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Assessing Water, Sanitation and Hygiene Infrastructures and Practices among Healthcare Workers in Maternal and Neonatal Wards of Six Rural Health Centers, Cambodia

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Bachelor of Science
University of Health Sciences
2015

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Abstract

Assessing Water, Sanitation and Hygiene Infrastructures and Practices among Healthcare Workers in Maternal and Neonatal Wards of Six Rural Health Centers, Cambodia

By Sereineat Nath

Background: Cambodia continues to be among the highest maternal and neonatal mortality rates in the region with 161 maternal deaths per 100,000 live births, and 15 neonatal deaths per 1,000 live births. These reported deaths of mothers and newborns are largely preventable. Maternal and newborn health outcomes may adversely be impacted by poor access to water, sanitation and hygiene (WASH). Inadequate access to WASH combined with limited health care services are likely to increase the risks of maternal and neonatal mortality. Therefore, this research study will explore the current state of WASH infrastructures and practices in Cambodian rural health centers, and provide recommendations accordingly.

Objectives: The objective of this qualitative study was to provide useful information and evidence to help improve WASH in Cambodian rural health centers. This research study aimed to assess the WASH conditions, such as infrastructures and practices, in maternal and neonatal wards as well as to identify gaps, related barriers, constraints, and potential solutions to the problems.

Methods: A number of qualitative methods including structured observations and semi-structured interviews were used to understand WASH infrastructures and WASH practices of healthcare workers in maternal and neonatal wards in six rural health centers in Tbong Khmum province, Cambodia.

Results: Severe lack of WASH resources, such as sanitation and hand hygiene facilities, as well as poor WASH practices in rural health centers were observed in the study, which are the main concerns regarding the improvement of maternal and neonatal health and survival. In addition to that, semi-structured interviews with healthcare workers show a lack of proper WASH, and infection prevention and control trainings in all studied health centers.

Conclusions: The study revealed major gaps in WASH infrastructures and practices in rural health centers in resource-limited settings towards maintaining safe care during ante-natal and post-natal periods. These issues need to be considered in global and national strategies, which will result in the improvement of quality of care for mothers and newborns. This research study highlights opportunities for future research, and offers insights that could influence policy and improve programming in WASH sectors, in order to reduce maternal and neonatal mortality.

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LIST OF ACRONYMS

ANC: Antenatal Care

CDC: Centers for Disease Control and Prevention

HAI: Healthcare-associated Infection

HC: Health Center

HCF: Health Care Facility

HICs: High Income Countries

IPC: Infection Prevention and Control

JMP: Joint Monitoring Program

LICs: Low Income Countries

LMICs: Low- and Middle-Income Countries

MCH: Maternal and Child Health

MMR: Maternal Mortality Rate

MDG: Millennium Development Goal

PNC: Postnatal Care

UNICEF: United Nations International Children's Emergency Fund

U.S.: United States

WASH: Water, Sanitation and Hygiene

WHO: The World Health Organization

TABLE OF CONTENTS

Chapter 1: Background and Literature Review

Background

The Cambodian healthcare system had gone through a mass destruction under Khmer Rouge regime. In the years 1975 to 1978, the entire healthcare system, including equipment, supplies, and infrastructures such as water, sanitation, and transportation, were destroyed (Hays, 2008). UNICEF estimated that about 1.7 million of approximately 7 million Cambodian population died under Khmer Rouge regime, between 1975 and 1979 (UNICEF, 2015). People with higher level of education, such as teachers, healthcare professionals and lawyers, were the majority of those who were killed. Additionally, physicians and other healthcare professionals were executed or prohibited from practicing. There were only 45 medical doctors who survived the tragedy; 20 among those doctors, left the country (McGrew, 1990). In 1979, Cambodia remained only 728 medical students, 28 dental workers, 26 pharmacists (McGrew, 1990). In mid-1980s, the public health and modern medical services were functioning again; however, healthcare personnel and some medicines remained in short supply (UNICEF, 2015).

Inadequate water, sanitation, education, and transportation is a major barrier in the development of health system in Cambodia. This plays an important role in morbidity and mortality among babies and young adults, as about half of the Cambodian population is under 25 years old (The World Factbook, 2017). Maternal and neonatal morbidity and

mortality, in particular, continue to be a major public health concern in Cambodia, especially in rural areas. Many of those diseases and deaths are preventable.

In order to examine the causes of maternal and neonatal morbidity and mortality, this study was carried out to explore the current situation of water, sanitation and hygiene (WASH) infrastructures, as well as WASH practices and behavior of healthcare workers, which highly relates to maternal and neonatal mortality. Structured observations and semi-structured interview were employed in this research study. Structured observation is performed when the researcher collects the data from afar, without a direct involvement of the participants (McLeod, 2015). The research tool is well structured and defined before the commencement of data collection. Semi-structured interview is a qualitative method that includes a set of open questions that allows researcher to explore certain themes (Sweeney et al., 2010). It also allows participants to discuss issues or raise concerns that interviewer may not have considered. The combination of structured observations and semi-structured interviews were used in this study to provide an organized way of exploring whether practices and behavior implemented in the settings of interest are matched with the accuracy of people's statement about their behavior and practices.

The study sought to answer the questions below:

- What is the current condition of WASH infrastructures in Cambodian rural health centers?
- What does WASH practice of healthcare personnel look like in maternal and neonatal wards?

- What are the main concern and constraint regarding WASH-related issues?

The potential solutions and recommendations were also provided according to the findings of the study.

Literature Review

Global Burden of HAIs

Healthcare-associated infection (HAI) is defined by WHO as "an infection occurring in patient during the process of care in a hospital or other health facilities, which was not present or incubating at the time of admission" (WHO, 2018). It is also known as *nosocomial* or *hospital infection* (WHO, 2018). Patient can get HAIs in any type of health care settings (WHO, 2018). The symptom of infections can be presented either during or after discharge. WHO stated that, globally, hundreds of millions of patients are affected each year by HAIs (WHO, 2018). Studies done in 17 Western European countries showed that about 16 million extra hospital days and 150,000 deaths are contributed by HAIs each year (WHO, 2011 & Guggenbichler et al., 2011). The CDC estimated that about 2 million patients contracted HAIs, annually, in the U.S. (CDC, 2015). In addition to that, United States spends more than $5 billion annually on HAIs (Collins, 2008). HAI does not affect only patients, but it also affects healthcare workers who provide care and maintain the effectiveness of hospital operations (WHO, 2018). WHO predicted that more than three million healthcare workers are being exposed to blood borne pathogens, annually (WHO, 2002). In developed countries, the overall prevalence of HAI could range from 5.1% to 11.6% (WHO, n.d).

A survey conducted by WHO First Global Patient Safety Challenge showed that HAI surveillance systems are put in place in many developed countries at national and sub-national level whereas there are only 23 developing countries reported having a functioning national surveillance system (WHO, 2018). In low- and middle-income countries (LMICs), only 9 published studies providing data of HAI at national level. Based on available data, the burden of HAIs falls heavily on LMICs than on high-income ones (WHO, 2018).

Despite being the most common adverse event during health care facility stay, the problem related to HAI has not been solved yet in any country or institution (WHO, 2011). The burden of HAIs is likely to be underreported and underestimated due to the fact that hospital stays may be shorter than the duration between infection and onset of clinical symptoms- the incubation period (Collins, 2008).

Maternal and Child Health (MCH)

UNICEF estimated that there has been 44% decrease of maternal mortality rate (MMR) globally since 1990 (UNICEF, 2016). While this improvement is noticeable, it was not sufficient to contribute to the achievement of the Millennium Development Goal (MDG) 5 target. Approximately 800 girls and women die every day from pregnancy and child birth-related complications (UNICEF, 2016). While there have been some reductions in maternal mortality, the survival of neonates (newborn babies in the first four weeks after birth) are in need of improvement.

Infections in healthcare settings attributed to approximately 10% of global maternal deaths in 2013 (Kassebaum et al., 2014). Moreover, there is a link between HAIs and neonatal deaths in facility-born infants, which is up to 60% (Zaidi et al., 2005). Studies carried out in Germany and Canada indicated that approximately 12 to 24 percent of very-low-birth-weight neonates acquired HAIs while receiving neonatal care in the ICU (Aziz et al., 2005 & Geffers et al., 2010). Zaidi et al. conducted a systematic review that showed that there is three to twenty times higher HAIs rates among neonates in low-income countries (LICs) in comparison to the ones in high-income countries (HICs) (Zaidi et al., 2005). Unknown or underestimates of the burden of HAIs among mothers and neonates in many LMICs resulted from the lack of reporting or surveillance systems (Richards et al., 1999).

According to WHO, WASH in healthcare facilities (HCFs) is a "prerequisite for effective and safe care, especially during childbirth"; WASH provision is critical for maternal and child health (MCH) (WHO, 2014). Infections can occur in women during pregnancy, labor, and after delivery which resulted from poor hygiene conditions and practices, including the use of contaminated equipment (Benova et al., 2014 & Shordt et al., 2012). Benova et al. showed in their systematic review that increased maternal morbidity and mortality rate was associated with poor WASH provision (Benova et al., 2014). Furthermore, studies showed that mothers who did not have access to safe WASH were 1.5 times more likely to be infected or die in comparison to those with sufficient WASH access (Benova et al., 2014). Handwashing by healthcare personnel, specifically by birth attendants, are known to be protective against maternal and newborn illness, as shown in both observational and prospective cohort (Allegranzi et al., 2011).

Access to improved WASH infrastructure in HCFs should be included in interventions for improving maternal and child health. However, this is not an easy task, in part due to lack of communication and interest among stakeholders, such as government, policy makers and healthcare professionals. More efforts are required from various policy makers and stakeholders, including funders and healthcare professionals, for these interventions to be devised.

WASH in Healthcare Facilities

Globally, the impacts of poor WASH have been widely recognized by the global community (UNICEF, 2016). WASH has been known as an important factor for the improvement of human health (Eid, 2015). The global progress of WASH coverage has been monitored by the Joint Monitoring Program (JMP) for Water Supply and Sanitation, conducted by WHO and UNICEF since 1990 (WHO/UNICEF, 2015). According to United Nations (UN), access to safe WASH in non-household settings is a critical step in recognizing basic human rights (WHO/UNICEF, 2015). Non-household settings, including healthcare facilities, workplaces, and schools, have become a central focus for WASH sector. WASH in HCFs has been a priority of JMP since 2015 (Cronk, 2015 & UN, 2012).

In LICs, such as Cambodia, there is still limited access to basic WASH infrastructure in HCFs, which makes the provision of quality of care to patients more difficult to be succeeded (WHO/UNICEF, 2015). A multi-national review of WASH situations in HCFs, conducted by WHO and UNICEF in 2015, showed that 38% of 66,101 assessed HCFs in

LMICs did not have access to improved water source, while 19% did not have any improved sanitation facilities, and 35% had inadequate water and soap for handwashing (WHO/UNICEF, 2015 & WHO/UNICEF, 2016). Safe WASH remains a main issue in many HCFs. Furthermore, an improved source of water does not necessarily mean adequate water quantity and quality; water found at the HCFs was often contaminated and not suitable for use (Cronk et al., 2015 & Bain et al., 2014). Despite the presence of sanitation facilities in HCFs, many toilets were locked and unavailable for patient use (WHO/UNICEF, 2016).

WASH in HCFs deserves more attention from policy-makers in LMICs. Therefore, WHO published "Essential Environmental Health Standards in Health Care", in 2008 to provide some guidance on WASH access and provision in HCFs (WHO, 2016). Additionally, WHO and UNICEF launched "The Global Action Plan", which aims to reach "universal access to WASH in health care facilities by 2030" by engaging various stakeholders, such as policy-makers, funders, and researchers (WHO/UNICEF, 2016).

WASH Behaviors and Infection Prevention Control Practices in Cambodian Health Facilities

Access to clean water sources, sanitation, and hygiene are critical to infection prevention and control (IPC), and also to promote positive health outcomes of patients and healthcare workers in health facilities (Bazzano et al., 2015). Maternal and neonatal mortality is strongly associated with poor WASH in health facilities (Velleman et al., 2014). Major

gaps exist in the optimal practice of IPC methods, specifically in gynecological and obstetrical practices, which results from lack of supportive resources and educated staff to assist midwives and birth attendants during and after deliveries. According to a qualitative study conducted by Bazzano et al., little attention has been given to the impacts of WASH and delivery and postpartum care in health settings (Bazzano et al., 2015). Other constraints in the facilities included lack of access to clean water, poor hand hygiene practice, poor medical waste disposal, and inadequate support for menstrual hygiene management (WaterAid 2015).

The operation and maintenance of clean environment is imperative for effective treatment of patients who seek for care in the health facilities. An assessment conducted by the Health Impact Evaluation Consortium Survey in 2008 found that among 447 assessed facilities, 67% of health centers had access to an improved water source compared to 51% in rural areas. In order to gain more information and insight into why and how certain WASH and IPC are and are not practices, further research should be carried out.

Healthcare Access in Cambodia

Cambodia's health system has gone through many periods of changes. Despite an improvement in health, Cambodia are still facing challenges in its effort to provide access to health care to everyone (DHS, 2012). More than 50% of women still deliver at home without skilled birth attendants, which is associated with higher maternal and neonatal

mortality (Hong et al., 2015). Abortion-related complications, sepsis, eclampsia and other infections are major causes of maternal deaths in Cambodia. (Matsuoka et al., 2010).

The problems are seen in rural areas where there are barriers to health facilities access, including costs, long distance, poor road conditions, lack of transportation, lack of access to emergency care, socio-cultural norms, and severe resource constraints on maternal HCFs. In addition, other than cash payments upfront, no other payment plans are available in public health facilities. Women have been using health care services provided by non-qualified health providers due to insufficient access to affordable health care and treatment. According to Matsuoka et al., women are exposed to higher risks of complication during and after delivery by utilizing health care services delivered by non-qualified health providers. (Matsuoka et al., 2010).

These barriers and issues are interconnected in many ways. For instance, the majority of people living in rural areas usually have low socioeconomic status; which prevent them from seeking care from both governmental and private HCFs. Misconceptions about the fees of governmental health facility is also a main barrier. People in rural areas believe that healthcare services provided by governmental health facility are usually overcharged. This misconception prevents rural inhabitants from seeking health services, which consequently leads to increased utilization of private health services, which normally have higher prices. People living in Cambodian rural areas are twice as likely to have poor access to HCFs in comparison to people living in urban areas (Matsuoka et al., 2010).

WHO estimated that there are approximately 7.9 midwives per 10,000 populations in Cambodia, while the rest of the Southeast Asia region has an average of 15.3 midwives per 10,000 populations ("Cambodia Neonatal and Child Health Country Profile," n.d.). This disparity is even greater between Cambodian rural and urban areas since four out of five Cambodians live in rural areas, with only 21% living in urban areas (Cambodian Demographic and Health Survey, 2010).

Of the expectant mothers living in urban areas such as Phnom Penh, 84% have access to healthcare facilities, whereas 20% of expectant mothers from the more rural regions, such as Mondol Kiri and Rotanak Kiri (Matsuoka et al., 2010). Continued efforts, such as the expansion of fee exemptions and health equity funds, have been put in to address these inequities (Dingle et al., 2013). Moreover, more trainings have been provided to midwives through midwifery financial incentive program to address the issue of underqualified healthcare workers (Dingle et al., 2013).

Research Study Overview

Problem Statement

Maternal and neonatal mortality is a major concern in Cambodia. The governments, together with other organizations, has been working continuously to reduce the maternal and neonatal mortality rates, which is an important milestone. Part of these mortality rates

of mothers and newborns are resulted from HAIs that are largely preventable (Houy et al., 2017).

Purpose Statement

This research study employed a number of qualitative methods that aimed to understand the current situation of WASH in Cambodian rural health centers. Structured observations focused on the aspects of WASH infrastructures as well as WASH practices and WASH-related behaviors of healthcare workers in rural health centers that play an important role in spreading the transmission of HAIs to mothers and neonates. This study was designed to inform stakeholders, such as government, policy makers, healthcare professionals and researchers, of existing constraints and barriers to achieving the quality of care in maternal and neonatal wards.

Significance Statement

The presence of high mortality rates of mothers and newborns due to preventable HAIs is linked to inadequate resources, limited knowledge, poor policy management, and lack of call to action. It is important to understand what is occurring in the HCFs that lead to the spread of HAIs to mothers and neonates, in order to design and implement interventions that can target those issues effectively.

This research study identifies WASH infrastructures and WASH practices in maternal and neonatal wards that can serve as pathways for spreading infections from healthcare workers to mothers and neonates. The results of this study are designed to bring more attention towards WASH-related issues, and helps inform various stakeholders, such as policy makers and funders, on policy discussions, plans to implement the interventions that address specific discovered WASH issues. As a result, this may lead to improved WASH infrastructures and practices, that may consequently lead to reduced mothers and newborns deaths.

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Chapter 2: Manuscript

Introduction

Cambodia has made some improvement regarding maternal and neonatal survival rates in the past 20 years (Bazzano et al., 2015). From 1990 to 2012, the neonatal mortality rates decreased by 2%, while maternal mortality rates decreased by 75% from 1990 to 2010 (Robertson, 2014). This is a glaring inconsistency between the great improvement in maternal mortality and the modest improvement on neonatal mortality, which should be addressed. Despite the improvement, the maternal and neonatal mortality rates in Cambodia remain high in comparison to other countries in the same region (as shown in **Graph 1**), and some of these deaths may be due to inadequate WASH provision and ineffective infection prevention and control (IPC) practices in maternal and neonatal wards (Bazzano et al., 2015).

A study conducted by Bazzano et al. showed that major gaps remain in regards to improving optimal healthcare practices and in decreasing barriers to having sustained and effective IPC practices during labor and postpartum periods (Bazzano et al., 2015). The root causes behind maternal and neonatal mortality are largely preventable. The risks of Healthcare-associated infections (HAIs) among mothers and neonates is high in places where there is limited access to WASH infrastructure (Adams & Al Sindhi, 2014). According to WHO, 56 % of neonatal deaths among facility-born babies in low- and

middle-income countries were attributed to HAIs, while unhygienic conditions causes 10.7% of those deaths (WHO, 2011).

Recent studies showed that, in Cambodian, an estimated 40% of neonatal and maternal mortality were linked to HAIs (WHO, 2016). The Cambodian Ministry of Health stated in "The National Strategic Plan for Infection Prevention and Control in Healthcare Facilities 2016-2020" that sufficient WASH is an important condition to achieve sustainable IPC practices and positive health outcomes (Cambodian Ministry of Health, 2015). Despite being an important key factor, there are major gaps in WASH resources, infrastructures, practices, knowledge, policies and actions. Therefore, assessing the current situation of WASH in rural health centers is a main step to addressing problems and developing effective interventions related to maternal and neonatal deaths, especially in countries where HAIs are widespread.

This qualitative study had three mains objectives:

1. To assess current condition of WASH infrastructures in Cambodian rural health centers
2. To evaluate WASH practice of healthcare personnel in maternal and neonatal wards in rural health centers
3. To explore main concerns and constraints in regards with WASH-related issues in rural health centers

Methodology

Research Design

The research study employed a number of qualitative methods including structured observations and semi-structured interviews to understand WASH infrastructure and WASH practices of healthcare workers in six rural health centers, in Tbong Khmum Province (as shown in the **Map** below). Structured observation is performed when the researcher collects the data from afar, without a direct involvement of the participants (McLeod, 2015). The research tool is well structured and defined before the commencement of data collection. Semi-structured interview is a qualitative method that includes a set of open questions that allows researcher to explore certain themes (Sweeney et al., 2010). It also allows participants to discuss issues or raise concerns that interviewer may not have considered.

RFA Graphic retrieved from https://www.rfa.org/english/news/cambodia/clash-with-vietnamese-over-borderland-06022015152907.html

WASH infrastructure and WASH practice behaviors were assessed at the six health centers through structured observation checklists to determine the state of hygiene infrastructure and resources as well as the WASH-related behavior of the healthcare workers during ante-natal care (ANC) and post-natal care (PNC). Interview focused on topics related to water access, water quality, access to sanitation and hygiene facilities, hand hygiene practices and behavior of healthcare workers, as well as other WASH-related issues. Midwives were also interviewed to understand existing WASH and IPC knowledge in this group of healthcare workers, and to determine other barriers to achieving quality of care for mothers and newborns. Data collection methodology is presented in **Table 1**.

Table 1. Data collection methodology

Methods	Data Collected	Participants	Location
Structured-observations	• WASH infrastructure • WASH practices	• 6 Health Centers • Midwives and staff on practices at 6 Health Centers	Tbong Khmum Province
Semi-structured interviews	• Access to water • Water quality • Access to sanitation facilities • Access to hygiene facilities • Hand hygiene practices and behavior • WASH-related issues	• Midwives at Health Centers	Tbong Khmum Province

Study Sites

This research project ran from June 2017 to August 2017 at six Cambodian rural health centers in Tbong Khmum province. Criteria for inclusion of health centers for sampling included geographic location, number of health center deliveries conducted each month, location relative to roads, socioeconomic status and rural designation. The six rural health centers were known to have inadequate financial support, poor human resources, and

outdated WASH infrastructures. The final selection of the study sites was made based on the decision of research team from *WaterAid*, Cambodia and Emory researcher.

Target Population

The target population of the study included healthcare workers in maternal and neonatal wards who currently work at the six rural health centers in Tbong Khmum province, Cambodia. WASH-related behaviors and practices of healthcare workers, specifically midwives, were observed during ANC and PNC to develop a general idea of hygienic practices among healthcare personnel, in order to identify specific situations that require further education or trainings. Semi-structured interviews were done with midwives at each health center to check the accuracy of the impression gained through observations, as well as to learn more about the WASH-related issues in rural health centers.

Sample Types

The structured observations were divided into two categories: infrastructure observation and WASH practices observation among healthcare workers. Some features were checked in infrastructure observation during health center visits, including *electricity supply, water supply, sanitation facilities, general cleanliness,* and *waste disposal* and *management*. **Table 2.** showed the checklist items of infrastructure observation. WASH practices of healthcare personnel were observed during ANC and PNC using observation checklist items as shown in **Table 3.** Semi-structured interview focused on questions related to water

access and quality, access to sanitation and hand hygiene facilities, as well as hand hygiene behavior of healthcare workers in maternal and neonatal wards in rural health centers (**Table 1**).

Table 2. WASH infrastructure observation checklist items

Domain	Features Checked
Electricity supply	• Electricity sources • Backup electricity sources • Sufficient electricity supply
Water supply	• Water sources • Secondary water sources • Sufficient water for health care activities
Sanitation facilities	Latrines: • Number and adequacy • Functioning • Cleanliness • Accessible for all users
General cleanliness and hygiene	Routine cleaning and condition of • Floor • Operating tables • Surfaces which mother or newborn may contact • Medical equipment Availability of cleaning supplies Availability of cleaning equipment
Waste disposal and management	• Sharp disposal • Waste disposal • Placenta disposal

Table 3. WASH observation checklist items

Domain	Features Checked
Antenatal Care (ANC)	• 5 key moments of hand hygiene • 6 steps of hand washing • PPE usage
Post-natal Care (PNC)	• 5 key moments of hand hygiene • 6 steps of hand washing • PPE usage

Sample Size

Sampling was done at six health centers over eight-week timeframe beginning from June, 2017 to August, 2017. The healthcare workers in maternal and neonatal were observed during their ANC and PNC practices, which generally took place from 8AM to 3PM. Water, sanitation and hygiene infrastructures were then observed at each health center from 3PM to 5PM. A total number of 6 WASH infrastructure observation checklists, and 6 WASH practice observation checklists were obtained from the 6 health centers. 24 midwives voluntarily participated in the interview sessions.

Significance of Population Sample

Healthcare workers, specifically midwives, served as valuable data for the overall research study, which provides important details that present a picture of WASH practices in maternal and neonatal wards in rural health centers as well as their point of views in regards

with WASH-related issues. Understanding their WASH and IPC practices is crucial for designing and implementing effective interventions.

Procedure

A researcher performed a two-week period of observations at the six health centers to test-trial the data collection tools. The research tools were then updated accordingly. Following the updates, the same researcher conducted a week of structured observation at each health center, focusing on the checklist items presented in **Table 2** and **Table 3.**

The researcher spent some time observing both outside and inside each health center for WASH infrastructure features. During WASH practice observation, the same researcher silently stood or sat in the corners of the room, and was not disruptive to the hospital staff or patients. The researcher silently observed and took notes of the practices of healthcare workers during ANC and PNC. The observations were carried out as discreetly as possible. Prior to entering the rooms, verbal consents were obtained from both patients and healthcare staff.

Data Analysis

Collected data of structured observations was entered and processed in Microsoft Excel (Redmond, WA) at the end of each observation shift at each health center. Semi-structured interview data was transcribed and translated into English. Color coding was used for

coding and managing the interview data through the analysis phase. Thematic analysis on the transcripts was performed through familiarization of issues emerging from initial coding stage.

Ethics Approval

This research study was submitted to the Institutional Review Board (IRB) of Emory University on February 18, 2017. Given the specific nature of this study, it did not require IRB review because it did not meet the definition of "research" with human subjects or "clinical investigation" as set forth in Emory policies and procedures and federal rules. It was also approved by the Cambodian Ministry of Health National Ethic Committee for Health Research (160 NECHR).

The Emory researcher had been granted permission from the director generals and chiefs of maternal and neonatal services at six health centers to conduct the study and interact with their healthcare workers. Participation in the study was voluntary and all information collected was kept confidential. Participants were informed about audio-taping during the interview; written individual consent (**Appendix D**) were provided by all participants.

Results

The key findings of the research study are presented under each of the headings in the following section:

1. WASH Infrastructures

WASH infrastructure observations of the six health centers revealed major gaps in obtaining improved water, sanitation and hygiene. Severe lack of WASH resources such as water, sanitation and hand hygiene facilities were observed in the study, which are the main concerns regarding improved maternal and neonatal health and survival. Findings of the WASH infrastructure observations are shown as below:

1.1 Electricity

All assessed health centers relied on the national/local grid for the main source of electricity. Two of the health centers were experienced an outage without any backup power during the observation session were documented as not having electricity at the time of assessment. Three of the assessed health centers were observed having a secondary source of electricity, such as a backup generator or solar power.

Electricity was available at the time when the health centers were open for services during the past seven days prior to the observations. Additionally, the electricity supply was generally enough to meet the basic electrical need in only three of the assessed health centers.

1.2 Water

All health centers had indoor running water available, which was in working order during the observation sessions; however, one health center reported having inadequate water supply during the dry season. All of the health centers were observed to have secondary sources of water. Rainwater collecting tanks, boreholes with hand pumps, and unprotected dug well were presented at each assessed health center as backup sources of water.

The main source of water supply was from improved piped water source, and was not additionally treated at the health centers for drinking and general purposes. The researcher noted that stored water was contaminated at many of the health centers with visible debris and cloudy color. Outside containers of stored water were observed without any covers to prevent contamination.

1.3 Sanitation Facilities

All assessed health centers had at least two functioning toilets at the time of assessment, but they were often not clean or accessible to all users (**Figure 1.**). There were separate improved toilets for staff and for clients (at least one for each group) at four health centers. However, only two of the six health centers had separate toilets for men and women on site. None of the sanitation facilities at the six health centers meet the needs of people with reduced mobility. The toilet was often at the back or outside of the facility far from the delivery and post-delivery area.

Figure 1. *A toilet in health center **B***

1.4 Hygiene

Generally, the six health centers did not have adequate hand washing facilities in all areas where healthcare took place. The only hand washing facilities seen in all health centers were sinks with a connected tap; no health center had a bucket or standing water (**Figure 2.**). Maternity wards at the six health centers were found with no sink at all, while delivery units had one sink available (**Figure 3.**).

All of the health centers had indoor running water for hand washing; however, only three health centers had soap or a suitable alternative present at all hand washing points with available clean towels. Illustrated hand hygiene posters were found at every hand hygiene

station in delivery unit and vaccination room. All the health centers had alcohol hand rub located in the maternity section.

Figure 2. *A sink in health center B*

Figure 3. *A sink in a maternal and neonatal ward in health center **C***

1.5 General Cleanliness

Based on the observation, the environmental condition in many of the health centers was relatively good. However, there were areas in delivery and post-delivery rooms with surface dirt, cobwebs and dust, along with unnecessary instruments, such as pots or pans, that appeared not well maintained. Two of the health centers did not have clean delivery room and beds. All the six health centers had plastic sheets for delivery beds, but they were not in good condition.

Floors, surfaces and toilets were cleaned at least once a day. However, there was no separate cleaning equipment or materials for floors, points of care delivery and

toilets/latrines. Disinfectants, such as chlorine, are not available at the assessed health centers.

Figure 4. *A delivery room in health center **A***

1.6 Waste Disposal and Management

Waste disposal was assessed based on three separate categories: sharp waste, infectious medical waste, non-infectious general waste. All the six health centers had at least three labelled bins (sharp wastes, infectious wastes and non-infectious general wastes) and a sharps disposal. The sharps disposal generally consisted of a cardboard box with appropriate insertion point for sharps. However, the majority of the health centers were observed with overflowing or not adequately sealed sharps disposal. Sharps disposal were either burned or buried at the health centers. Though the six health centers had a brick

incinerator, only two were functional at the time of assessment. The remaining ones burned their wastes in an uncovered pit (**Figure 5.**).

Placenta was separated from other wastes. In the majority of the health centers, the mother and the family were more likely to bring the placenta home and dispose of it personally due to cultural belief. In the remaining health centers, placenta was buried in a covered concrete pit (**Figure 6.**). None of the pits was observed as being full at the time of assessment.

Figure 5. *Ground cinteration in replacement of broken incinerator*

Figure 6. *Placenta pits in health center **A***

2. WASH Practices among Healthcare Workers

WASH-related behavior of healthcare workers in maternity wards and delivery units was observed by a researcher to determine the current state of WASH practices in rural health centers. The observation items included 5 key moments of hand hygiene (**Appendix E**), 6 steps of hand washing (**Appendix F**), and PPE usage, recommended by WHO.

2.1 During Antenatal Care (ANC)

Based on the observation, the majority of the healthcare workers in maternal and neonatal wards at the six health centers did not follow the 5 key moments of hand hygiene during ANC. Most of the healthcare workers did not practice hand hygiene before touching a

patient, before performing clean/aseptic procedures, or touching surroundings. However, they did wash their hands after touching a patient or after body fluid exposure.

When washing their hands with soap or using alcohol hand rub, researcher observed that the midwives or staff on practices did not follow the six steps of hand washing recommended by WHO. The healthcare workers in maternal and neonatal wards, in majority of cases, were found not wearing gloves when performing blood draw, giving injection, handling urine or contacting with patient's fluid.

2.2 During Post-Natal Care (PNC)

Similarly, to the observation during ANC, researcher observed that healthcare workers in maternal and neonatal wards at the six health centers did not follow the 5 key moments of hand hygiene during PNC. Per observation visits, staff on practices did not wash their hand or use alcohol hand rub before touching mothers or newborns.

Though healthcare workers did wash their hands after touching a mother or a baby, they did not follow the six steps of hand washing recommended by WHO. In addition to hand wash, no glove usage was found when examining or giving vaccination to the mothers and babies.

3. Semi-structured Interviews

Semi-structured interviews were conducted with the midwives at the six health centers to see if their statements are accurately matched with the observations. Interviews included the topic of water access and water quality, access to sanitation and hand hygiene facilities, hand hygiene behaviors of healthcare workers, as well as other WASH-related issues at the health centers.

Some WASH-related issues were explored during the interviews. The interviewed midwives understood, and could state the importance of WASH in the health centers. In addition, they claimed that there were inadequate WASH resources provided to rural health centers. Water was for general purposes other than drinking. In addition to inadequate water supply, a lack of access to sanitation and hand hygiene facilities remain a big issue. Furthermore, midwives also stated that there was no any maintenance of the existing WASH infrastructures in the health centers.

The majority of the participants described WASH-related issue in the health center this way:

> *"Because our health center is located in rural area, we do not have enough WASH resources. We do not have clean water that we can drink in the health center. We have to bring our own water. There are only two toilets at the health center, and there is no separation for male or female. In addition to that, there is no bathing facilities available for women who come for the delivery. The toilets are far from*

the delivery and post-partum room, which makes it hard for women who just delivered."

Hand hygiene behavior was also explored through the interviews. The participants could state the importance of hand hygiene practice in providing quality of care to patients, and to protect themselves from infections. However, they did not have clear understanding of when and how they should wash their hands. The majority of the participants stated that they washed their hand only after touching the patient because of the time constraints. Moreover, participants also mentioned that they never receive any trainings on WASH or IPC.

Midwives described hand hygiene behavior at the health center as follow:

"We all know that hand washing is really important, but sometimes we are too busy to wash our hands before examining the patients. We always wash our hands after touching patient though because it is helpful and protective for ourselves. The main challenge in hand hygiene is that we have no habit to do so, and we have never been trained on WASH or IPC."

The majority of participants interviewed suggested that there should be enough provisions of WASH facilities and knowledge as well as encouragement in order to get everyone in the health centers involved with WASH-related behavior.

By analyzing the interviews, it is more likely that inadequate hand hygiene facilities and materials, inadequate clean water, in combination with limited knowledge and lack of trainings leaded to poor hand hygiene practices and behaviors of healthcare workers. It is important that more trainings and behavior change educations are provided periodically to healthcare workers in rural healthcare settings.

Findings and Discussion

The data from this research study presented gaps and barriers in WASH resources as well as WASH-associated behavior of healthcare workers within the settings in which mother and newborn care take place in rural Cambodian province. These findings show the essential resource challenges and lack of access as well as training in low income healthcare facilities, which should be recognized and incorporated into interventions that aimed at improving maternal and neonatal health at facility level.

Water, sanitation and hygiene in rural healthcare facilities, specifically in Cambodia, requires urgent attention in order to improve the health of mothers and newborns. Hygiene has not been prioritized on the international development agenda, despite the fact that hand washing with soap could save 300,000 people annually (UNICEF, 2010). Safe drinking water and sanitation in the absence of hygienic behavior will not prevent infections. In 2012, a US Intelligence Community Assessment identified WASH-related problems in rural healthcare facilities, such as increased risk of disease from unsafe drinking water and poor sanitation, as a threat to American interests (UNICEF, 2010).

Policies, institutions and infrastructures to improve drinking water, sanitation, hygiene and wastewater management in rural healthcare facilities must be put in place today in order to solve problem regarding to maternal and neonatal health. Such actions will also build resilience to cope with the future impacts.

Taking all of these factors into account, water, sanitation and hygiene in health care facilities must be given greater priority in the health community, which presently puts too much focus on curative approaches. This formative research study explicitly includes qualitative and observational exploration of WASH infrastructure and WASH-related behaviors of healthcare workers during ANC and PNC in maternity wards and delivery units in health centers. WASH practices during these stages are important to ensuring maternal and neonatal survival. Additionally, WASH-related improvements are crucial to meet development goals, reduce maternal and neonatal mortality, and improve health in a sustainable way. Improving WASH in rural healthcare facilities has been identified as essential to the prevention of healthcare-associated infections, including the incidence of maternal and neonatal sepsis.

Some suggestions made include the improvement of hardware and software components, in which hardware components are aimed at improving overall water, sanitation and hygiene infrastructure in health centers, such as construction and maintenance of water points, toilets, hand-washing equipment, burial pits for autoclaved waste and placenta pits for the disposal of placenta and other body tissues. Meanwhile, software components are processes management and practices aimed at improving hand hygiene practices and

implementation of waste management protocols. More training on WASH and IPC as well as WASH behavior change education should be provided to healthcare providers in rural healthcare settings.

Strengths and Limitations of the Study

This research study is one of the very few studies that has been done in Cambodia that focused on assessing WASH conditions in rural health centers. The findings from this study provide information and evidence of current situation of WASH in maternal and neonatal wards in Cambodian rural health centers, which clearly need improvements. This will serve as a formative research for future intervention addressing WASH-related issues in healthcare facilities in low-resource settings.

The research was limited in scope in several ways, which should be taken into consideration when interpreting the results. The observation of the health center took place over a limited timeframe, and were not repeated, and therefore may not be representative of the usual state of the health center. The study took place at only six health centers, and therefore the results identified may not be generalized to geographic regions beyond the area studied.

Assessing Water, Sanitation and Hygiene Infrastructures and Practices among Healthcare Workers in Maternal and Neonatal Wards of Six Rural Health Centers, Cambodia

By

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Chapter 3: Public Health Implications and Recommendations

Devastated by war, Cambodia has been putting in continuous efforts into improving its healthcare system, healthcare delivery, healthcare practices, and its own population wellbeing. Reduction of maternal and neonatal mortality rates are among the primary goals of many healthcare programs. However, in order for these programs to succeed their goals, it is crucial to identify the root causes of maternal and neonatal mortality, which will lead to effective implementation of interventions that specifically address these root causes. Conducted literature reviews surrounding WASH and IPC in Cambodian healthcare facilities show a linkage between WASH and IPC behaviors in maternal and neonatal wards and maternal and neonatal mortality. It is also important to note that inadequate amount of accurate data makes planning for development of health care system in Cambodia more difficult.

There has been only a few research studies conducted in Cambodian rural healthcare facilities utilizing structured observation methods to identify WASH infrastructure and practices of sample populations in target settings. The current decrease of maternal and neonatal mortality may be stagnant if there is no concrete understanding of protocols and specific behaviors carried out by health care workers in maternal and neonatal wards. Structured observational studies can be used to understand more about the gaps, and also to inform policy discussions to enhance the implementation of healthcare interventions.

This study aimed to reveal the state of WASH infrastructures and practices of healthcare staff, whose practices and behavior can be a potential risk of infections for mothers and newborns. Understanding the current situation of WASH can highlight points for future interventions to improve specific protocol, and therefore improving the overall quality of healthcare delivery, reducing the spread of HAIs, and increasing positive health outcomes. Based on the result of the study, several conclusions regarding recommendations for future implementations and areas of research are presented as follows:

1. **Improve WASH infrastructures in all assessed health centers**

Insufficient water, sanitation and hygiene facilities that provide safety and privacy to the healthcare staff and patients may increase the practice of poor hygiene, which as a result could impact health outcomes of patients and staff (Bazzano et al., 2015).

Some suggestions made include the improvement of hardware components that aims at improving overall water, sanitation and hygiene infrastructure in the six health centers, such as construction and maintenance of water points of use, toilets, hand-washing equipment, burial pits for autoclaved waste and placenta pits for the disposal of placenta and other body tissues. Installing on-site water filters should also be considered for drinking purpose of both patients and staff. In addition to that, more soap or hand sanitizers should be provided to both patient and staff. Overall, these could lead to better practice of WASH in all assessed health centers that could result in better health outcomes among healthcare workers and patients.

2. **Promote WASH-related behavior change among healthcare workers**

Based on the result of WASH practice observations during ANC and PNC, healthcare workers oftentimes did not wash their hands before examining mothers and newborns. Additionally, healthcare workers were observed not wearing glove when interact with mothers and neonates. These specific health behaviors of healthcare workers may lead to infection transmission. Having enough WASH facilities alone would not make any change if healthcare workers continue practicing poor hygiene. Therefore, further efforts in regards with WASH behavior change among healthcare workers in rural health centers should be considered, in order to prevent the spread of HAIs.

3. **Provide more trainings on WASH and IPC to healthcare staff**

The results of semi-structured interview revealed a major lack of knowledge among healthcare workers regarding hand hygiene practices as well as infection prevention and control. Healthcare personnel in all of the assessed health centers have limited knowledge on how and when to properly wash their hands. Additionally, this researcher observed that medical instruments and cleaning equipment were not safely and correctly handled after the completion of medical procedures.

Therefore, there is an urgent need for periodic trainings on WASH and IPC practices for all staff members. It would also be important to display reminders to follow WASH and IPC protocol when practicing health care. Some suggestions regarding the improvement of

software components, such as the processes management and practices aimed at improving implementation of waste management protocols, are also recommended.

4. **Improve healthcare access in rural areas of Cambodia**

The access to healthcare in rural areas of Cambodia remains a major concern despite an increase in the number of deliveries in healthcare facilities as opposed to home deliveries (Matsuoka et al., 2010). Mothers and newborns in rural areas are facing high risk of contracting bacterial infections, illnesses and mortality due to lack of access to healthcare facilities and availability skilled birth givers at home (Matsuoka et al., 2010). Children in rural areas attributed to approximate 90% of mortality rates of children under five, while 85% were contributed to mothers with low-education, according to Cambodia Demographic Health Survey 2010 (Cambodian DHS, 2010). Therefore, it is important to improve the healthcare access in Cambodian rural areas.

Implementation of the recommendations suggested above will help Cambodia improve its quality of care in maternal and neonatal wards, specifically in rural health settings, which could potentially lead to improved maternal and neonatal health, and a decrease in maternal and neonatal mortality. The findings from this study provide better insight of the current state of WASH in Cambodian rural health centers, which is essential for future studies and interventions.

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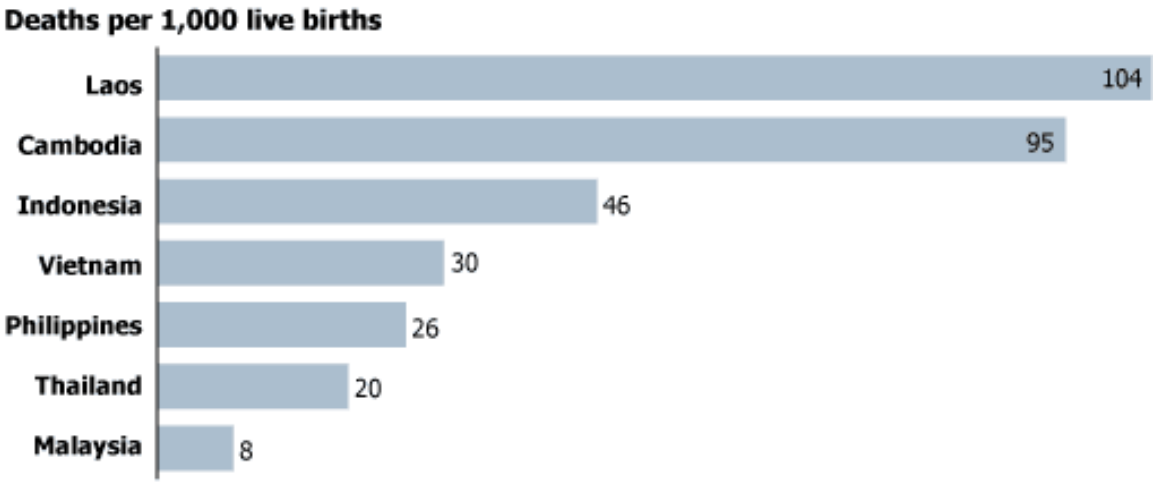
Graphs

Graph 1. Maternal and Neonatal Mortality in SEA Region



Appendices

Appendix A. WASH Infrastructure Assessment Tools

SECTION 1: IDENTIFICATION DATA	
1.	Date of assessment/visit: (___ / ___ / ___) (dd/mm/yyyy)
2.	Health center name: _____
3.	Operational District (OD) name: _____
4.	Province: _____
5.	District: _____

6.	Commune: _____
7.	Village: _____
8.	Total duration of the assessment: _____ (hours)

SECTION 2: ELECTRICITY SUPPLY			
1.	Is electricity available at the health center?	___ No ___ Yes	If No, skip to SECTION 3
2.	What is the main source of electricity in the health center?	__ National/community utility power __ Generator __ Solar power __ Don't know __ Other, specify….	
3.	Is this main source of electricity functioning at the time of assessment?	__ No __ Yes (During the observation, the investigator turns on the light to confirm the electricity is functioning)	
4.	What is the secondary source of electricity in the health center?	__ No secondary source __ National/community utility power __ Generator __ Solar power __ Don't know __ Other, specify….	
5.	Was electricity available in the health center in the past 7 days?	__ Always available, no interruption __ Often available, interruptions < 2h/day __ Sometimes available, prolonged interruptions > 2h/day __ Don't know	

6.	Is the electricity supply generally enough to meet the basic electrical need of the health center?	__ No, not enough __ Yes, generally enough	

SECTION 3: WATER SUPPLY			
1.	What is the main source of water in the health center?	__ None __ Piped water on premises __ Tube well or borehole on premises __ Protected dug well on premises __ Protected rainwater collection on premises __ Improved source off-premises within 500m __ Improve source off-premises over 500m __ Unprotected dug well __ Tanker truck __ Surface water __ Don't know __ Other sources, specify….	If No, skip to SECTION 4
2.	Is the main water source functioning during the time of assessment? (**Functioning**: water available from this source at the time of assessment)	__ No __ Yes (Investigator confirms by checking the taps during health center observation)	
3.	Does the main source of water provide enough water?	__ No, never enough __ Yes, sometimes, only seasonally __ Yes, enough water all year __ Don't know	
4.	Other than the main source of water, does this health center have a secondary source of water?	__ No __ Yes	If No, skip to question 6

5.	If yes, what is the secondary source of water for this health center?	__ Piped water on premises __ Tube well or borehole on premises __ Protected dug well on premises __ Protected rainwater collection on premises __ Improved source off-premises within 500m __ Improve source off-premises over 500m __ Unprotected dug well __ Tanker truck __ Surface water __ Don't know __ Other sources, specify…	
6.	Are these water sources used for drinking water?	__ No __ Yes	If No, skip to question 10
7.	Does the health center treat the water for drinking purpose?	__ No __ Yes	If No, skip to question 9
8.	If Yes, what treatment methods are used?	__ Filtration __ Disinfection by boiling __ Disinfection by using chlorine __ Don't know __ Other, specify….	
9.	If No, why? (**Multiple answers possible**)	__ The drinking water source is considered safe __ No filter or purification materials __ Lack of knowledge on how to treat water __ Lack of time to treat the water __Don't know __ Other, Specify….	
10.	Does the health center provide drinking water to clients?	__ No __ Yes (Confirmed by observing if the drinking water for clients is available at the patient waiting areas, e.g. reception/triage, during the health center observation)	If No, skip to question 12

11.	If Yes, what is the source of drinking water provided for clients?	__ Water available at health center __ Bottled water bought by the health center __ Don't know __ Other, Specify….	
12.	What is the source of drinking water for staff?	__ Water available at health center __ Bottles water bought by the health center __ Staff bring their own bottled water __ Don't know __ Other, Specify….	
13.	Does the health center have enough water supply for all purposes throughout the year?	__ No, never enough __ Yes, sometimes, only seasonally, even only used for general purposes other than drinking __ Yes, enough water all year only for general purposes other than drinking __ Yes, enough water all year for all purposes, including drinking __ Don't know	

SECTION 4: SANITATION FACILITIES			
1.	How many toilets/latrines are there on the health center premises at this time?	…….. (Record 0, if there is none) (Verify by the counted number during health center observation)	If 0, skip to question 7
2.	How many of them are **improved** toilets/latrines? (**improved**: flushed toilets, pit latrines with slab or VIP)	**……** (Record 0, if there is none) (Verify by health center observation)	If 0, skip to question 7
3.	Are they functioning at the time of assessment?	__ No __ Yes	
4.	Are there separate improved toilets/latrines for men and for	__ No __ Yes	

	women/girls (at least one for each group)?		
5.	Are there separate improved toilets/latrines for staff and for clients (at least one for each group)?	__ No __ Yes	
6.	Does at least one of these improved toilets/latrines meet the needs of (designated for) people with reduced mobility? Meeting the needs of people with reduced mobility: Accessible without stairs or steps, having handrails for support attached to the floor or side walls, the door with at least 80cm wide, the door handle and seat within reach of people using wheelchairs or crutches/sticks	__ No __ Yes	
7.	How are fecal wasters from the improved, usable toilets/latrines managed?	__ Flush to sewer __ Onsite storage in septic tank __ Onsite storage in latrine __ Don't know	
8.	Is there a **functioning** system in place to adequately drain rainwater away from the health center and health center grounds? (**Functioning**: no visible flooding of the health facility grounds and drainage canals free of debris and lead away from the facility)	__ No __ Yes __ Don't know	

SECTION 5: GENERAL CLEANLINESS AND HYGIENE			
1.	Are floors, surfaces and toilets/latrines of the health center cleaned on the routine basis?	__ No __ Yes	If No, skip to question 6

2.	If Yes, how often (at which frequency) are floors, surfaces and toilets/latrines cleaned?	__ At least once a day __ Every 2 days __Once every 3-4 days or twice per week __Once a week (weekly) __ Don't know	
3.	Are floors, surfaces and toilets/latrines cleaned with water and detergent/disinfectant (e.g. chlorine 0.05%)?	__ No __ Yes (Check at the store of cleaning equipment/materials if there is detergent/disinfectant available during health center observation)	If No, skip to question 5
4.	If Yes, how often (at which frequency) are floors, surfaces and toilets/latrines cleaned with water and detergent/disinfectant?	__ At least once a day __ Every 2 days __ Once every 3-4 days or twice per week __ Once a week (weekly) __Don't know	
5.	Are there cleaning equipment/materials separately for floors, points of care delivery and toilets/latrines?	__ No __ Yes (Check at the store of cleaning materials if there are separate for floors, points of care delivery and toilets/latrines available during health center observation)	
6.	Does the health center have any appliances available for sterilizing medical equipment?	__ No, there is none or broken one __ Yes (Check at the sterilization room is there is a functioning sterilizer during health center observation)	If No, skip to question 8
7.	If Yes, what type of appliances does health center use to sterilize medical equipment? **(Multiple answers)**	__ Electric autoclave __ Non-electric autoclave/Pressure cooker __ Electric dry heat sterilizer __ Electric boiler or steamer __ Don't know __ Other, specify…	
8.	Does the health center have any infection prevention and control	__ No __ Yes	

	(IPC) guidelines for healthcare facilities?		
9.	Has there been any IPC training offered to health center staff?	__ No __ Yes	If No, skip to question 11
10.	Have all clinical staff of the health center been trained (at least once) on the 5 key moments of hand hygiene and 6 steps of hand wash?	__ No, none __ Yes, some __ Yes, all	
11.	Does health center display hygiene promotion posters near hand hygiene stations and/or patient waiting areas?	__ No __ Yes	
12.	Does this health center have an IPC focal point?	__ No __Yes	
13.	Does the health center provide soap for hand washing for staff?	__ No __ Yes __ Sometimes __ Don't know	
14.	Does the health center provide soap for handwashing for patients and caregivers?	__ No __ Yes __ Sometimes __ Don't know	

SECTION 6: WASTE DISPOSAL AND MANAGEMENT		
1.	Is there a functional incinerator at the health center?	__ No __ Yes
2.	How does the health center dispose sharp waste?	__ Burn in incinerator __ Burn on the facility ground __ Dump in onsite pits __ Dump on flat ground __ Bury inside facility ground __ Remove offsite __ Other, specify…
3.	How does the health center dispose infected medical waste?	__ Burn in incinerator __ Burn on the facility ground __ Dump in onsite pits

		__ Dump on flat ground __ Bury inside facility ground __ Remove offsite __ Other, specify…
4.	Does the health center have placenta pits?	…….. (Record 0, if there is none) (Verify by the counted number during health center observation)
5.	How does the health center dispose placenta?	__ Mother takes placenta home __ Burn in incinerator __ Burn on the facility ground __ Dump in onsite pits __ Dump on flat ground __ Bury inside facility ground __ Remove offsite __ Other, specify…

Appendix B. WASH Practices Assessment Tools

SECTION 1: WASH PRACTICE OF HEALTHCARE WORKERS DURING ANTENATAL CARE (ANC)		
1. Hand wash with soap and dry with clean cloth or using alcohol hand rub	Before touching a patient	__ Never __ Always __Sometimes
	Before clean/aseptic procedures	__ Never __ Always __Sometimes
	After body fluid exposure/risk	__ Never __ Always __Sometimes
	After touching a patient	__ Never __ Always __Sometimes
	After touching patient's surroundings	__ Never __ Always __Sometimes
2. Have the clinical staff of the health center followed six steps of hand washing as displayed on the poster?		__ Never __ Always __Sometimes
3. Does the healthcare worker wear gloves	When performing blood draw	__ Never __ Always __Sometimes
	When handling urine test	__ Never __ Always __Sometimes
	When contact with patients' fluid	__ Never __ Always __Sometimes
4. Does the clinical staff of the health center use new gloves per patient or per procedure?		__ Never __ Always __Sometimes

SECTION 2: WASH PRACTICE OF HEALTHCARE WORKERS DURING POST-NATAL CARE (PNC)		
1. Hand wash with soap and dry with clean cloth or using alcohol hand rub	Before touching a mother	__ Never __ Always __Sometimes
	Before clean/aseptic procedures	__ Never __ Always __Sometimes
	After body fluid exposure/risk	__ Never __ Always __Sometimes
	After touching a mother	__ Never __ Always __Sometimes
	After touching patient surroundings	__ Never __ Always __Sometimes
2. Hand wash with soap and dry with clean cloth or using alcohol hand rub	Before touching a newborn	__ Never __ Always __Sometimes
	Before clean/aseptic procedures	__ Never __ Always __Sometimes
	After body fluid exposure/risk	__ Never __ Always __Sometimes
	After touching a newborn	__ Never __ Always __Sometimes
	After touching newborn surroundings	__ Never __ Always __Sometimes
3. Have the clinical staff of the health center followed the 6 steps of hand washing?		__ Never __ Always __Sometimes

4. Wearing gloves	When performing blood draw	__ Never __ Always __Sometimes
	When cleaning the injuries from delivery	__ Never __ Always __Sometimes
5. Does the clinical staff of the health center use new gloves per patient or per procedure?		__ Never __ Always __Sometimes
6. Does the clinical staff of the health center wash his/her hands properly before wiping newborn's eye and before applying antimicrobial?		__ Never __ Always __Sometimes
7. Does the clinical staff of the health center wash his/her hands properly before giving vaccination?		__ Never __ Always __Sometimes

Appendix C. Semi-structured interview guide – Midwives

Facilitator's welcome, introduction and instructions to participants

Welcome and thank you for volunteering to take part in this interview. You have been asked to participate as your point of view is important. I realize you are busy and I appreciate your time.

Introduction: This interview is designed to assess your current thoughts and feelings about the **WASH** conditions in Cambodian rural healthcare facilities. The interview will take no more than one hour. May I tape the discussion to facilitate its recollection? (if yes, switch on the recorder)

Anonymity: Despite being taped; I would like to assure you that the discussion will be anonymous. The tapes will be kept safely in a locked facility until they are transcribed word for word, then they will be destroyed. The transcribed notes of the interview will contain no information that would allow individual subjects to be linked to specific statements. You should try to answer and comment as accurately and truthfully as possible. If there are any questions or discussions that you do not wish to answer or participate in, you do not have to do so; however please try to answer and be as involved as possible.

Ground rules

- There are no right or wrong answers.
- Do you have any questions? (answers).
- OK, let's begin

Warm up Question

Please introduce yourself by telling us your name, your role at the health center, and how long you have worked in this health center.

Introductory Question

I am just going to give you a couple of minutes to talk about your experience of providing care to women surrounding childbirth. Would you mind sharing your experience?

Main questions

- **Questions on Water Access and Water Quality**

1. What does "Clean Water" mean to you?
2. How do you tell if the water is clean or not?
3. How important is clean water in the health centers?
4. Where do health centers get clean water from?
5. What are the main challenges of getting clean water supply in health centers?
6. What needs to be improved for hospitals to have access to clean water?

- **Questions on Hand Hygiene Behavior**

1. Can you describe the 5 key moments of proper hand hygiene?
2. How important is hand hygiene practice of healthcare workers in the health centers?
3. In general, what do you think about hand hygiene practice in this health center? Do healthcare workers follow the 5 key moments? Do healthcare workers wash their hand properly? If not, why?
4. What are the main issues around actually practicing hand hygiene here?

5. What are some ideas on how to improve hand hygiene behavior among healthcare personnel in healthcare facilities?

Concluding question

Of all the things we've discussed today, what would you say are the most important issues you would like to express about WASH-related issues in rural HCFs in Cambodia?

Conclusion

Thank you for participating. This has been a very successful discussion. Your opinions will be a valuable asset to the study. We hope you have found the discussion interesting. If there is anything you are unhappy with or wish to complain about, please speak to me later. I would like to remind you that any comments featuring in this report will be anonymous.

Appendix D. Patient Inform Consent Form (English Version)

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Appendix D: Patient information sheet and informed consent form in local language (& English)

WaterAid is conducting a study to explore WASH practices in maternity wards and delivery units in rural health centers in Tbong Khmum province, Cambodia. The purpose of the study is to better understand WASH infrastructure and resources as well as WASH-related behavior among healthcare workers. We will observe staffs during their daily work as well as ask for participants to involve in our interviews. The results of this study will help to develop protocols to prevent infection from spreading in the hospital.

Participation in the study is voluntary. If you choose to take part, you are free to leave the study at any time without having to give a reason. There are no foreseeable risks of physical harm to you from being in this study.

The information we collect will be kept confidential. Your name will not be associated with the results. A study number rather than your name will be used on study records. Your name and other facts that might point to you will not appear when we present this study or publish its results.

Your Rights as a Participant

This research has been reviewed and approved by the Institutional Review Board of Emory University and the WaterAid. If you have any questions about your rights as a research participant, you can contact the Emory Study Team at 017658556.

Is there anything you would like to ask me about the study?

Verbal consent obtained? *Yes* *No*

Appendix D. Patient Inform Consent Form (Khmer Version)

ឧបសម្ព័ន្ធ ឃ: **Informed Consent** (ជាភាសាខ្មែរ)

WaterAid ធ្វើការសិក្សាស្រាវជ្រាវមួយដែលស្វែងយល់អំពីទឹក និងការអនុវត្តន៍អនាម័យ (WASH) នៃមន្ត្រីសេវាសុខាភិបាលនៅក្នុងផ្នែកសម្ភព និងផ្នែកសម្រាលនៅមណ្ឌលសុខភាពចំនួន ៦ នៅខេត្តត្បូងឃ្មុំ ក្នុងប្រទេសកម្ពុជា។ គោលបំណងនៃការសិក្សានេះគឺដើម្បីស្វែងយល់អំពីហេដ្ឋារចនាសម្ព័ន្ធទឹក អនាម័យ ព្រមទាំងការអនុវត្តន៍របស់មន្ត្រីសេវាសុខភាព។
យើងនឹងសង្កេតមើលមន្ត្រីសេវាសុខភាពក្នុងអំឡុងពេលបំពេញការងារប្រចាំថ្ងៃរបស់ពួកគេ ព្រមទាំងស្នើសុំអោយមានការចូលរួមក្នុងបទសម្ភាសន៍របស់យើងផងដែរ។ លទ្ធផលនៃការសិក្សាស្រាវជ្រាវនេះនឹងជួយអភិវឌ្ឍពិធីសារជាតិស្តីអំពីការបង្ការ និងគ្រប់គ្រងការចម្លងរោគនៅតាមមណ្ឌលសុខភាព។

ការចូលរួមក្នុងការសិក្សានេះគឺដោយស្ម័គ្រចិត្ត។ ប្រសិនជាអ្នកជ្រើសរើសចូលរួមហើយចង់បញ្ឈប់ការសម្ភាសន៍វិញ អ្នកអាចបញ្ឈប់ការសម្ភាសន៍នៅពេលណាមួយដោយគ្មានការបង្ខិតបង្ខំ។ យើងបានព្រាងទុកថាគ្មានហានិភ័យប៉ះពាល់រាងកាយឡើយដល់អ្នកចូលរួមក្នុងការសិក្សាស្រាវជ្រាវនេះ។

ពត៌មានដែលយើងទទួលបាននឹងត្រូវបានរក្សាការសំងាត់។ ឈ្មោះរបស់អ្នកនឹងមិនត្រូវបានភ្ជាប់ជាមួយលទ្ធផលនោះទេ។

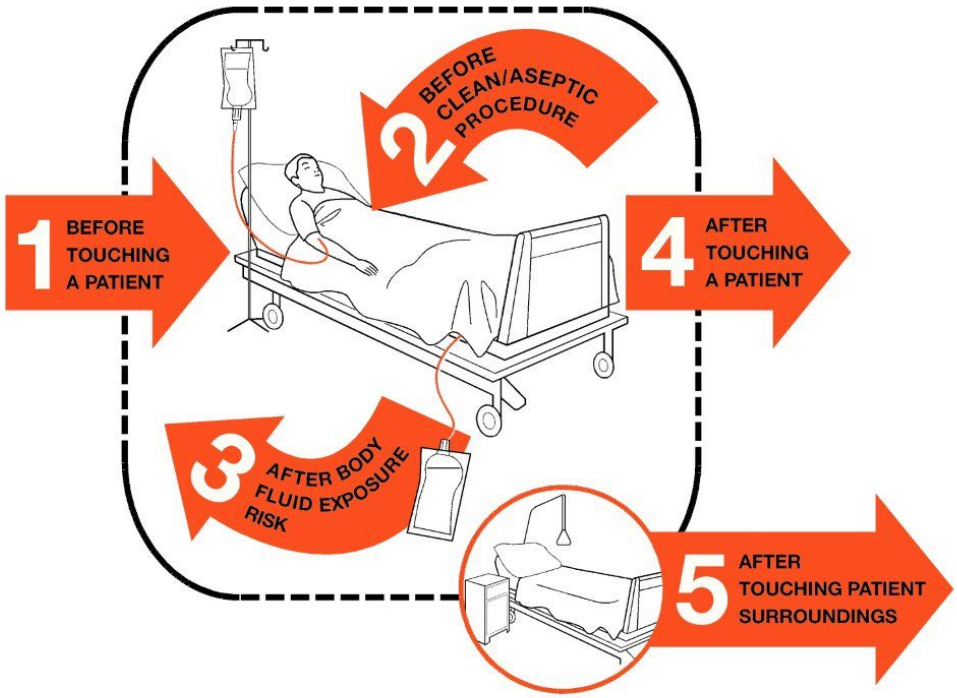
សិទ្ធិរបស់អ្នកចូលរួម:
ការស្រាវជ្រាវនេះនឹងត្រូវបានពិនិត្យ និងអនុម័តដោយក្រុមប្រឹក្សាភិបាលនៃសាកលវិទ្យាល័យ Emory និងអង្គការ WaterAid។ ប្រសិនបើអ្នកមានសំនួរទាក់ទងអំពីសិទ្ធិនៃការចូលរួមក្នុងការសិក្សាស្រាវជ្រាវមួយនេះ អ្នកអាចទាក់ទងក្រុមស្រាវជ្រាវនៅសាកលវិទ្យាល័យ Emory: 017 658 556

តើអ្នកមានសំនួរ ឬចម្ងល់ដែរឬទេ?
តើអ្នកយល់ព្រមឬទេ?

☐ បាទ/ចាស ☐ ទេ

Appendix E. 5 Key Moments of Hand Hygiene

Your 5 Moments for Hand Hygiene



1	BEFORE TOUCHING A PATIENT	WHEN?	Clean your hands before touching a patient when approaching him/her.
		WHY?	To protect the patient against harmful germs carried on your hands.
2	BEFORE CLEAN/ ASEPTIC PROCEDURE	WHEN?	Clean your hands immediately before performing a clean/aseptic procedure.
		WHY?	To protect the patient against harmful germs, including the patient's own, from entering his/her body.
3	AFTER BODY FLUID EXPOSURE RISK	WHEN?	Clean your hands immediately after an exposure risk to body fluids (and after glove removal).
		WHY?	To protect yourself and the health-care environment from harmful patient germs.
4	AFTER TOUCHING A PATIENT	WHEN?	Clean your hands after touching a patient and her/his immediate surroundings, when leaving the patient's side.
		WHY?	To protect yourself and the health-care environment from harmful patient germs.
5	AFTER TOUCHING PATIENT SURROUNDINGS	WHEN?	Clean your hands after touching any object or furniture in the patient's immediate surroundings, when leaving – even if the patient has not been touched.
		WHY?	To protect yourself and the health-care environment from harmful patient germs.

World Health Organization | Patient Safety — A World Alliance for Safer Health Care | SAVE LIVES Clean Your Hands

WHO acknowledges the Hôpitaux Universitaires de Genève (HUG), in particular the members of the Infection Control Programme, for their active participation in developing this material.

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Appendix F. 6 Steps of Hand Washing