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Stopping Neonatal Sepsis: Identifying Tools to Monitor and Evaluate Water, Sanitation, and Hand Hygiene (WASH) and Infection Prevention and Control (IPC) in Primary Healthcare Settings in Amhara Region, Ethiopia

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Abstract

Stopping Neonatal Sepsis: Identifying Tools to Monitor and Evaluate Water, Sanitation, and Hand Hygiene (WASH) and Infection Prevention and Control (IPC) in Primary Healthcare Settings in Amhara Region, Ethiopia

By: Enneye Abiy Makonnen

Neonatal sepsis is considered the third major cause of death after pre-term birth and intrapartum related complications and accounts for 2.6 million neonatal deaths per year. Although the rate in under- five child deaths reduced prior to the 2000s, these past few decades reveal a slower decline in annual neonatal mortality than children. Ethiopia is one of the top five countries that experiences the highest number of neonatal deaths worldwide, while Amhara has the highest neonatal deaths in the country. Global organizations such as WHO and UNICEF published an alarming baseline global assessment of Water, Sanitation, and Hygiene (WASH) infrastructure in healthcare facilities and made a call for global action. Their assessment highlights low-income countries have limited WASH services, especially in maternal and primary care. Despite establishing hospital WASH standards and mechanisms to promote systematic accountability at a national level, monitoring and evaluation efforts are lacking at a primary level. Although Ethiopia provides valuable national WASH data, there is a need for routine monitoring of WASH initiatives at local, hospital settings. For this special studies project, the focus will be geared towards an intervention that Felege Hiwot and Debere Tabor hospital implement to monitor and evaluate WASH and infection prevention and control (IPC) compliance in reducing incident hospital-acquired neonatal sepsis (bloodstream infections) in Amhara, Ethiopia. The tool guide was divided into four categories and each tool was assessed based on specific key indicators. Based on our scoring criteria, *Hand Hygiene Technical Reference Manual: Observation Form, Infection Prevention and Control Assessment at the Facility Level, Guidelines on Core Components of IPC Programs at the National and Acute Healthcare Facility Level, Baby-friendly Hospital Initiative Monitoring Tool, and Water and Sanitation for Health Facility Improvement Tool (WASHFIT)* scored the highest from their categorical domain. Improving monitoring and evaluation will bring continuous improvement to our target hospitals and neonatal outcomes.

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Chapter 1: Introduction

Neonatal sepsis is considered the third major cause of death after pre-term birth and intrapartum related complications and accounts for 2.6 million neonatal deaths per year [1]. Neonatal sepsis is a life-threatening, systemic infection that occurs in newborns in the first twenty-eight days of life [2]. Sepsis can be identified as either early or late onset. Early-onset sepsis is when neonates experience symptoms before seven days of life [2]. Early-onset sepsis can be due to mother to neonate transmission of contaminated amniotic fluid or presence of bacteria from the mother's lower genital tract upon vaginal delivery. Late-onset sepsis is when neonates experience symptoms at or after seven days of life, potentially due to initial neonatal colonization from environmental contamination or poor hygiene management from care providers [2]. Signs and symptoms of neonatal sepsis include respiratory distress, fever, lethargy, poor feeding, hypothermia, and shock [3]. Without immediate treatment measures, neonatal sepsis may lead into neurological complications, such encephalopathy and seizures, renal failure, pericarditis, respiratory distress, and potentially death [4].

Sepsis is considered the top global burden of neonatal morbidity and mortality according to the World Health Organization [1]. Although from 1990 to 2016, global action was initiated in reducing morbidity and mortality in children under five, neonatal mortality declined at a slower rate. Vulnerable global regions, such as sub-Saharan Africa, continue to be heavily impacted and have shown a 40% decrease in neonatal deaths throughout that time span [5]. This slow regression has brought detrimental consequences for the population census of neonates in sub-Saharan Africa, particularly in Ethiopia [5].

According to the WHO, Ethiopia is one of the top five countries that experiences the highest number of neonatal deaths (97,000 annually) worldwide [6]. Ethiopia is a landlocked country, located in the horn of Africa with an area of 1,126,829 km^2, which is twice the size of France or Texas. Ethiopia is home to more than 115 million people as of 2020, making it the second largest populated country in Africa, after Nigeria [7]. Although Ethiopia is considered a low-income country, the country experienced a progressive, economic growth of 6.1 percent and is considered the fastest economically growing country in the world [8]. Ethiopia is a rural country with 80% of the population living in rural areas [9]. The country consists of two independent cities and nine regions. Amhara, which is the second largest populated region in Ethiopia, after Oromo, continues to experience greater challenges in neonatal mortality reduction. While Ethiopia exhibits neonatal mortality of 28 per 1000 live births, Amhara exhibits a higher neonatal mortality of 47 per 1000 births [10,11].

Problem Statement

Although neonatal mortality in rural areas of Ethiopia are 43 deaths per 1000 live births, Amhara has the highest neonatal deaths in the country. Between 2005-2019, Amhara experienced a slow rate of 8% in neonatal mortality reduction [11]. Factors of neonatal mortality could be due to lack of accessible obstetrics and neonatal health services or inadequate quality of care among hospital staff [11]. According to UNICEF data for maternal and newborn health disparities in Ethiopia, less than 1 percent of newborns in rural areas receive postnatal care and 0.2 percent of newborns in Amhara receive postnatal care within two days [11]. Each year, between 5.7 and 8.4 million people die due to inadequate quality of care in lower to middle income countries (LMIC) [12]. These deaths make up to 15% of a country's population mortality [12]. For Amhara mothers that have the advantage of accessing basic neonatal care, it is vital that hospital facilities

deliver adequate, quality care and apply health promoting interventions to prevent the spread of infection to mothers and neonates. Global organizations such as WHO and UNICEF published an alarming baseline global assessment of Water, Sanitation, and Hygiene (WASH) infrastructure in healthcare facilities and made a call for global action. Their assessment highlights that low-income countries have limited WASH services, especially in maternal and primary care [12]. Evidence shows that newborns that are delivered in low-income hospitals are three to twenty times more likely to have a hospital-acquired infection compared to high income countries [13]. With limited WASH infrastructure, this raises the probability for patients and hospital staff to have a hospital-acquired infection in low-income settings [13] Furthermore, it is crucial that low-income hospitals should assess if basic WASH services are present and adequate to promote positive patient outcomes [12]. In November 2018, WHO and Ethiopia Ministry of Health performed a situational analysis on WASH coverage in health care facilities and how it may impact quality of care. Despite establishing hospital WASH standards and mechanisms to promote systematic accountability at a national level, monitoring and evaluation efforts are lacking at a primary level [12]. Although Ethiopia provides valuable national WASH data, there is a need for routine monitoring of WASH initiatives at local, hospital settings [12].

Purpose Statement

For this special studies project, the focus will be geared towards an intervention that Felege Hiwot and Debere Tabor hospital implement to monitor and evaluate WASH and infection prevention and control (IPC) compliance in reducing incident hospital-acquired neonatal sepsis (bloodstream infections) in Amhara, Ethiopia. The first two aims are completed, and our special studies project will be focusing on our third aim.

The aims for the special studies project are:

1. To review the Synergy Study and WASHcon results for key findings and barriers that hinder neonatal sepsis prevention from our primary hospitals
2. Identify and collaborate with the quality improvement officer and Stop Sepsis Now team to assess how WASH and IPC initiatives are currently being monitored and evaluated at our primary hospitals
3. To gather existing monitoring and evaluation tools to develop a tool guide and identify what areas need to be assessed to reduce hospital-acquired neonatal sepsis

Chapter 2: Literature Review

Global Burden of Neonatal Sepsis

It is estimated that there are 2.6 million neonatal deaths annually with one third of neonatal deaths attributed to infections and sepsis [14]. According to the World Health Organization (WHO), sepsis is a life-threatening organ dysfunction that is considered one of the major global health concerns and leads to an increase in neonatal mortality in low and middle-income countries (LMICs) [14,15]. 3.6 million neonates are falling into mortality during their first four weeks of life [16]. Under the United Nation's Sustainable Development Goals, there have been great gains in decreasing neonatal mortality to a target goal as low as 12 deaths per 1000 livebirths by 2030 [16]. Although the rate in under- five child deaths reduced prior to the 2000s, these past few decades reveal a slower decline in annual neonatal mortality than children and impacted newborns with pneumonia and diarrhea—not sepsis [10]. With these gains in reducing other infections, the proportion of newborns dying of sepsis continues to rise. [17] Globally, there are over three million cases of neonatal sepsis annually. Within those neonatal sepsis cases, between 500,000 and 900,000 result in death [18] Further, neonatal sepsis differentially and negatively impacts vulnerable populations such as low birthweight infants, rural families without access to treatment, hospitalized newborns, and women with geriatric pregnancies [19]. Compared with other causes of neonatal death, neonatal sepsis causes 1.6 times more mortality than malaria globally and over four times more childhood deaths than HIV [20]. Although neonatal sepsis is preventable, the probability of life-threatening outcomes for their baby increases when pregnant women have sepsis. Key maternal risk factors for developing sepsis include preterm delivery, premature rupture of membranes, stillbirth, spontaneous abortion, and newborn congenital abnormalities [21].

Continuing the work on improving neonatal health, the third Sustainable Development Goal (SDG) developed by the United Nations in 2015 focuses on ensuring healthy lives and promoting well-being for everyone. Specifically for neonates, SDG target 3.2 aims to end "preventable deaths of newborns and children under five years old, by reducing neonatal mortality to at least as low 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births" [22]. Although 141 countries have either met or are expected to meet the SDG target goal by 2030, 54 countries are not on track. Three quarters of the countries not on track are in Sub-Saharan Africa—a region which bears 59% of global neonatal deaths [22]. If current trends continue in these 54 countries, more than 43 million children will die due to preventable deaths [22]. This quantity of death is higher than the population of Angola (35 million) and near the population of Uganda (48 million). Half of these deaths would be among newborns [22]. In clinical settings, healthcare professionals must provide routine care for uncomplicated labor and birth as well as identify signs of neonatal sepsis rapidly. Established individual risk factors for neonatal sepsis include fetal distress during labor, fetal tachycardia, meconium-stained amniotic fluid, and an Apgar score of six or less. If these maternal labor-related risks for neonatal sepsis are not evaluated, the newborn may later develop sepsis and its life-threating complications. Most newborn sepsis occurs early—within the first few days of life [23] The clinical presentation of neonatal sepsis is not always specific—particularly for early sepsis which is the most common globally [23]. Factors that increase the probability of early-onset neonatal sepsis include prematurity, prolonged rupture of membranes, and maternal intra-amniotic infection [21]. Later signs of sepsis include fever, hypothermia, poor feeding, respiratory distress, seizures, and hypotension [21]. Despite the profound impact of neonatal sepsis—particularly early neonatal

sepsis—on child survival/mortality, it has not yet received widespread focal attention as a public health priority compared to other global diseases such as HIV, TB, or Malaria.

Global Interventions for Newborn Sepsis Reduction

In order to prevent neonatal sepsis globally, there is a need to establish a global criterion to educate on neonatal sepsis prevention and promote intersectional collaboration among health professionals, health facilities, communities, and families. Having strong knowledge and training in neonatal sepsis prevention and early treatment can promote newborn survival [24]. In 1996, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) developed a collaborative intervention strategy called the Integrated Management of Newborn and Childhood Illness (IMNCI) [25]. IMNCI was designed to promote the health of children under five years old through early detection and timely treatment for common childhood illness, assessing newborns for signs of acute neonatal illnesses and improving growth and development during the first five years of life. IMNCI also promotes collaboration among healthcare workers, patients and families, and communities. The benefits of this program are that healthcare workers improve patient care performance, improve overall healthcare services in health organization, and improve health knowledge on best practices to promote quality of life for neonates and children in communities [25]. Neonates are more prone to develop subtle signs and symptoms when they have sepsis. Without timely, focused assessment of the key warning signs for newborn sepsis, which include feeding difficulties, temperature below 35.5 degrees Celsius or above 37.5 degrees Celsius, poor independent movement, and convulsions [26], life threatening signs and symptoms of sepsis can quickly progress to more serious disease.

Quality Improvement and Infection Prevention in Hospitals

Hospitalized infants (including those who are low birth weight or in neonatal intensive care units (NICUs), are particularly at risk for sepsis due to physiologic vulnerability, poor environmental conditions, and medical interventions. Common pathogens that are attributed to late- onset neonatal sepsis include klebsiella, escherichia coli, and candidiasis [27].

To reduce neonatal sepsis in hospitals, the WHO recommends that hospital facilities implement quality improvement approaches to improving routine clinical care and universal infection prevention strategies [28]. Quality improvement implementation is derived from concurrent evidence-based practices, and hospitals then apply the recommendations to their hospital practices. The Institute for Healthcare Improvement (IHI) describes quality improvement as "a formal approach to the analysis of performance and systematic efforts to improve it." [29]. The Associates in Process Improvement (API) developed a continuous quality improvement approach which focuses on how to accelerate improvement in a healthcare facility current practice. The API model focuses on setting measurable goals, evaluating improvement with quantifiable measures, and selecting the changes that will result in improvement [30]. Quality improvement is an overall structured approach to optimizing routine care. It can be conducted by various departments including front-line clinicians, infection prevention control for formal CQI (continuous quality improvement) offices.

Within quality improvement, infection prevention and control (IPC) is a key component in preventing hospital-acquired infections while reducing the potential risk for community transmission [31]. The WHO defines infection prevention and control (IPC) as a "practical evidence-based approach which prevents patients and healthcare workers from being harmed by

avoidable infection and as result of antimicrobial resistance" [32]. Applying IPC practices in hospitals can prevent hospital-acquired infections and infectious outbreaks [33]. Since hospital-acquired infections are highly affected in low-resource settings, the WHO proposes that hospitals, especially facilities that reside in high infectious disease locations, should adopt IPC practices into their local healthcare facilities and national level [34]. Although IPC practices evidence-based guidelines. IPC guidelines can be customized and rolled-out in hospital-specific ways using quality improvement methods, which can blend global evidence with local context to create the most powerful and customized sepsis-preventing strategies that are locally relevant and maximally sustainable [34].

WHO: Core Components for Infection Prevention and Control Programs

The WHO created a package of eight infection prevention and control core components to prevent hospital-acquired infections at local hospitals and in national programs. The WHO designed the IPC principles to blend IPC evidence-based practices with facility- and national-level quality improvement strategies to reduce neonatal sepsis. The eight core principles of WHO-IPC are: 1) infection prevention and control programs, 2) national and facility level infection prevention and control guidelines, 3) infection prevention and control education and training, 4) health care-associated infection surveillance, 5) multimodal strategies for implementing infection prevention and control activities, 6) monitoring, evaluation and feedback, 7) staffing and bed occupancy at the facility level, and 8) materials and equipment for the infection prevention and control department at the facility level. Each core principle is elaborated upon in more depth below.

- The first principle recommends that all healthcare facilities have an IPC program at the facility-level which is consistent with the national program. The IPC program is designed for hospital leadership and healthcare staff to collaborate for protecting patients, families, and employees from hospital-acquired infections and respond to communicable disease outbreaks. The IPC team is designed to include staff with IPC knowledge and skills. Members variably include physicians, infection preventionists, pharmacists, laboratories, nurses, and epidemiologists. Having an interdisciplinary IPC team whenever possible can lead to the most powerful solutions for preventing HAIs (hospital-acquired infections) [35].
- The second principle recommends that all healthcare facilities establish facility-specific evidence-based IPC guidelines and protocols to guide employee practice in all relevant departments. Then, the facility's ICP team raises awareness of these guidelines and trains relevant staff on the guidelines. IPC teams also monitor the IPC guideline uptake and evaluate staff knowledge and practices to ensure the guidelines are specifically applied to hospital practices.
- The third principle recommends that all facilities provide IPC education and training on the guidelines at a facility level with national level support. These training courses are designed to involve "real life" simulations and generate strategies to reduce transmission and infections. IPC training is variably used in new hire orientation, annual compliance, and performance reviews and reported back to national-level IPC agencies. To maximize IPC

sustainability, WHO recommends hospitals host IPC training and provide quality resources and job aids.

- The fourth principle recommends that hospitals establish a surveillance system for hospital- associated infections. This can be paper-based or technology-based monitoring to detect and report positive infections, monitor trends, and prevent outbreaks. Where available, facility-wide surveillance can document IPC practices, promote quality improvement and stronger collaboration between local hospitals and national IPC programs.
- The fifth principle advises hospital IPC programs to create multimodal interventions with elements such as educational training, safety culture and IPC audit-feedback cycles to improve practice. IPC interventions with multiple components are more likely to reduce neonatal sepsis, promote sustainability, and prevent future infections.
- The sixth principle recommends that both local and national levels monitor, evaluate, and provide feedback to users about IPC practices and impact. Routine monitoring and local-national communication can enable national officials to review data findings, collaborate with local hospitals on improvement plans or suggest focused interventions specific to the facility.
- The seventh principle recommends that hospitals evaluate the staff-to-patient ratios and patient bed occupancy. WHO recommends the patient-to-bed ratio should not exceed the facility's standard capacity and healthcare worker staffing levels should be assigned based on patient workload.

- Finally, the eighth principle recommends that patient-care areas be cleaned and provided with IPC equipment and materials at the point of use. Targeted supplies may include hand soap, clean towels, and personal protective equipment [36].

Neonatal Sepsis in Sub-Saharan Africa

Sub-Saharan Africa experiences the highest burden of proportionate neonatal mortality with 27 deaths per 1,000 live births in 2019, greater than Central and Southern Asia with 24 deaths per 1000 live births [37]. Sub-Saharan Africa (SSA) has the highest number of total neonatal sepsis deaths globally with 750,000 newborns dying each year compared to South-East Asia of 200,000 neonatal deaths [38]. 26% of neonatal deaths are associated with neonatal infections—including sepsis [39]. The probability of death is ten times higher for a neonate born in sub-Saharan Africa compared to those born in high-income countries [40].

Based on current trends, 5.29-8.73 million DALYs are lost each year in SSA due to neonatal sepsis. Disability-adjusted life years (DALYs) are used to measure the impact of illness and death on life-expectancy [39]. The economic burden for neonatal sepsis costs has been estimated to be up to $469 billion (about $1,400 per person in the US) [39]. These financial burdens and DALY losses could be reduced with prevention measures. Consequently, quality improvement and infection prevention strategies in hospitals may bring substantial sepsis-prevention benefits for these high-risk populations. Although quality improvement is the fundamental healthcare approach to improve patient outcomes in high-income countries, quality improvement is infrequently practiced in many LMIC contexts, especially in SSA [41]. While the purpose of

quality improvement is to improve routine clinical performance using locally specific solutions and resources, it has not been widely adopted in SSA.

To reduce neonatal mortality, WHO recommends improving quality of care for neonates at birth, and promote essential newborn care (e.g., cord care, thermal care and feeding support) and Kangaroo Mother Care (KMC) for low-birth-weight infants (LBW) [42]. These early practices reduce neonatal sepsis and pneumonia risk [42]. Although these essential newborn care practices are evidence-based, promote survival, and could support achieving SDG target 3.2, there has been limited published uptake in sub-Saharan African to date [43]. UNICEF estimates 42 of the 48 countries in this region are not yet on track to meet this target by 2030 [44].

Nigeria, the country with the largest population in SSA, created a program called the Society for Quality Healthcare in Nigeria (SQHN). The program was designed to "lead, advocate, and facilitate the continuous improvement of quality and safety in healthcare in Nigeria" [45]. In SQHN's 2011 workshop, 97% of respondents believed patient safety was a global issue [45]. In learning from Nigeria's national prioritization of QI, other countries, and hospitals in SSA may develop quality improvement programs which blend locally relevant IPC-QI with national programs.

Quality Improvement and Neonatal Sepsis in Ethiopia

Particular attention to neonatal deaths is needed in Ethiopia, which has the fourth largest burden of neonatal deaths in the world [46]. Further, 99% of all neonatal deaths occur in LMICs such as Ethiopia [24]. Although neonatal mortality has declined globally, Ethiopia continues to experience about 81,000 newborn deaths per year. Within Ethiopia, the Amhara region has the highest prevalence of neonatal sepsis at 64% [47]. Many of these deaths nationally and in

Amhara occur among vulnerable newborns—including those born of low birthweight. In order to prevent neonatal sepsis in Ethiopia, hospitals need to adopt quality improvement strategies by implementing infection prevention guidelines and protocols, and by strengthening hospital surveillance systems [21]. Limited surveillance of infection prevention and water, sanitation, and hygiene (WASH) strategies can deliver a detrimental effect for LMICs including Ethiopia. Yet, Ethiopia has historic strengths in national quality improvement (2017) and water, sanitation, and hygiene initiatives, which could be leveraged to reduce neonatal sepsis at the facility level [48].

Ethiopian Quality Initiatives

In 2017, the WHO launched a global network called Maternal Newborn and Child Health Quality of Care Initiative to improve quality of care for mothers and newborns at hospitals. Ethiopia was one of the ten WHO collaborating sites which partnered to prevent maternal and neonatal mortality and improve patient-care experience by 2030 [49]. As a WHO partner, the Ethiopian Ministry of Health (MOH) designed a maternal and newborn action plan focused on quality improvement exercises for hospitals. These exercises were performed in fourteen Ethiopian learning sites. By 2019, Ethiopia presented eighteen quality improvement projects at the WHO global summit [49]. However, in this national package of QI case studies, key interventions for preventing newborn sepsis have not yet been prioritized. For example, the cases did not focus on facility-level surveillance reporting, performance evaluation, or audit-feedback cycles [50]. Yet, including long-term interventions such as these in national initiatives to promote quality newborn care may begin to close quality gaps at local hospitals.

Ethiopian Water and Sanitation Initiatives: CASH & One WASH

In 2014, Ethiopia Federal Ministry of Health developed Clean and Safe Health Facilities (CASH) program designed to "reducing hospital-associated infections and promoting a safer hospital environment by improving IPC and patient safety" [51]. The national CASH program focuses on clean care environments, infrastructure to promote high quality WASH (water, sanitation, and hygiene), e.g., waste management, sufficient and safe water supply, environmental cleaning, and controlled patient visitation [51]. Using quality improvement as a guide, local hospital CASH teams perform assessments using the CASH audit tool to evaluate gaps in WASH quality [51]. Based on these formative hospital assessments, local CASH teams designed solutions to address local facility WASH challenges. A few limitations of CASH audit tool are that the tool is generalized and not specific to the facility, it does not provide staff with improvement interventions based on findings and lacks guidance on water and sanitation management [51]. Also, the CASH program initial evaluations were funded by the national government. However, longitudinal CASH assessments and maintenance of WASH practices are not part of the national program. Consequently, maintaining CASH standards of care and continued assessment is based on individual hospital priorities and finances. There is no ongoing national CASH certification [51]. In 2013, the Ethiopian Federal Minister of Health developed One WASH National Program (OWNP) to focus on improving healthcare infrastructure for water, sanitation, and hygiene OWNP was a partnership between the Ethiopian MOH, African Development Bank, and UNICEF. It was designed to address four strategic areas: rural WASH, urban WASH, institutional WASH, and WASH capacity-building. One successful outcome for the OWNP was on their phase 1 action plan, 38,336 constructed water supply granted 18.7 million Ethiopians the access to clean water at the community-household level [52]. Although OWNP was designed to

provide district -level WASH infrastructure (e.g., in woredas), administrative delays resulted in limited WASH infrastructure development [30].

A multinational consortium including the World Health Organization (WHO), United Nations International Children's Emergency Fund (UNICEF), and the Nell Hodgson Woodruff School of Nursing Emory- Ethiopia Partnership developed the Saving Little Lives at Birth (SLL) program to improve maternal and neonatal health in Ethiopia [54]. With the mission of reducing neonatal mortality, the program consists of four components, which includes Kangaroo Mother Care (KMC), emergency resuscitation for respiratory distress, nutritional support, and neonatal sepsis prevention [54]. In 2018, funded by the Emory University Office of the Executive Vice President for Health Affairs and Robert W. Woodruff Health Sciences Center Fund, the Emory-Ethiopia Partnership developed a Synergy Study which focused on WASH infrastructure, environmental conditions, and prevalence of neonatal sepsis. The purpose of the Synergy Study was to evaluate the prevalence of neonatal sepsis related to limited WASH infrastructure and practices. The Synergy Study was carried out at Felege Hiwot and Debere Tabor hospital located in the Amhara region of Ethiopia. During the study, 605 infants were monitored through the first 28 days (about 4 weeks) of life. With frequent reassessments, laboratory diagnostics were collected and analyzed to screen for potential neonatal sepsis. Tools such as WASHCon and WASHCon Lite were used to measure WASH infrastructure, environmental assessment sampling, and evaluation of staff compliance with hospital regulations [55].

After the Synergy Study trial was performed, results showed that 1 in 5 newborns were positive of neonatal sepsis and the probability of a low birthweight infant (<2500g) developing sepsis is 2.4 times higher than a normal birthweight infant (≥2500g) [49]. Laboratory diagnostics revealed

89% of the blood cultures containing multidrug-resistant organisms. WASHCon and WASHCon lite results revealed challenges such as environmental cleaning, limited access to water, poor hospital infrastructure, and lack of adequate hand washing among hospital staff [50]. With these results, this increases the likelihood for neonatal patients to have sepsis and exhibit future life-threatening outcomes. Although these studies did not reduce incidence cases of neonatal sepsis, these results gave the synergy team overall context on both hospitals' WASH conditions, hospital staff work performance, and environmental cleaning management. Due to these findings, the Emory-Ethiopia partnership formally created the "Stop Sepsis Now" project to improve WASH and IPC practices in preventing neonatal sepsis in Felege Hiwot and Debere Tabor hospital [56].

To reduce hospital-acquired neonatal sepsis in Felege Hiwot and Debere Tabor Hospital, the Stop Sepsis Now team established a solution-based approach which consists of five phases. The first phase consists of communicating the Synergy Study findings with hospital staff, stakeholders, and national leaders. The second phase requires the team to develop a literature review which focuses on effective solutions and concurrent evidence-based practice for WASH and IPC in primary-care settings. The third phase involves multidisciplinary team collaboration among hospital leaders and staff to review evidence-based recommendations and brainstorm a facility wide action plan to help reduce hospital-acquired neonatal sepsis [50]. On April 2021, former team member, Kelly Geith, developed a tool guide for Debere Tabor and Felege Hiwot hospital on WASH and IPC recommendations to prevent neonatal sepsis. With these recommendations, this will require reviewing these recommendations to develop effective, sustainable interventions that will help reduce hospital-acquired neonatal sepsis for these

hospitals. The fourth phase involves co-developing feasible, co-bundle interventions and adopting these interventions into the hospital guidelines. Lastly, the fifth phase focuses on piloting these guidelines, monitoring staff working compliance, and evaluating neonatal sepsis outcomes [56].

To promote long-term effectiveness in WASH and IPC measures, both hospitals will need to develop a quality improvement program for their facility. Having a quality improvement program with a strong monitoring and evaluation system will enhance staff accountability, promote a positive patient safety culture, and communication between local, district, and national level. To promote sustainability, we need to monitor and evaluate hospital staff performance to assess gaps that may hinder the hospitals from achieving their goals. Monitoring and evaluating WASH and IPC measures will help to reveal what the root causes are and the barriers that are leading to poor neonatal outcomes. With our findings, applying feasible WASH and IPC interventions will help bridge the gap, thus improving hospital infrastructure and neonatal outcomes.

While there have been improvements in the past twenty years to reduce neonatal sepsis globally, rates remain high in Ethiopia and the country will continue to experience a slower decline due to poor socioeconomic status and lack of safe neonatal practices if immediate actions are not initiated. [47]. Although Ethiopia has a national quality improvement system in place, gaps in WASH and IPC compliance still exist at a local level [15]. Preventing hospital-acquired neonatal sepsis long-term will require improving our monitoring and evaluation system (based on WASH and IPC principles) at a primary facility level. Monitoring and evaluation will help hospitals

assess staff work performance and current infrastructure, identity gaps, and promote change to improve patient outcomes [57]. To improve quality improvements in WASH and IPC, the Ethiopia Ministry of Health recommends evaluating audit tools and develop an implementation toolkit [58]. To reduce hospital-acquired neonatal sepsis in our target hospitals we need to review WASH and IPC tools that are being practiced in primary facilities globally. Reviewing these tools will guide our target hospitals in actions to monitor and evaluate WASH and IPC to promote positive neonatal outcomes.

Chapter 3: Methods and Results

The main goal for this deliverable is to gather existing monitoring and evaluation tools and develop a tool guide that will identify what areas need to be addressed to reduce neonatal sepsis. To develop a tool guide to enable monitoring, we sought tools that covered topics such as hand hygiene, IPC, maternal and newborn, and WASH. Tools were eligible for inclusion in the guide if they provide guidance on strategies to implement monitoring and evaluation in hospital facilities. Tools were obtained from published infectious disease articles and retrieved from online searches such as PubMed, Google, Emory Libraries, electronic journals, CAB direct database, and public health websites.

Tools that were eligible were included in the guide, which was created using Microsoft excel. The excel tool guide includes six tabs: tool instruction, tool guide, top ranking, description tool guide, legend, and references. Each tab is described below in turn.

The tabs evaluating the tools first divides the tools into four subcategories: 1. Hand hygiene, 2. Quality improvement and infection prevention and control (IPC), 3. Maternal and newborn health, and 4. WASH. Hand hygiene is a fundamental, cost-effective intervention to prevent hospital-acquired infections [59]. Therefore, hand hygiene is significant in reducing the spread of infection and for reducing neonatal deaths. Although hand hygiene is part of WASH, hand hygiene is its own category. Since IPC is part of quality improvement, tools that focus either on IPC or quality improvement were combined and placed under one table. Due to targeting a specialized patient population, tools that focused specifically on maternal and neonatal health were also included in the tool guide.

Each tool is listed in the guide based on title. For each tool, the following are also noted: affiliated author or organization, format. Each tool was scored based on ten key indicators. The following key indicators include global or domestic, apply to low-income countries, used in Ethiopia, scoring metric, interpretation, rapid assessment, applicable, led by local staff, led by external partner, and action plan. Detailed descriptions for each indicator are included under the instruction tab.

Each tool received a score based on whether it did or did not meet the objective for each indicator. Tool was scored based on the indicator. Please review the table for description details of each indicator and scoring. After the tool was assessed along each indicator, we then add the ten indicator scores to receive an overall total score. The higher the score, the more suitable that it would be for our target hospitals. After each tool received an overall score, the resources were ranked from highest to lowest per category domain. It is important to note that the score does not determine the overall quality of the resource.

In addition to the tool table, a third tool tab provides detailed information on our target hospital's rationale for each indicator score. The tool guide provides a key legend to help identify what each color-coded score means. This tool was inspired by the traffic light scoring system which is commonly used in performance and program management. The purpose of this approach was to deliver our evaluation and rating of these tools visually. The scoring category includes unable to assess (orange-no score), low (red-0), moderate (yellow-1), and high (green-2). Having a high (green) score indicates that the tool meets the expectation of that specific indicator and that the tool targeted in a global context. Having a moderate (yellow) score shows that some resources

may be feasible, however, certain key considerations may not apply nor be suitable. Having a low (red) score shows that the resource is not feasible and does not apply to that specific indicator. (e.g., limited resources, protocols).

Lastly, a reference tab was created to provide our target hospitals the website links to access the resources. Since this project did not require human research subjects, IRB approval was not required.

Results

Below we report on the identified and evaluated monitoring and evaluation tools included in the guide by domain: hand hygiene, IPC, maternal and newborn health, and WASH.

Hand Hygiene

In the hand hygiene domain, we identified 11 resources, all derived from the World Health Organization (WHO). The hand hygiene resources consist of a total of four surveys, five recommendation guides, one observation form, and one assessment framework. Among these tools, eleven were global and applied to low-income countries, including Ethiopia. Although the Association for Professionals in Infection Control and Epidemiology (APIC) is an organization separate from the WHO, the organization referenced WHO as the recommended action for hand hygiene. These resources consist of various subjects related to hand hygiene compliance, including observations, knowledge, infrastructure, perception, and supply chain management. The *Hand Hygiene Technical Reference Manual: Observation Form* met all ten indicators and had the highest rating (12), followed by the *Hand Hygiene Self-Assessment Framework 2010* (11) and the *APIC Implementation Guide: Guide to Hand Hygiene Programs for Infection Prevention* (11). While the *WHO Soap and Hand Rub Consumption* only met five indicators and had the lowest evaluation score (6), none of the four surveys provided a scoring metric and interpretation. Refer to figure one for more detailed information.

Infection Prevention and Control (IPC)

For the quality improvement domain, there were 12 resources that focused on quality measures and infection prevention collectively. These resources were derived from WHO, Centers for

Disease Control and Prevention (CDC), Agency for Healthcare Research and Quality (AHRQ), United States Centers for Medicare and Medicaid Services (CMS), United States Agency International Development (USAID), and Federal Ministry of Health (MoH) Ethiopia. The quality improvement (IPC) resources consist of three systematic assessments, one survey, one manual, four recommendation guidelines, two toolkits and one worksheet. Seven were global and applied to low-income countries, including Ethiopia. Although there were no tools that scored a 12, *Infection Prevention and Control Assessment at the Facility Level* (10) and *Guidelines on Core Components of IPC Programs at the National and Acute Healthcare Facility Level* (10) were two tools that scored the highest, meeting nine indicators. Refer to figure two for more detailed information.

Maternal and Newborn Health

For maternal and newborn health domain, there were a total of six resources. These resources were derived from WHO, Wellstart International, Provincial Infectious Disease Advisory Committee (PIDAC), Survive and Thrive, and Human Reproduction Program. The maternal and newborn health resources consist of three recommendation guides, one framework, and two tools. Two were global and applied to low-income countries, including Ethiopia. Although there were no tools that scored a perfect rating from all indicators, *The Baby-friendly Hospital Initiative Monitoring Tool* met eight of the indicators and scored the highest evaluation (10), followed by *Standards for Improving Quality of Maternal and Newborn Care in Health Facilities* (9), *Hospital care for mothers and newborn babies: quality assessment and improvement tool* (6) and *Improving Care of Mothers and Babies: A guide for improvement teams* (6). Refer to figure three for more detailed information.

Water, Sanitation and Hygiene (WASH)

For the WASH domain, there were a total of ten resources identified. These resources were derived from WHO, United Nations International Children's Emergency Fund (UNICEF), WaterAid, CDC, MoH and government of Ethiopia. The WASH resources consisted of two assessment tools, one assessment technical guide, one assessment checklist, two surveys, two recommendation guides, one risk assessment, and one module. For our ten resources, six were global and applied to low-income countries, including Ethiopia. Although there were no tools that scored a perfect rating from all indicators, *Water and Sanitation for Health Facility Improvement Tool* (WASHFIT) (10) met nine of the indicators and scored the highest evaluation (13), followed by *Joint Monitoring Program – Service Level for Monitoring WASH and Related Infection Prevention and Control Measures in Delivery Rooms* (9) and *WaterAid: Technical Guide for Handwashing facilities in public places and buildings* (9). Refer to figure four for more detailed information.

Chapter 4: Discussion, Conclusion, and Recommendations

To reduce hospital-acquired neonatal sepsis in our target hospitals, a tool guide was created to assess monitoring and evaluation tools that can be feasibly used by our target hospitals to monitor, track, evaluate WASH and IPC in response to WASH-improving interventions. The tool guide was divided into four categories and each tool was assessed based on specific key indicators. Based on our scoring criteria, *Hand Hygiene Technical Reference Manual: Observation Form, Infection Prevention and Control Assessment at the Facility Level, Guidelines on Core Components of IPC Programs at the National and Acute Healthcare Facility Level, Baby-friendly Hospital Initiative Monitoring Tool, and Water and Sanitation for Health Facility Improvement Tool (WASHFIT)* scored the highest from their categorical domain. When measuring hospital improvement and progress, it's important to apply monitoring and evaluation approaches that are measurable and applicable to the facility's current state. Below are our findings for each categorical domain.

Hand Hygiene

For hand hygiene, eleven tools were designed and developed under the World Health Organization (WHO). While researching these tools, numerous organizations referenced WHO resources as the primary intervention for hand hygiene. Organizations such as APIC referenced and applied WHO resources into their recommendation guide. Out of the eleven hand hygiene tool resources, *Hand Hygiene Technical Reference Manual: Observation Form* met all the indicators. This manual provides comprehensive information on the concepts of hand hygiene and interventions to prevent the spread of micro-organisms [59]. This resource includes the *WHO "5 Moments for Hand Hygiene"* and how to perform hand hygiene observations [59]. It is used

to facilitate training, education sessions, and supports evaluation and feedback post observation [59]. The observation session may be performed at or less than ten minutes depending on the observed activity [59]. It is the instructor's responsibility to document hand hygiene if it was performed or missed [59]. The main goal for this resource is to improve hand hygiene practices, utilize hand hygiene resources, and promote saving lives [59]. In the manual, it provides an observation form that allows observers to evaluate healthcare workers while they are delivering healthcare activities to patients [59]. *Hand Hygiene Self-Assessment Framework 2010* met nine indicators and was placed second in the top rating. Although the *Hand Hygiene Self-Assessment Framework 2010* had moderate score on rapidness, the framework could be performed as a baseline, situational assessment [60]. The tool is used to evaluate the current condition for gaps and which areas require attention or improvement [60].

Although the five recommendation guides (except APIC) provided external tools and strategies to improve monitoring and evaluation, these resources did not provide their own tool, scoring metrics, nor interpretation. Due to these guides providing various tools, the level of rapidness could not be collectively assessed. The tool guide also includes four hand hygiene surveys that focus on baseline knowledge, staff performance, and supply stock. Although these tools provide routine evaluation and promote sustainability for our target hospitals, these tools focus on subjective and compliance entries which are not quantifiably measured.

Infection Prevention & Control (IPC)

In the quality improvement and infection prevention domains, there were twelve resources. These resources were derived from WHO, Centers for Disease Control and Prevention (CDC), Agency for Healthcare Research and Quality (AHRQ), United States Centers for Medicare and Medicaid Services (CMS), United States Agency International Development (USAID), and

Federal Ministry of Health (MoH) Ethiopia. Although there were no tools that scored a twelve nor met all of indicators, I*nfection Prevention and Control Assessment at the Facility Level and Guidelines on Core Components of IPC Programs at the National and Acute Healthcare Facility Level* met eight indicators and both scored the highest evaluation (score-12). After reviewing both tools, *Infection Prevention and Control Assessment at the Facility Level* tool contains identical information and supports the implementation actions in the Guidelines on *Core Components of IPC Programs at the National and Acute Healthcare Facility Level.* Although these tools are not made for rapid evaluation, the purpose of the *Guidelines on Core Components of IPC Programs at the National and Acute Healthcare Facility Level* framework is to assess the strengths and gaps of fundamental IPC conditions in a hospital setting [61]. The remaining WHO resources provide various tools and guidelines for quality improvement. With that, these resources did not provide their own tool, scoring metrics, nor interpretation.

Reviewing these resources, some tools overlapped and provided the same resource recommendations. Tools from United States organizations such as, Agency for Healthcare Research and Quality (AHRQ), United States Centers for Medicare and Medicaid Services (CMS), United States Agency International Development (USAID) were reviewed and compared to other tools. Barriers with these tools included recommendations that are only affiliated to the US, questions related to specific supplies, tools are not used in low-income countries, and not performed in Ethiopia.

Maternal and Newborn

For the maternal and newborn domain, there were a total of six resources. These resources were derived from WHO, Wellstart International, Provincial Infectious Disease Advisory Committee (PIDAC), Survive and Thrive, and Human Reproduction Program. Although there

were no tools that scored a twelve from all indicators, the *Baby-friendly Hospital Initiative Monitoring Tool* met eight indicators and scored the highest evaluation (score-12), followed by Standards for *Improving Quality of Maternal and Newborn Care in Health Facilities* (score-10.) Established in 1991, the purpose of the *Baby-friendly Hospital Initiative* is to guide mothers on education, skills, and confidence on the importance of breastfeeding and milk substitutes [62]. Breastfeeding is important during the first days of life and helps newborns in preventing infections and long-term hospitalization [62]. In Amhara, 22% of infants are born prematurely, which is nearly double the national average [63]. With that, it is important to evaluate compliance in premature newborns for breastfeeding to decrease probability of exhibiting life-threatening complications such as necrotizing enterocolitis (NEC) [64]. Due to the high volume of baby-friendly hospitals, there was a need for monitoring and evaluation to ensure credibility, promote sustainability, and continuous long-term improvement [62]. The *Baby-friendly Hospital Initiative Monitoring Tool* is based on a global criterion on ten successful steps to successful breastfeeding [62]. The tool consists of both a monitoring and reassessment tool that evaluates staff and mothers on current knowledge, skills, and management of breastfeeding [62]. This tool will help foster collaboration among hospital management and staff in identifying gaps and planning for long-term sustainability and improvement [62]. *Standards for Improving Quality of Maternal and Newborn Care in Health Facilities* is a framework designed to identify gaps in work areas, define standards of care, and measure quality improvement of care for mothers and newborns [65]. The framework consists of WHO eight domains that target priority of care in local health facilities [65]. The domains focus on areas in standard of care such as evidence-based care, health monitoring systems, patient education, and WASH infrastructure [65]. Although the framework guides quality of care standards on a national level, the framework

consists of two to thirteen statements that stir hospitals towards measurable improvement for childbirth care and help local facilities identify best practices for maternal and newborn care [65].

Water, Sanitation, and Hand Hygiene (WASH)

In the WASH domain, there were a total of ten resources identified. These resources were derived from WHO, United Nations International Children's Emergency Fund (UNICEF), WaterAid, CDC, MoH and the government of Ethiopia. Although there were no tools that met all the indicators, *Water and Sanitation for Health Facility Improvement Tool (WASH FIT)* scored the highest evaluation, followed by Joint Monitoring Program – *Service Level for Monitoring WASH and Related Infection Prevention and Control Measures in Delivery Rooms* and *Technical Guide for Handwashing Facilities in Public Places and Buildings*. Developed by the WHO and UNICEF, *WASHFIT* is a framework that strives to improve quality of care through water, sanitation, and hygiene in healthcare facilities [66]. The framework provides a set of tools that are to be used on a continuous and regular basis to improve WASH measures and healthcare waste management infrastructure [66]. Although this tool was used in Ethiopia, the framework provided numerous tools, and this may affect the level of rapidness and timeliness in completing the tool. Compared to the Joint Monitoring Program – *Service Level for Monitoring WASH and Related Infection Prevention and Control Measures in Delivery Room*s, this tool requires minimal assessment and prioritizes evaluation based on which room performs the most deliveries [67]. Joint Monitoring Program – *Service Level for Monitoring WASH and Related Infection Prevention and Control Measures in Delivery Rooms* is a module that monitors basic WASH services and provides core indicators that aligns with the *WHO Guidelines on Core Components*

of IPC Programs at the National and Acute Health Care Facility Level and *Standards for Improving Quality of Maternal and Newborn Care in Health Facilities* [67]. Reviewing the WASH resources six resources had moderate to low scores on level of rapidness and seven resources did not provide an individualized action plan.

Limitations

The development of the monitoring and evaluation tool guide had several limitations. Gathering existing resources and scoring each tool were performed only by the author. With that, there may be outside resources that were not identified or those included may not have been accurately assessed. Scoring each tool was based on information provided. To ensure accuracy, the tool guide will be reviewed and validated by the synergy team. The next stage of action is to define the priority tool from each of the domains based on the scoring criteria. After, we would need to make a specific recommendation on which is the best tool for each domain based on the scoring criteria.

In order to reduce hospital-acquired neonatal sepsis in Felege Hiwot and Debre Tabor hospital, we need to adopt facility level, monitoring, and evaluation. Based on the scoring criteria, *Hand Hygiene Technical Reference Manual: Observation Form, Infection Prevention and Control Assessment at the Facility Level, Guidelines on Core Components of IPC Programs at the National and Acute Healthcare Facility Level, Baby-friendly Hospital Initiative Monitoring Tool, and Water and Sanitation for Health Facility Improvement Tool (WASHFIT)* scored the highest from their categorical domain. Although these resources may be used as a fundamental and/or routine level evaluation, these tools will bring meaningful benefit in reducing neonatal sepsis at our target hospitals.

Applying monitoring and evaluation will require our target hospitals to approach this intervention with capacity-building and sustainability in mind. Our actions will require change within the hospital culture and increase accountability from hospital employees and leadership. Factors when applying sustainable change at a facility level are quality leadership and management, financial resources, staff training, and advocacy.

For leadership and management, it is important to have strong integration and collaboration between the primary, district, and national level [68]. Establishing a systematic communication and feedback mechanism on the current monitoring and evaluation initiatives and analyzing audit data would provide national officials with insight, thus preventing unnecessary intervention efforts [68]. Although the Ministry of Ethiopia has a quality improvement network for improving care for maternal and newborns at a national level, establishing a quality improvement benchmark at a local level will promote prioritizing and collaborative efforts among hospital staff [68]. In order to meet this level of benchmarking, local hospitals must adopt these objectives into facility level protocols, establish roles and responsibilities in supporting these quality improvement activities, and provide educational staff training to meet national regulatory requirements [68]. Providing educational training on quality improvement in WASH and IPC will give staff fundamental knowledge of what are the best practices [68]. Applying these existing tools into their hospital practices, quality improvement and hospital leadership would receive guidance in evaluating staff compliance in quality improvement for maternal and newborn, WASH, and IPC [68].

Financial resources have a strong impact in monitoring and evaluation implementation and long-term sustainability [68]. With a limited budget, challenges such as insufficient water supply, poor hospital infrastructure, and limited hand hygiene utilities hinder the process for WASH and IPC improvement [68]. To prevent future challenges, we should strengthen capacity-building efforts by strengthening our collaboration between local and national officials, global stakeholders, and private organizations and provide resourceful support in maintaining monitoring and evaluation in local hospital facilities. Lastly, we should deliver awareness on the importance of WASH and IPC in promoting safe, quality care for neonates while also motivating and advocating our hospital staff [68]. Improving monitoring and evaluation will bring continuous improvement to our target hospitals and neonatal outcomes [68].

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Figures

Author	Tool Guide: Name	Format	Global or Domestic?	Apply to low income countries	Used in Ethiopia	Scoring Me	Interpretation	Rapid Assessm	Applicable	Led by Local S	Led by External Partner	Action Plan	Overall Sco
World Health Organization (WHO)	Hand Hygiene Self-Assessment Framework 2010	Framework: Five main commonents (including subset question)	Global	Yes	Yes	Yes	Yes	Moderate	High	Yes	Yes	Yes	11
World Health Organization (WHO)	Hand Hygiene Technical Reference Manual	Observation form: Eight observations	Global	Yes	Yes	Yes	Yes	High	High	Yes	Yes	Yes	12
World Health Organization (WHO)	Hand Hygiene Knowledge Questionnaire for Health-Care Workers	Survey: Twenty-one question (including subset question)	Global	Yes	Yes	No	No	High	High	Yes	No	Yes	9
World Health Organization (WHO)	Perception Survey for Healthcare Workers	Survey: Twenty-four questions (including subset questions)	Global	Yes	Yes	No	No	High	High	Yes	No	Yes	9
World Health Organization (WHO)	Soap and Hand Rub Consumption	Survey: Six evaluation entries	Global	Yes	Yes	No	No	Low	Moderate	Yes	No	Yes	6
World Health Organization (WHO)	Ward Infrastructure Survey	Survey: Twenty-eight questions and grid	Global	Yes	Yes	No	No	Low	High	Yes	No	Yes	7
World Health Organization (WHO)	Hand Hygiene for All Initiative: Improving access and behavior in healthcare facilities	Recommendation Guide	Global	Yes	Yes	UTA	UTA	UTA	High	Yes	Yes	Yes	8
World Health Organization (WHO)	Guide to Implementation: A Guide to the Implementation of the WHO Multimodal Hand Hygiene Improvement Strategy	Recommendation Guide	Global	Yes	Yes	UTA	UTA	UTA	High	Yes	Yes	Yes	8
World Health Organization (WHO)	Improving infection prevention and control at the health facility: an interim practical manual	Recommendation Guide	Global	Yes	Yes	UTA	UTA	UTA	High	Yes	Yes	Yes	8
Association for Professionals in Infection Control and Epidemiology (APIC)	APIC Implementation Guide: Guide to Hand Hygiene Programs for Infection Prevention	Recommendation Guide	Domestic	Yes	Yes	Yes	Yes	High	High	Yes	Yes	Yes	11
World Health Organization (WHO)	Resources Considerations for Investing in Hand Hygiene Improvement in Health Care Facilities	Recommendation Guide	Global	Yes	Yes	UTA	UTA	UTA	High	Yes	No	Yes	7

Figure 1: Hand Hygiene Tool Guide

Author	Tool Guide: Name	Format	Global or Domestic?	Apply to low income countries	Used in Ethiopia	Scoring Method	Interpretation	Rapid Assessment	Applicable	Led by Local Staff	Led by External Partner	Action Plan	Overall Score
World Health Organization (WHO)	Infection Prevention and Control Assessment at the Facility Level	Systematic assessment tool: 81 (Combining all components questions)	Global	Yes	Yes	Yes	Yes	Low	High	Yes	Yes	Yes	10
Agency for Healthcare Research and Quality (AHRQ)	Hospital Survey on Patient Safety Culture	Survey: Section A-F: 38 questions	Domestic	No	No	Yes	No	UTA	Moderate	Yes	No	Yes	4
U.S. Centers for Medicare & Medicaid Services (CMS)	Centers for Medicare & Medicaid Services Hospital Infection Control Worksheet	Worksheet: Section 1 A-D, 2A (44 questions)	Domestic	No	No	Yes	No	Low	Low	Yes	Yes	Yes	4
United States Agency International Development (USAID) and Strengthening Pharmaceutical Systems (SPS)	Infection Control Assessment Tool: Infection Prevention Program	Systematic assessment Tool: 40 questions	Domestic	No	No	Yes	Yes	Low	Low	Yes	No	No	3
World Health Organization (WHO)	Guidelines on core components of IPC programmes at the national and acute health care facility level	Framework: 81 (Combining all components questions)	Global	Yes	Yes	Yes	Yes	Low	High	Yes	Yes	Yes	10
World Health Organization (WHO)	Minimum requirements for infection prevention and control programs	Recommendation Guideline	Global	Yes	Yes	UTA	UTA	UTA	High	Yes	Yes	Yes	8
World Health Organization (WHO)	Strengthening infection prevention and control in primary care: a collection of existing standards, measurement and implementation resources	Recommendation Guideline	Global	Yes	Yes	UTA	UTA	UTA	High	Yes	Yes	Yes	8
World Health Organization (WHO)	Improving infection prevention and control at the health facility	Recommendation Guideline	Global	Yes	Yes	UTA	UTA	UTA	High	Yes	Yes	Yes	8
World Health Organization (WHO)	Recovery Toolkit Supporting countries to achieve health service resilience: A library of tools & resources available during the recovery period of a public health emergency	Toolkit	Global	Yes	No	UTA	UTA	UTA	High	UTA	UTA	Yes	5
World Health Organization (WHO)	Infection prevention and control in primary care: a toolkit of resources	Toolkit	Global	Yes	Yes	UTA	UTA	UTA	High	Yes	Yes	Yes	8
Centers for Disease Control and Prevention (CDC)	Infection Prevention and Control Assessment Tool for Acute Care Hospitals	Systematic assessment tool: IPC Program and Infrastructure (5 questions) and IPC Training, Competency, and Implementation of Policies and Practices (85 questions)	Global	No	No	No	No	Low	Moderate	No	Yes	No	3
Federal Ministry of Health Ethiopia	Infection Prevention and Patient Safety Training Resource Package Participant's Manual	Manual: Nine checkoff sections	Domestic	Yes	Yes	Yes	No	Low	High	No	Yes	Yes	7

Figure 2: Infection Prevention and Control (IPC) Tool Guide

Author	Tool Guide: Name	Format	Global or Domestic?	Apply to low income countri	Used in Ethiopi	Scoring Me	Interpretatio	Rapid Assessm	Applicable	Led by Local S	Led by External Partner	Action Plan	Overall Sco
World Health Organization (WHO) and Wellstart International	The Baby-friendly Hospital Initiative Monitoring Tool	Tool: Questionnaire, interview questions, Likert scale, multiple choice	Global	Yes	Yes	Yes	No	Moderate	High	Yes	Yes	Yes	10
World Health Organization (WHO) Region Office: Europe	Hospital care for mothers and newborn babies: quality assessment and improvement tool	Improvement tool: Six sections	Global	Yes	No	Yes	No	Low	Moderate	No	Yes	Yes	6
Provincial Infectious Diseases Advisory Committee (PIDAC)	Best Practices for Infection Prevention and Control in Perinatology: In All Health Care Settings That Provide Obstetrical and Newborn Care	Recommendation guide	Domestic	No	No	Yes	No	Moderate	Low	Yes	Yes	Yes	5
World Health Organization (WHO) and Human Reproduction Programme	WHO recommendations on maternal and newborn care for a positive postnatal experience	Recommendation guide	Global	No	UTA	No	No	UTA	Low	Yes	No	Yes	3
World Health Organization (WHO)	Standards for Improving Quality of Maternal and Newborn Care in Health Facilities	Framework: Eight domains	Global	Yes	Yes	Yes	Yes	UTA	Moderate	Yes	Yes	Yes	9
Survive and Thrive	Improving Care of Mothers and Babies: A guide for improvement teams	Recommendation guide	Global	Yes	No	No	No	UTA	High	Yes	No	Yes	6

Figure 3: Maternal and Newborn Health Tool Guide

Author	Tool Guide Name	Format	Global or Domestic?	Apply to low income countries	Used in Ethiopia	Scoring Method	Interpretation	Rapid Assessment	Applicable	Led by Local Staff	Led by External Partner	Action Plan	Overall Score
WHO/UNICEF	Water and Sanitation for Health Facility Improvement Tool (WASHFIT)	Framework: Tool 2A, 2B, and 2C	Global	Yes	Yes	Yes	Yes	Low	High	Yes	Yes	Yes	10
WaterAid	Technical Guide for Handwashing facilities in public places and buildings	Technical guide: Four sections	Global	Yes	Yes	Yes	No	High	Moderate	UTA	Yes	Yes	9
The Government of Ethiopia	Clean and Safe Health Facilities (CASH) Initiatives Audit Tool	Assessment Tool: 31 questions	Domestic	Yes	Yes	Yes	Yes	Low	Moderate	Yes	Yes	Yes	8
WHO	Essential environmental health standards in health care	Assessment checklist: 11 sections	Global	Yes	UTA	Yes	Yes	Low	High	Yes	Yes	No	8
WHO/UNICEF	Understanding barriers to quality of care: An approach for conducting a situational analysis of water, sanitation and hygiene (WASH) and quality in health care facilities	Survey: Core questions for monitoring WASH in health care facility service provision: (16 questions) Analysing the enabling environment for WASH in health care facilities (four sections)	Global	Yes	Yes	Yes	Yes	Moderate	Moderate	No	Yes	No	8
WHO/UNICEF	Core questions and indicators for monitoring WASH in health care facilities in the Sustainable Development Goals	Survey: Five sections (16 questions)	Global	Yes	Yes	Yes	Yes	Moderate	Moderate	No	Yes	No	8
Ministry of Health- Ethiopia	Healthcare Facilities WASH Guideline	Recommendation Guide	Domestic	Yes	Yes	No	No	No	High	UTA	Yes	No	5
WHO/UNICEF	Joint Monitoring. Programme for Water Supply, Sanitation and Hygiene. (JMP) service levels for monitoring WASH and related infection prevention and control (IPC) measures in delivery rooms	Module: Five sections (28 questions)	Global	Yes	Yes	Yes	Yes	High	Moderate	No	Yes	No	9
Centers for Disease Control and Prevention (CDC)	Best Practices for Environmental Cleaning in Healthcare Facilities in Resource-Limited Settings: Version 2	Risk Assessment: Determining environmental cleaning method and frequency	Global	Yes	UTA	Yes	Yes	Low	Moderate	Yes	Yes	No	7
WHO/UNICEF	Water, Sanitation, and Hygiene in Healthcare Facilities: Practical Steps to Achieve Universal Access to Quality Care	Recommendation Guide	Global	Yes	Yes	UTA	UTA	UTA	UTA	UTA	UTA	No	3

Figure 4: Water, Sanitation, and Hand Hygiene (WASH) Tool Guide