions and a comparison could have been made to get a more qualitative analysis. However, the purpose of this study was to map the results, therefore this was not seen as relevant. Another limitation was the English language as a criterion. It might have limited the study, as there could be results in other languages.

CONCLUSION

Handwashing is one of the main preventive measures in healthcare associated infections, an important part of patient safety and quality care. Also, with the global pandemic, Covid-19, its importance as a control measure has been highlighted.

However, since the time of Semmelweis and his handwashing innovation to reduce infection and maternal mortality until now there is a knowledge gap in handwashing practices in maternal healthcare and a high proportion of infections related to poor hand hygiene (Tulchinsky 2018). Globally sepsis and infections, especially in low- and middle-income countries, are one of the main causes in maternal mortality and morbidity (Forouzanfar et al 2015).

Therefore, handwash is essential in maternal care. This is not seen in the level of research done in handwashing in maternal care in low- and middle-income countries, that are reaching higher levels of health facility births (Montagu et al 2017).

The study concludes that more research and statistics in the area is therefore needed to support the evidence-based approach in healthcare and the reduction of maternal mortality and morbidity. There has been a call for in-depth research to understand and influence key preventive behaviors and practices, such as handwash, together with information on maintenance and environmental hygiene (Graham et al 2016). The future of maternal health outcomes lies on strengthening understanding of the problems in maternal healthcare especially in low- and middle-income countries.

SUMMARY IN SWEDISH

Inledning/Bakgrund

Sedan år 2000 har den globala mödradödligheten minskat med 37 % och neonatal dödligheten sjunkit med 41 procent (UN 2019). Detta har uppnåtts genom ökning av facilitetsbaserade förlossningar, närvaro av kvalificerad vårdpersonal, rena förlossningar och god förvaltning (WHO 2018; Songa et al 2015). Många låg- och medelinkomstländer har nu nått till att över 50% av förlossningarna är inom hälsovårdsanläggningar (Graham et al 2016; Cross et al 2016; Montagu et al 2017). Men med en ökning i förlossningar på hälsoinrättningar tillkommer en ny utmaning - sjukvårdsrelaterade infektioner (Graham et al 2016). Även om allt fler förlossningar äger rum på sjukhus med kvalificerad vårdpersonal har risken för infektioner inte försvunnit.

Det har uppskattats att sjukvårdsrelaterade infektioner påverkar 15,5% av patienterna i utvecklingsländerna och orsakar 700 000 dödsfall på grund av antimikrobiell resistens (WHO 2019; Say et al 2014; Global handwashing partnership 2017). Detta ökar också längden på sjukhusvistelser från 5 till 30 dagar vilket förorsakar överbelastning, avsaknad på medicinsk utrustning, minskad personalproduktivitet samt kostar i vissa länder så mycket som 19 miljarder dollar per år (Global Handwashing Partnership 2017). Det sårbara tillståndet hos mödrar och nyfödda har lett till en växande oro för sjuklighet och dödlighet relaterad till sjukhusinjektioner. WHO:s systematiska analys av globala orsaker till mödradödlighet (Say et al 2014) uppgav att det finns starka bevis mellan dålig hygienpraxis och miljön vid födseln och dess bidrag till livshotande infektioner hos mödrar och spädbarn. WHO (2019) uppskattade att 11% av mödradödligheten är på grund av infektioner relaterade till ohygieniska förhållanden under förlossningen och dålig hygienpraxis under sex veckors postpartum.

Sjukhusförvärvade infektioner har visat sig spridas genom kontakt, det vill säga via händer. Därför är den viktigaste och effektivaste förebyggande- och kontrollåtgärden inom hälso- och sjukvården handhygien (WHO 2018; USAID, 2018; Bedoya 2017 ;; Orji et al 2005). I Oxford Textbook of Global Health of Women, Newborns, Children and Adolescents (Devakumar et al 2018: Pg 128) listas handtvätt som en viktig del av ren födelsepraxis och som ett sätt att minska infektioner hos mödrar och nyfödda. Förbättrad

handhygien har visat sig minska sjukhusförvärvade infektioner med 40% (Global Handwashing partnership 2017).

Även om handtvätt är en känd praxis som utgör en del av de flesta sjukvårdsskolningar, överförs fortfarande mest infektioner inom sjukvården via sjukvårdspersonalens händer genom direktkontakt (Bouzid et al 2018). WHO (2018) framhöll i sin rapport om att leverera hälso- och sjukvårdstjänster av hög kvalitet, att även med ökad kvalificerad födelsedeltagande och anläggningsbaserade födslar finns det fortfarande många kvinnor och nyfödda som drabbas av förebyggbara sjukdomar och dör eller utvecklar livslånga funktionsnedsättningar på grund av dålig vårdkvalitet. Detta inkluderar infektioner som beror på dålig handhygien. Därför har handtvätt listats som en central del av förebyggandet av infektioner och en bas för kvalitetsvård som definieras som effektivt och säkert (Graham et al 2016).

Denna forskning fokuserar på handtvätt med vanlig eller antimikrobisk tvål och antiseptisk handtvätt som inkluderar handtvätt men antiseptiska medel. Dessa är åtgärder som rekommenderas i WHO:s systematiska analys av globala orsaker till mödradödlighet. Forskningen fokuserar också på låg- och medelinkomstländer exklusive studier i höginkomstländer. Bördan för infektioner inom sjukvården är hög i låg- och medelinkomstländer. Den sammansatta infektionsdatan tyder på att sjukvårdsrelaterade infektioner är minst tre gånger så höga som i resursrika länder. (ISID 2018; Bouzid et al 2018). Samtidigt har det förekommit en snabb ökning av hälsofaciliteter i låg- och medelinkomstländer.

Syfte och forskningsfråga

Det har visat sig att även om utrustning och lämplig infrastruktur är tillgänglig, så följer i genomsnitt 61% (i vissa fall upp till 90%) av sjukvårdspersonalen inte de bästa handtvättsmetoderna (Global Handwashing partnership 2017). Detta har lett till diskussioner om en förbättring av handtvätt på sjukhusnivå måste fokusera på både beteende och infrastruktur (Bouzid et al 2018). WHO (2019) erkände avsaknaden av systematisk bedömning i rapporten om vatten, sanitet och hygien inom hälso- och sjukvården i låg- och medelinkomstländer. Rapporten visade att fokus ofta låg på

infrastruktur men med saknad eller ingen information om praxis. Global Handwashing Partnership (2019 a) gjorde en översyn av studierna från de senaste 10 åren och den aktuella situationen inom handtvättsforskning. Studien omfattade 155 resultat med olika programmatiska områden som varierade från stadsdesign till mödrars och barns hälsa. Det fanns emellertid endast två forskningsresultat som gjordes inom hälso- och sjukvårdsinställningen med mödrars och barns hälsa i centrum. En studie var från en neonatal intensivvårdsavdelning och en annan från en förlossningsavdelning. Dessa framhöll bristen på forskning om handtvättande inom mödrahälsovården. Samtidigt har forskningar och WHO (Graham et al 2016; Koblinsky et al 2016; WHO 2015) talat för behovet av forskning kring kvalitetsvård som gäller moderns hälsa.

Syftet med denna studie är att kartlägga forskning om handtvätt inom mödrahälsovården i låg- och medelinkomstländerna.

Forskningsfrågan angående denna studie är:

• Hurudan är den nuvarande situationen för handtvättforskning inom mödravården i låg- och medelinkomstländerna?

Teoretisk referensram

Den 51:e världshälsoförsamlingen uttalade och uppmuntrade medlemsländerna att "anta en evidensbaserad strategi för hälsofrämjande politik och praxis" (Green 2000).

Det är en av de viktigaste rekommenderade metoderna för att förbättra hälsovården i låg resurs länder (Bejoy Nambiar et al. 2017). Kärnan inom denna forskning ligger i begreppen evidensbaserat hälsofrämjande, som förbättrar patientsäkerheten genom handtvätt vid hälso- och sjukvård. Konceptet är relevant för både individuella beteendeförändringar av bästa praxis och systemförändring inom sjukvården.

Evidensbaserat är inte ett nytt begrepp inom hälsa och medicin, men det utgör en viktig komponent inom modern medicin och folkhälsa. Historiskt sett har folkhälsan alltid baserats på bevis särskilt inom områdena hälsoskydd och sjukdomsförebyggande (Jenicek 1998). Den franska läkaren Pierre Charles Alexandre Louis introducerade en

rörelse på 1830-talet vid namnet Médecine d'observation som uppgav att läkare "inte borde lita på spekulationer och teori om sjukdomsorsaker och inte heller på enstaka upplevelser, utan de bör göra stora serier av observationer och härleda numeriska sammanfattningar från vilka den verkliga sanningen om den faktiska behandlingen av patienter kommer att uppstå" (Vandenbroucke, 1996, s. 1335). Tillvägagångssättet har sedan dess utvecklats till att utgöra en central del av kliniskt beslutsfattande som är en grundläggande färdighet inom hälsovården (Patelarou et al 2017).

Metod

För att kartlägga studierna, användes litteraturöversyn av referentgranskade studier som forskningsmetod. En litteraturöversikt stöder evidensbaserad praxis (Liberati et al. 2009) eftersom den undersöker relevant material från vetenskapliga artiklar och andra källor som är relevanta för forskningsområdet, ger en beskrivning, sammanfattning och en kritisk utvärdering av dessa i relation till forskningsproblemet som undersöks (Fink 2014). Resultaten ger en sammanfattning av relevant forskning från området och en bild av möjliga informationsgap i forskningsområdet. Både kvalitativ och kvantitativ forskning inkluderas och syntetiseras i resultaten vilket gör forskningen till en blandad forskningsstudie (Onwuegbuzie, Collins, et al. 2010).

Sökningen efter relevanta publikationer gjordes utgående från 16 utvalda databaser i Arcadas biblioteksamling för hälsa samt från tre relevanta källor. Databaserna hade alla en gemensam egenskap, de hade filter i sökfunktionen. De tre källorna som inkluderades utanför Arcada-databaserna var: Lancet, Global Handwashing Partnership och The International journal of Gynecology and Obstetrics. Artiklarna söktes med hjälp av nyckelord som är relevanta för forskningen.

Analys

På grund av materialets heterogena natur användes systematisk innehållsanalys för att kartlägga och beskriva studierna (Paré & Kitsiou 2017). Informationen om handtvätt och

mödrars hälsa i låg- och medelinkomstländernas hälsofaciliteter är fragmenterad, därför användes den induktiva metoden vilket innebar att kategorier skapades baserade på resultaten (Elo & Kynga 2008).

Innehållsanalys är en systematisk process där forskaren känner igen teman och information från texten samt kodar dessa (Neuendorf, 2016) baserat på vilka giltiga slutsatser kan dras (Riff et al., 2014). Det är innehållskänsligt och därför användbart vid utvärderingen av sekundära data (Hart, 2018). I studien användes endast manifestinnehåll som är synligt samt uppenbara komponenter från studierna. Till en början användes en lista med frågor som stödde kodningen.

Resultat

Handtvätt utgjorde huvudrollen (nämnd i titeln) i få studier (n = 3). Men det var bara en studie som fokuserade på vårdgivarens handtvätt specifikt inom mödravården.

En av studierna, Handtvätt under den perinatala perioden (av Pavani et al 2015) var i resultaten uppdelad i två delar eftersom det var en rapport som inkluderade två studier vilka båda fokuserade på handtvätt. Båda delarna behandlade generella studier om handtvätt under perinatalperioden som inkluderade mödrars, familjers och vårdgivares handtvätt i hemmen. Studien definierade hälsoeffekter såsom barndödlighet och spädbarnsdödlighet, vilka exkluderar mödrars hälsa och dödlighet. De flesta hälso- och sjukvårdsinställningar inom studierna berörde intensivvårdsenheter för nyfödda.

De två andra handtvättsspecifika studierna baserade sig på förlossningsavdelningarnas rutiner. Fokus för en av studierna (av Adekunle-Olarinde et al 2018) var att bedöma mängden vatten som behövs vid handtvätt under förlossning, i processen tog studien fram att handtvätten var otillräcklig. Handtvätt utgjorde inte huvudmålet för studien utan nämndes i titeln. Detta resulterade i att bara en studie fokuserade på vårdgivarens handtvätt specifikt inom mödravården.

Resten av studierna som ingick i forskningen hade handtvätt endast i abstraktet (n = 6). De flesta av dem var bedömningar av intrapartumvård eller rena leveransmetoder som inkluderade handtvätt som en faktor. Handtvättbeteende bedömdes i utvärderingarna och

andra studier (n = 5) men endast en hade det som ett huvudämne i sin studie. De flesta artiklar insåg att handtvättmetoderna var otillräckliga (n = 8).

Diskussion och kritisk granskning

Studien fann bara tre resultat som var handtvättspecifika. Men endast en av studierna fokuserade sig specifikt på handtvätt inom mödrahälsovården.

Handtvätt är en av de viktigaste förebyggande åtgärderna inom hälsovården, en viktig del av patientsäkerhet och kvalitetsvård. Sedan Semmelweis och hans handtvättande innovation för att minska infektioner och mödrars dödlighet fram till nu finns det ett kunskapsgap inom handtvätt rörande mödrahälsovård och en hög andel infektioner relaterade till dålig handhygien (Tulchinsky 2018). Globalt är sepsis och infektioner, särskilt i låg- och medelinkomstländer, en av de främsta orsakerna till mödrarnas dödlighet och morbiditet (Forouzanfar et al 2015). Därför är handhygienen, särskilt handtvätt, avgörande inom moderomsorgen. Detta kan inte ses på forskningsnivån rörande handtvätt inom mödraomsorgen, särskilt i låg- och medelinkomstländer som når högre nivåer av förlossningar inom sjukvården (Montagu et al 2017).

Mer forskning och statistik inom området behövs för att stödja insatser att minska mödrars dödlighet och sjuklighet. En djupgående studie för att förstå och påverka förebyggande beteenden och praxis, som handtvätt, tillsammans med information om underhåll och miljöhygien behövs (Graham et al 2016). Framtiden för mödrarnas hälsoutfall ligger på att stärka förståelsen av problemen angående mödrahälsovården.

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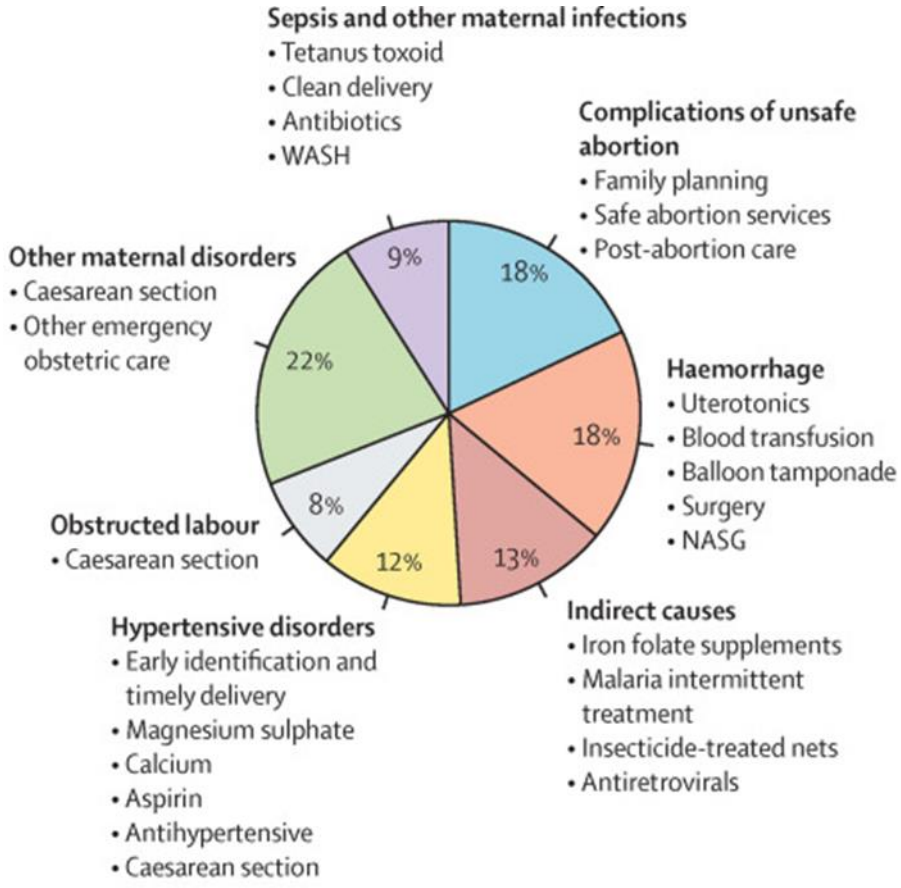
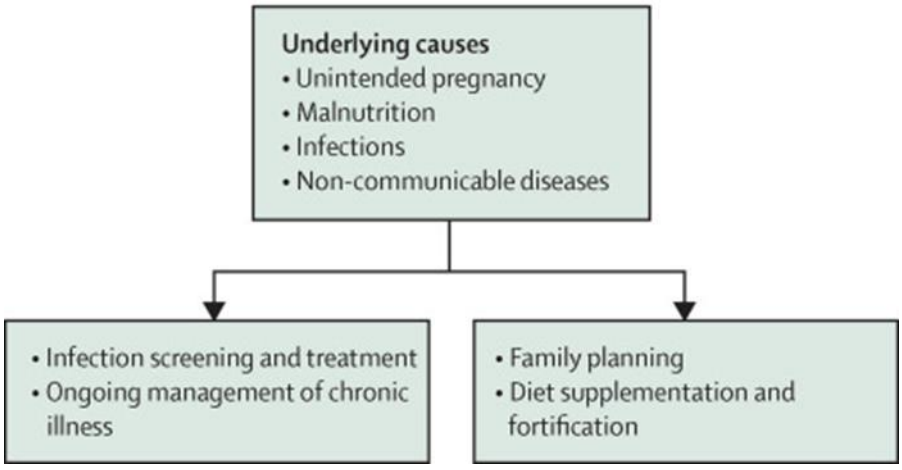
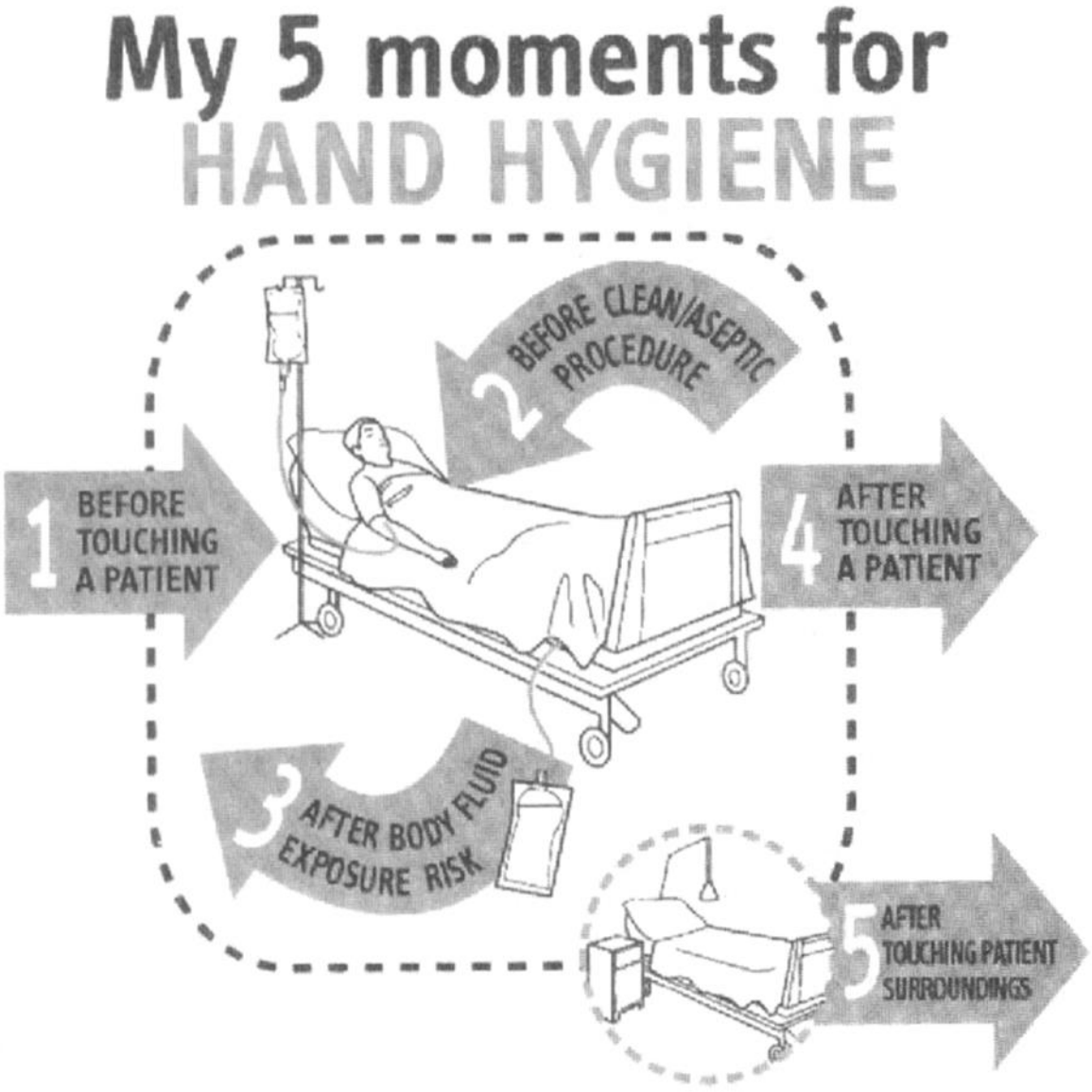
APPENDICES

ANNEX 1: Strategies toward ending preventable maternal mortality (EPMM). World Health Organization, 2015





ANNEX 2: The "My 5 moments for hand hygiene" (WHO 2009)



ANNEX 3: Factors affecting compliance to hand hygiene (Mathur 2011)

Health care staff related factors	Clinical factors	Environmental/institutional/behavioral/ other factors
Physician status (rather than a nurse)	Working in an intensive-care unit	Wearing gowns/gloves (beliefs that glove use obviates the need for hand hygiene)
Nursing assistant status (rather than a nurse)	Working during the week (versus the weekend)	Hand washing agents causing irritation and dryness
Male sex	If involved in activities with high risk of cross-transmission	Sinks are inconveniently located/shortage of sinks Lack of soap and paper towels
Lack of role models among colleagues or superiors	Understaffing, patient overcrowding, insufficient time	Belief of low risk of acquiring infection from patients
Not thinking about it/ forgetfulness	Patient needs take priority	Lack of knowledge of guidelines/protocols
	Hand hygiene interferes with health-care worker relationships with patients	Skepticism regarding the value of hand hygiene
		Disagreement with the recommendations
		Lack of institutional priority
		Lack of active participation in hand-hygiene promotion at individual or institutional level
		Lack of administrative sanction of non-compliers/rewarding compliers

ANNEX 4: Coded results from the study

Study	Location of study	Country Classification			Type of health care setting (as named in the study)	Role of handwashing		Purpose of the study	Results on handwashing performance among health care workers	
		Low-Income	Middle-income	Not clear		Main role	Not in main role		Inadequate	Adequate
Hands washing, glove use, and avoiding recontamination before aseptic procedures at birth: A multicenter time-and-motion study conducted in Zanzibar. (Gon et al 2019)	Zanzibar (Tanzania)	X			Labor wards but facility type not specified	X		Assessment of handwashing	X	

Quality assessment of peripartum care (Changaee et al 2014)	Lorestan province (Iran)		X		University Hospitals		X	General quality assessment of peripartum care	X	
Delivery, immediate newborn and cord care practices in Pemba Tanzania: a qualitative study of community, hospital staff and community level care providers for knowledge, attitudes, belief systems and practices (Dhingra et al 2014)	Pemba (Tanzania)	X			Health facility type not specified		X	Assessment of attitudes, beliefs and practices of the community and health workers in delivery immediate newborn and cord care practices	X	

Clean delivery practices in rural northern Ghana: a qualitative study of community and provider knowledge, attitudes, and beliefs (Moyer et al 2012)	Kassena-Nankana District (Ghana)	X			Health facility type not specified		X	Assessment of knowledge, attitudes and practices of community members and healthcare providers regarding clean delivery	X	
Adherence to evidence-based care practices for childbirth before and after a quality improvement intervention in health facilities of Rajasthan, India (Iyengar et al 2014)	Rajasthan (India)		X		District hospitals, community health centres and primary health centres		X	General assessment of childbirth practices	X	

Quality of intrapartum care by skilled birth attendants in a refugee clinic on the Thai-Myanmar border: a survey using WHO Safe Motherhood Needs Assessment (Hoogenboom et al 2015)	Thai-Myanmar			X	Clinic		X	General assessment of intrapartum care with WHO Safe Motherhood Needs Assessment tool	X	
Assessment of Quality of Midwifery Care in Labour and Delivery Wards of Selected Kordestan Medical Science University Hospitals	Kordestan (Iran)		X		University Hospitals		X	General assessment of care in labour and delivery wards	X	

(Simbar et al 2009)										
The Water@Birth Study: an exploratory study on the requirements of water for hand hygiene during labour and delivery in low-income countries. (Adekunle-Olarinde et al 2018)	Ethiopia & UK			X	Hospitals	X		Assessment of the volume of water required for handwash during childbirth	X	
Handwashing in the Perinatal Period Part 1: To report on a systematic review of the biomedical literature regarding	Multiple low- and middle-income countries			X	Not only health care settings	X		Literature Review on handwashing in the Perinatal Period.	-	-

handwashing in the perinatal period in low- and middle-income country contexts. (Pavani et al 2015)										
Handwashing in the Perinatal Period Part 2: Synthesis of Qualitative Research Studies on Handwashing Behaviour in the Perinatal Period (Pavani et al 2015)	Kenya, Indonesia, Bangladesh	X			Not only health care settings	X		Qualitative Research Studies on handwashing behaviour	X	