simavi

SUPPORTING HEALTHY SOLUTIONS BY LOCAL COMMUNITIES

Getting It Right

Improving maternal health through water, sanitation & hygiene

cover photo: Bangladesh 2011. ©Huib van Wersch

Contents

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Abbreviations

FAO	Food and Agriculture Organization
MDG 5	Millennium Development Goal (1990-2015) for improved maternal health
MMR	Maternal mortality ratio (deaths per 100,000 live births)
TBA	Traditional birth attendant
UNFPA	United Nations Fund for Population Activities
WASH	Water, sanitation and hygiene
WHO	World Health Organization

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Executive summary

Each year 290,000 women die from complications during pregnancy, birth and the neonatal period; and, an estimated 10 to 20 million women suffer from related health complications. Almost 90% of the maternal deaths occur in Sub-Saharan Africa and South Asia. Much of this is preventable through practices that have long been established. Maternal mortality has decreased by one-third over the past 20 years, in part related to increase in safe deliveries by skilled personnel, reduced fertility and antenatal care. However, these substantial improvements have not benefited rich and poor alike. The burden of mortality and morbidity falls disproportionately on the poor and remains a great challenge in our world.

It has long been known that improved water, sanitation and hygiene (WASH) provide significant health benefits in general, reducing risks of bacterial and viral infections, parasitic infections and other diseases such as upper respiratory infection, trachoma and scabies. For example, it is estimated that the risk of diarrhoea is reduced by up to 48% from hand washing with soap. This study examines the impact of water, sanitation and hygiene on maternal mortality, focussing on the pregnancy, delivery and the postpartum period.

A review of literature and research was done to examine how access to safe water, sanitation and application of hygiene practices can affect maternal health. Two studies, one using global data bases and the other with data collected from studies in Africa, showed significant correlations between increased access to water and sanitation and reductions in maternal mortality. Specific evidence was found about:

- Location of the water source: the burden for pregnant women carrying water long distances affection weight gain during pregnancy.
- Water quality: Hepatitis E, transmitted orally through faecal contamination and poor sanitation is more severe in pregnant women than for the general population.
- Water quality: Arsenic contamination of drinking water, which affects more than 130 million people worldwide, is linked to anaemia, putting pregnant women at greater risk of haemorrhage (profuse bleeding).
- Lack of sanitation leads to hookworm infestation which may infect nearly 44 million pregnant women worldwide, and is related to anaemia and through this, risk of haemorrhage.
- Hygiene during the birthing process is essential to avoid infections. This includes hand hygiene, as well as clean equipment and cord cutting, inserting nothing unclean into the vagina.
- Personal hygiene (frequent cleansing) is important to manage obstetric fistula (and perineum ruptures) which may affect 2 million young women.

It should be noted, however, that relatively few high quality studies were found on the basis of which generalizations can be made about the specific linkages between water, sanitation and hygiene on the one hand and maternal health on the other.

Much more literature can be found on the impact of hygienic practices during delivery on neonatal mortality. Clean delivery procedures are key to preventing neonatal deaths. An estimated 3.3 million newborn babies die before reaching 28 days. Unhygienic practices during delivery that cause death of the newborn baby are also likely to have an impact on the health of the mother.

The evidence, despite its flaws, indicates the crucial importance of mothers having access to safe water, sanitation and clean birthing. However, in many settings, a woman may share decision-making power with others. She may have little influence on basic expenditures and important health decisions such as delivery in a clinic, having a toilet, going for emergency care. In many societies, the husband, older women, elders may have considerable influence. The hygiene and sanitation promotion in both the health and WASH sectors tend to focus mainly on women, which seems insufficient.

Both sectors (health and WASH) promote hygiene and sanitation, although not always in a coordinated way. There is some indication that the educational/promotional aspects relating to WASH and (maternal and newborn) health should be improved and addressed throughout the continuum from pregnancy to child care. Similarly, health centres and hospitals should have consistent or at least predictable running water, clean toilets, safe refuse disposal, clean beds and areas for deliveries. Consistent hygiene in clinics and hospitals should be ensured.

For maternal health, the study concludes that some very basic elements of human development related to water, sanitation and hygiene that were accepted in the 19th and early 20th centuries are still unavailable to a large proportion of pregnant women in the 21st century. Further, more research, of high quality, is needed to learn about the linkages between WASH and maternal health in the context of low-income countries. This literature review points to many areas in which further study and consistent, effective intervention are required.

1. Introduction by Rolien Sasse, Director of Simavi

"Think of what happens to a family when a mother does not survive giving birth to her child. The unnecessary death of 290.000 mothers each year during pregnancy and delivery is a major loss and personal drama, but also leads to unsettled and disadvantaged families. When their mother dies, children have a significantly smaller chance of surviving to their sixth birthday or, if they survive, of subsequently climbing out of poverty. Mothers have a key role in their families and communities. When women are healthy and able to reap the benefits of opportunities that come their way, they will also make a difference to the people around them.

Through the experience of countries that have drastically reduced their maternal mortality rates, we have learned much about the necessary policies and interventions. As with most complex health and development issues, there is no one magic bullet. Besides increasing knowledge on family planning methods, changing the position of women in their communities and improving access to quality (maternal) health care, it is quite obvious that access to clean water, sanitation and hygiene at home and in the clinic play a key role as well.

Nevertheless, the effect of water, sanitation and hygiene on maternal mortality is greatly under-researched. This paper seeks to address the links through a survey of current literature from the water, sanitation and hygiene (WASH) as well as the maternal health angle. A review of a large number of documents reveals both the multitude of relationships between maternal health and WASH, and various areas that deserve further research. The findings show that access to water, sanitation and hygiene, from pregnancy to birth and the weeks of recovery afterwards, have in different ways an impact on the health outcomes and survival of the mother.

Finally, the paper provides several policy, programmatic and research recommendations to address the importance of WASH for maternal health. These recommendations particularly center on the need for integration of WASH and maternal health interventions within Ministries, (international) institutions and organizations.

Maternal mortality has to be reduced by 75% by 2015 to reach Millennium Development Goal 5. We are off track, particularly in the poorest countries and regions. Most of these countries also face the direst water, sanitation and hygiene situation. Let us therefore address the linkages between the two because pregnancy and birth should not be such a high risk factor in women's lives."

Methodology

The objective of the study was to review published literature describing the impact of water, sanitation and hygiene on maternal health and mortality. Published literature was reviewed on evidence-based interventions and "packages" of interventions across: maternal health, mortality or morbidity; reproductive health, antenatal and neonatal care; water or sanitation or hygiene and health services; helminths and maternal health; hand washing practices; TBAs; (cultural practices in) delivery/birthing; midwifery; quality/cleanliness of health services and clinics; and decision making, power relations and health seeking behaviour. The search for relevant materials included the publications of Elsevier, Medline, Lancet, Google scholar as well as international organizations including WHO, UNICEF, UNFPA, JMP, WB. Preference was given to interventions and research related to Asia and Africa. Of the 2,000 articles identified, approximately 500 were reviewed in full. The emphasis was on peer-reviewed publications and literature mainly dating past 2000 with some exceptions where the paper was particularly relevant or dealt with aspects that are not time-bound (eg., history of maternal health interventions). Through interviews, ideas and references were solicited from the London School of Hygiene and Tropical Medicine, the Women and Health Initiative of the Harvard School of Public Health, the Royal Dutch Organisation of Midwives (KNOV), and Prof. Dr. Jos van Roosmalen (formerly of the University of Leiden, in the Netherlands), all of whom were most generous in their responses. Kathy Herschderfer, senior advisor from the Royal Tropical Institute in Amsterdam reviewed the report.

Limitations of the study: The literature survey and the groups consulted noted that there is relatively little research on the links between water, sanitation and hygiene on the one hand and maternal health on the other. There are no meta-studies specifically on this topic. Much of the research to which reference is made are relatively small studies, are location-specific or not of high quality, thus pre-empting the ability to provide evidence-based generalizations over large populations. In the future, greater emphasis on research and interventions related to the links between water, sanitation, hygiene and maternal health in developing countries is needed.

Issues such as the impact of malaria and environmental hygiene on maternal health are not covered by this literature review.

2. Extent of the problem

Maternal mortality—the death of women during pregnancy, childbirth, or in the neonatal period up to four weeks after delivery— remains a major challenge to health systems worldwide. Of the estimated 287,000 maternal deaths in 2010, 99% of these occurred in developing countries with sub-Saharan African and Southern Asia accounting for 85% of the global burden **[1]**.

As shown in figure 1 below, there are large differences between various regions of the world. This extraordinary inequity between the burden of women dying in developing and industrialized countries has been called the largest discrepancy of all public-health statistics **[2]**. Tragically, many of these deaths could be prevented by practices and interventions that have been proven to be effective.

The health of many women who survive beyond childbirth is also compromised. Of the 140 million women who give birth each year, an estimated 10 to 20 million suffer from complications related to pregnancy and poor birth management. This includes continuing illnesses and conditions such as anaemia, urinary tract infections, damage to pelvic structure, fistula, incontinence, infertility **[3] [4] [5]**.

Reduction in maternal deaths

After a long period of very slow improvement, between 1990 and 2010 the estimated worldwide annual maternal mortality has dropped by almost 50%, from about 546,000 deaths down to about 287,000 **[6]** with varying progress found in different regions. South Asia has experienced a far more rapid improvement than Sub-Saharan Africa—about 42% **[7]**. Without the HIV/AIDS epidemic, maternal deaths would have been reduced by perhaps another 18%, with the greatest reduction in Sub-Saharan Africa **[6]**.

	2010	Range	Esimated number of maternal deaths 2010	Lifetime risk of maternal death (2010)
	Deaths per 100,000 live births			One in…
Sub-Saharan Africa	500	400-750	162.000	39
South Asia	220	160-320	83,000	150
Europe	20	18-24	2200	2900
Worldwide	210	170-300	287.000	180

Figure 1: Maternal mortality ratio—deaths of women per 100,000 live births by region.
Source: WHO, UNICEF, WB, UNFPA, 2010

Since 1990, the average decrease in maternal mortality has been about 2.3% each year. However, the Millennium Development Goal 5 calls for a 75% decrease in maternal mortality by 2015, which would imply a rate of annual decline of 5.5% **[6] [1]**. Thus, many developing countries are not on track to achieving the goal of a three-fourths reduction in maternal mortality by 2015.

Reasons for reductions in maternal mortality

Why has maternal mortality decreased? As each situation differs, it is difficult to identify all the causes of these improvements in the maternal deaths or to pinpoint the relative importance of each. However, factors often sighted are the increase in safe deliveries by skilled personnel, reduced fertility, antenatal care as well as international advocacy and availability of additional resources to improve maternal health **[8] [1] [6]**.

Interestingly, the early downward trend in maternal mortality in northern Europe (Netherlands, Denmark, Norway and Sweden) starting around 1850 and more recent evidence from Sri Lanka and Malaysia (1945-1955) corroborate the importance of skilled personnel attending childbirth, clean deliveries and good management **[9] [10] [11] [12]**.

Inequity: the poor die young

Unfortunately these substantial improvements in maternal health have not benefited rich and poor alike. The reduction in maternal mortality has been uneven between and within countries, favouring those families with more resources. For example, on average in Africa, the richest 20% of African women are three times more likely to have skilled attendants at birth compared to the poorest quintile. These wealthier families are able to afford the direct and indirect costs associated with birth (data 1994-2005) **[13]**.

Direct causes of death

In order to investigate the specific links between water and sanitation to maternal health, we must first identify the direct causes of maternal mortality. Between 11% and 17% of maternal deaths happen during childbirth itself; and between 50% and 71% occur in the immediate post-partum period. Mortality is extremely high on the first and second days after birth **[2]**. Four main killers that are the immediate or direct causes of about 70% of maternal deaths worldwide are **[5]**:

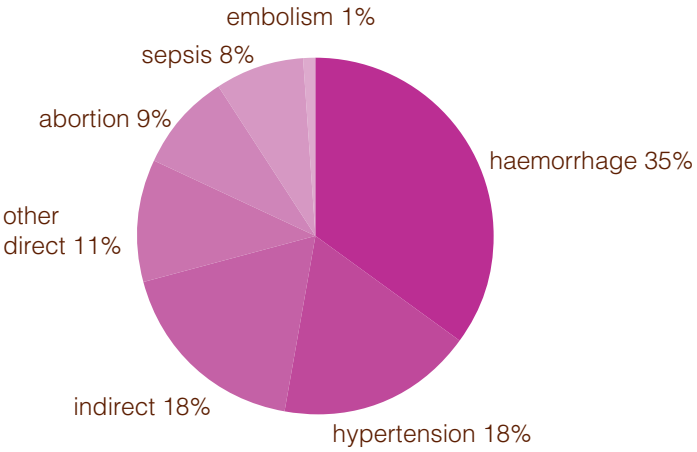

Figure 2: Causes of maternal deaths.
Source: Countdown to 2015

Severe bleeding/haemorrhage

Each year almost 14 million women may suffer severe blood loss during childbirth or the post-partum period of whom around 140,000 die while another 1 to 2 million will suffer long-lasting consequences of complications **[2] [14] [15] [16]**. Anaemia reduces resistance to blood loss and is related to haemorrhaging during and after birth. In anaemic women, the risk of dying during pregnancy or childbirth is about 3.5 times higher than in non-anaemic women **[17] [18,19] [20]**. With 35% of the maternal deaths caused by haemorrhage, it is the leading direct cause of maternal mortality.

Hypertensive disorders and (Pre-)Eclampsia

Pre-eclampsia, leading to eclampsia consists of central nervous system seizures, which often leave the patient unconscious and, if untreated, lead to one out of about 5 maternal deaths each year. Signs of pre-eclampsia are a sharp rise in blood pressure, leakage of large amounts of the protein albumin into the urine and swelling of the hands, feet, and face. It may be prevented by antenatal monitoring and simple drug treatment **[14] [15]**.

Puerperal sepsis

A general term used to describe infections of the genital tract and is particularly common with unhygienic births and induced abortions. One path for infections is through the birth canal of the woman, where microorganisms can cause puerperal sepsis. An early symptom of puerperal sepsis is fever **[21] [14] [15]**. It is significantly related to morbidity as women who survive the initial infection may go on to develop pelvic inflammatory disease, chronic pelvic pain, damage to reproductive organs, and infertility **[18]**.

Unsafe abortion

As may be expected, the precise proportion of deaths attributable to complications from unsafe abortion is not known. Estimates range from 8% to 30% of the total maternal mortality, much of which could be averted with family planning services **[14] [15] [22]**. Safe abortion reduces maternal mortality **[5]**. An example is the decrease in maternal mortality in Romania from 159 deaths per 100,000 live births in 1989 to 83 deaths over a two-year period, after the country's restrictive abortion law was revoked **[2]**. In addition, abortion-related morbidity can pose a serious threat to women throughout their reproductive years **[21]**.

3. Significance of water, sanitation and hygiene for health

There is considerable evidence about the importance of water, sanitation and hygiene for health in general. It has been estimated that globally about 2 million deaths could be prevented annually if everyone practiced appropriate hygiene and had access to safe, reliable drinking water and sanitation. In this estimate are many children under five years in developing countries who suffer from diarrhoea and subsequent malnutrition and diarrhoea-related diseases. Small children are at greater risk from diarrhoea and life-threatening dehydration[1].

Based on systematic reviews, Cairncross et al (2010) found risk reductions in diarrhoea of 48% from hand washing with soap, 17% associated with improved water quality and 36% from safe excreta disposal **[30]**. Some common health problems related to poor water and sanitation include: bacterial and viral infections (diarrhoea, cholera, dysentery, typhoid, poliomyelitis and hepatitis), parasitic infections (amoeba and giardia, roundworms, whipworms, hookworms and schistosomiasis), and other infections such as upper respiratory infections, trachoma and scabies **[25]**. Much of the impact of safe water supply and improved sanitation on health is mediated through hygiene practices. For example, hand washing with soap reduces the risk of diarrhoea, and of upper respiratory and skin infections. Face washing prevents trachoma and other eye infections **[31]**.

Overall, the health advantages of water, sanitation and hygiene are brought about through the:

- Quality of water used for drinking and cooking.
- Quantity of water used for personal and household hygiene.
- Consistent use of hygienic toilets to remove human excreta from the environment.
- Personal and domestic hygiene practices such as hand washing with soap after defecation and before eating; bathing; face and eye hygiene; maintenance and cleanliness and of toilets and water points; universal use of toilets; safe disposal of young child's stools; and domestic control of garbage and animals.

[1] *The onset of severe dehydration occurs when 10% to 15% of body fluids are lost, something that can easily happen in small children and can go un-noticed initially. Diarrhea can also contribute to under-nutrition through mal-absorption of food nutrients [19].*

Coverage and evidence of impact

In terms of global coverage, somewhat less than two-thirds of the world's population (4.1 billion people) have some form of improved sanitation at home—a basic hygienic latrine or a flush toilet. It is estimated that more than one-third still rely on dirty, unsafe toilets or defecate in the open **[31]**.

The situation for drinking water appears better than that for sanitation. Around 13% of the world's population (884 million people) live in households where water is collected from unprotected and often distant sources. More than half (3.6 billion) receive piped water at or near the home. However, these high coverage figures mask underlying concerns about the reliability and quality of the water supply. The health advantage of safe water can be undermined by defective piped water systems, by polluted water sources as well as by unhygienic storage or use in the home.

The richest quintile is more than twice as likely than the poorest quintile to use improved drinking-water

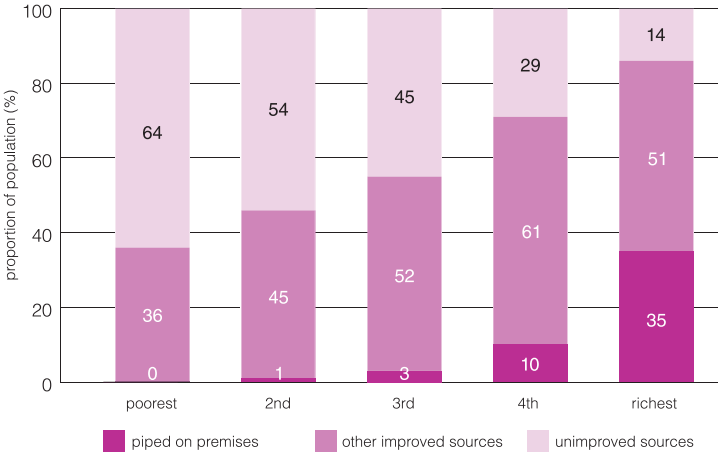

Figure 3: Progress on sanitation and drinking water
Source: WHO/UNICEF, 2010

Countdown to 2015 is a group which periodically reports progress toward achieving MDG 4 (child mortality) and MDG 5 (maternal health) for 72 low-and-middle income countries. It recently noted that it is possible to achieve rapid gains in coverage of improved water sources and sanitation facilities. Of the 69 *Countdown* countries with available trend data, 23 have met the Millennium Development Goal target on the proportion of the population using an improved drinking water source, and 16 are on track with higher coverage in urban areas compared to rural areas. It was also reported that median coverage of improved sanitation remained low but has increased from 27% in 1990 to 40% in 2010 with 10 countries achieving the MDG target and 10 more on track. There is also a pronounced difference between urban and rural settings **[22]**.

Quantity of water: More water used for hygiene from a close water source

The distance to water source also has implications for maintaining personal and household hygiene. Research indicates that very low amounts of water (often less than 5 litres per capita per day) are collected when the round trip to collect water takes 30 minutes are more **[32]**. The potential health advantage of having a water point in the family compound or in the household is substantial because more water is available for hygiene. A further advantage of having a functioning water supply near or in the home is that less water needs to be stored. Household water storage increases risk of contamination from vector-borne diseases and from oral-faecal routes **[32]**. Curtis (1995) found that provision of a yard tap nearly doubled the odds of a mother washing her hands after cleaning her child's anus and more than doubled the odds that she would wash any faecal soiled linen immediately **[33]**.

Two studies in 1999 and 2004 of household water use in rural areas of sub-Saharan Africa concluded that a rough average for use of water in rural areas was around 10 litres per person per day with huge variations between countries and households. This average is, however, far below the basic level of 20 litres considered as the minimum needed to maintain personal and domestic hygiene needed for good health **[34] [35]**.

"Mirembe is the pregnant, 26-year-old mother of four girls. Two previous pregnancies ended in stillbirths. Her deliveries were attended by her mother-in-law on the mud floor of her home. She and her children suffer from chronic diarrhoea. Her water choices are limited. The local well dried up two years ago. The river is polluted by run- off from farms. Now she must walk 2 km each way to fetch potable water. The health risks are high. Her poor health puts her surviving children at risk and her children's ill health limits their potential."

Source: Watt, 2011 [93]

Availability of water during birth:

"The work of traditional birth attendants like Mdala Rhoda in Songambele village, Tanzania was made easier and more effective by being able to replenish her supply of water."

Source: Fisher, 2006 [91]

4. WASH in relation to maternal health

We will examine linkages between WASH and maternal health. However, beyond a few subjects such as hygiene during the birthing process and helminthic infestation, there is remarkably little research showing a link between water, sanitation and hygiene as independent variables associated with maternal mortality and morbidity.

During pregnancy

During the months before delivery, the health status of the woman can be affected by variables such as: distance to the water source and quantity of water used, quality of water, having and using a clean toilet.

One study, using global databases from World Bank, WHO and UNICEF, found that increased access to improved water sources and improved sanitation is significantly associated with decreased maternal mortality ratios (odds ratio 0.58, P=0.008 and 0.52, P=0.009 respectively). The authors (Cheng et al) suggest that better water quality and sanitation reduce the risk of morbidity related to illnesses such as anaemia, nutritional deficiency, hepatitis as well as reducing the workload of women. They note that both clean water and skilled birth attendants are necessary for lower maternal mortality **[36]**.

A recent study by Muldoon and colleagues examined the link between the strength of the health system and important public health outcomes across nations. Access to sustainable water and sanitation was associated with a lower maternal mortality ratio (aRR 0.88; 95% CI 0.82-0.94). Water and sanitation was also associated with a lower infant mortality and child mortality (aRR 0.85; 95% CI 0.78-0.93 and aRR 0.82; 95% CI 0.75-0.91 respectively) **[98]**.

Distance to water source: Carrying water

Women should gain about one kilogram per month in the second and third trimesters of pregnancy. However, carrying water is one of the heaviest tasks and is known to affect weight gain during pregnancy and infant birth weight. For example, Rosen and Vincent found three studies from Sub-Saharan Africa estimating that carrying water accounted for an average of 10% of the carrier's daily calorie intake, with considerable variation **[34] [35]**. Thus easy access to safe water may improve maternal health, simply because pregnant and nursing women no longer have to carry heavy loads of water several times a day **[18]**. The reader may think about being pregnant and carrying a full suitcase (20 kilograms) one kilometre each day. This is roughly equivalent to the very modest provision of 15 litres of water per person for a family of four people when the water point is located 160 meters away.

A study, in which water was tested as an independent variable, was undertaken by Alvarez et al (2009), comparing variables between many countries in Sub-Saharan Africa using data from studies undertaken between 1997 and 2006. It showed a significant correlation (r = -0.399; P=0.008) between decreasing maternal mortality and the increasing access to improved water sources such as piped water, public tap, borehole or pump, protected well **[4]**.

> "Let us start with a pregnant woman. She is likely to have to collect and carry water for her baby's delivery from a hand pump outside her home; globally more than 40% of households do not have a water supply on their premises. If she is very unfortunate she will be among the 13% who do not even have a hand pump and rely on an unimproved water source, made even more risky by the fact that most people in her community lack even a basic toilet."
>
> Source: Brocklehurst, 2010 [82]

Water quality affects maternal health

In addition to the quantity used, the quality of water can have an impact on the pregnant woman. Water quality refers to both its microbiological and chemical (salinity, arsenic, fluoride…) quality.

A study of the impact on pregnant women of biological contamination of water through faecal-oral routes was undertaken by the IDCCR-B (International Centre for Diarrhoeal Disease Research, Bangladesh) after an urban outbreak of Hepatitis E (HEV). The report noted that the transmission of HEV is an example of an illness which has a differential impact on pregnant women and is transmitted usually through faecal contamination of drinking water, with periodic outbreaks in Asia and Africa. For pregnant women, this HEV infection is a more severe illness than for the general population with poor outcomes for themselves and their babies **[37]**.

Chemical contamination of water can also have negative impacts on pregnant women. The following examples relate to salinization of water and arsenic contamination. One recent study (2011) examined the impact of increasing saline intrusion during the dry season in shallow groundwater aquifers and ponds in

coastal areas of Bangladesh with a population of more than 35 million. It appeared that people, particularly the poor, in these coastal areas were consuming 2½ to 8 times the WHO/FAO daily recommended intake of sodium/salt (2 grams a day) in the dry season when water from the sea and from brackish ponds washes into the drinking sources. In the study of 1,000 pregnant women with hypertension, a sharp rise of 2.4 times more cases of hypertension/pre-eclampsia were diagnosed in the pregnant women during the dry season **[38]**.

Arsenic contamination of drinking water supplies is a global problem. Estimates are that 136 to 178 million people worldwide drink water contaminated with arsenic above the WHO/FAO guideline of 10 parts per billion for drinking water. Areas where arsenic contamination is of concern include Bangladesh, India, Hungary, Chile, China, Argentina, Taiwan, Ghana, Mexico, the Philippines, New Zealand and the United States **[39]**. Several studies have established a link between moderate arsenic contamination and anaemia **[40] [41] [42]**. It is known that anaemia adversely affects the pregnant woman and her birth outcomes. One small study in Bangladesh found that high exposure to arsenic (greater than 50 was more likely to lead to spontaneous abortion (OR=2.5) **[41]**. Two other studies found that high arsenic exposure was associated with anaemia and resulted in about 25% more spontaneous abortions and infant deaths **[43]**.

Sanitation: Anaemia, haemorrhage and hookworm

Household sanitation, that is, universal use of hygienic toilets, provides a significant health advantage to the pregnant woman through a somewhat complex route. With an increased need for iron, the pregnant woman is particularly at risk of anaemia. Several studies find that in areas where hookworm is prevalent, it is known to be a significant factor contributing to the development of anaemia in women of reproductive age and a strong predictor of iron status in the blood (and thus, anaemia) **[44] [45] [46,45]**. Women infected with moderate and heavy intensities of hookworm infection are more likely to suffer from anaemia than women having no or light intensities **[47]**. Hookworm infestation in pregnancy is also associated with decreased infant birth weight and intrauterine growth retardation. It also adversely affects women's health, making women tired, breathless and less able to work and care for their children **[17] [48]**.

Estimates are that 56 million people in India and 142 million in Sub-Saharan Africa over the age of 15 years are infected with hookworm **[49]**. A conservative estimate by the WHO suggests that at any given time, nearly 44 million pregnant women globally may be infected with hookworm **[44]**. It is one of the most common human parasites along with malaria. Hookworm is widespread where people defecate on the moist ground. The hookworm eggs exit the human in faeces and are transmitted both by skin penetration, usually through the bare foot, as well as in contaminated food and drink. The worms can live in the human intestine from 1 to 10 years and attach to the intestinal lining causing rupture and blood loss.

The most common intervention for pregnant women is deworming coupled with nutritional or iron folate supplements which, as several studies showed, improve pregnancy outcomes **[44] [45]**. However, prevention is important, underscored more than 80 years ago by the Rockefeller Sanitary Commission for the Eradication of Hookworm (USA) which stated: "Cure alone is almost useless in stamping out hookworm disease, because the patient can go out and immediately pick up more hookworms. The cure should be accompanied by a sanitation campaign for the prevention of soil pollution" **[31]**. Thus the interventions recommended to prevent hookworm (as well as ascariasis, whipworm) and anaemia from these infections are clean, consistently used toilets and footwear backed up by improved access to sanitation and hygiene promotion **[27] [18]**.

Birth: Hygiene affects maternal health

More than 2 out of 5 maternal deaths occur within 24 hours of birth from causes related to haemorrhage and puerperal sepsis, and many surviving mothers probably suffer longer-term effects. Sepsis (bacterial infection in the bloodstream or body tissues) is mainly caused by unhygienic practices and poor infection control in labour and delivery **[50]**. For delivery, the **"six cleans"** promoted by the World Health Organization are strongly associated with a lower incidence of puerperal sepsis saving lives of both mothers and babies **[51] [18]**, that is:

- Clean hands of the attendant and mother,
- Clean perineum (region from anus to vulva),
- Clean delivery surface under the mother,
- Clean blade for cord cutting
- Clean cord tying
- Clean towels to dry then wrap the baby and mother
- (Some also add: nothing unclean inserted into the vagina)

The relation of these items to maternal health are discussed below, while the health of the newborn is discussed later.

Clean hands

Clean hands are essential to promote safe and healthy deliveries. Hand washing reduces exposure of the mother and newborn to pathogens and thus helps reduce mortality **[18]**. The importance given to hand washing is highlighted in the WHO (World Health

Organization) short course called *Essential Newborn Care Course*, which is given at the local level to clinic staff. The course guide mentions the need to wash hands 25 times, including stating this 5 times: *Wash hands before and after touching a mother or baby* **[52]**. The point is that birth attendants should keep their hands clean throughout the birthing process. Vaginal examination with dirty hands -- which pushes pathogens up into the body-- can kill a mother.

Edmond et al (2010) notes: "Overall, interventions to improve hand washing rates have been remarkably successful in research settings. The reasons for lack of successful scale-up of hand washing interventions into policy, programs, and behaviour change are less clear." **[53]**. Indeed, the WASH sector, in general, has over the past 15 years experienced a rapid increase in the number of interventions promoting hand washing with soap, both in developing and industrialized countries. These behavioural change programmes take time and commitment. Hand washing promotion, as with hygiene promotion in general, deserves consistent and long-term effort.

Clean perineum and bathing

One small study found in Tanzania that women who bathed before delivery were almost three times less likely to develop puerperal sepsis than women who did not bathe **[51]**.

After the birth

Longer term implications of WASH for maternal and reproductive health

Fistula

Access to water and sanitation is essential to living with the consequences of fistula (as well as the healing of perineum ruptures and episiotomy). It is estimated that more than 2 million young women in Asia and sub-Saharan Africa live with untreated obstetric fistula, a hole that develops between the bladder or rectum and the vagina as a result of obstructed and difficult childbirth. Fistula results in incontinence, as women cannot control urine or faeces, often meaning they lose status and dignity, becoming shunned by their community and families. Women with fistula tend to be young, impoverished and have little or no access to medical care. Incontinent of urine and/or stool, these women become ostracized and shunned by their community. Patients with uncomplicated fistulae can undergo a simple surgery to repair the hole in their bladder or rectum **[18] [54] [55]**. However, before this, basic personal hygiene, including frequent cleansing of the genital area, is very essential to help manage obstetric fistula and to prevent infections **[56]**.

A tradition birth in Bangladesh

"The mother is situated on the earthen floor in the cold season, the cord-cutting utensils (blades) may be placed, for example, on banana tree leaves, dirty rags are used as a mat, and clay is used for stopping bleeding. The mother wears dirty clothes because the birth process is considered unclean. Rather than focusing on the cleanliness of the birth process, emphasis is on preventing contamination of the household. Washing is more to remove pollution after childbirth rather than to be clean for the birth. The newborn typically is placed wet and unattended on the ground until after the placenta is delivered. Usually, the baby is bathed on the first day, within several hours of delivery. Only 28% of mothers could be considered to provide exclusive breastfeeding for five months."

Source: Darmstadt, 2006 [77]

Menstrual hygiene

From a longer-term perspective, safe reproductive health should begin early and include menstrual hygiene to avoid subsequent health problems. Menstrual hygiene refers to having water and clean, private toilets, using menstrual pads only once or reusing cloths that have been adequately cleaned and dried, having a place to wash regularly and change clothes. A survey by WaterAid in Bangladesh reported health problems resulting from poor menstrual hygiene such as vaginal scabies, abnormal discharge, and urinary tract infection. Other studies also suggest links between poor menstrual hygiene and urinary or reproductive tract infections and other illnesses **[57] [58] [59] [18]**.

5. WASH and neonatal health

Neonatal health and maternal health are closely related. Unhygienic practices that affect the health of the newborn will most likely also affect the health of the mother, although this has not been sufficiently researched. Many gaps remain in our knowledge of how neonatal morbidity and mortality affect maternal outcomes or how common factors affect both.

Globally, in 2009, an estimated 3.3 million babies died before reaching 28 days compared with an estimated 4.6 million deaths in 1990. This is a reduction of 28% in annual deaths from 32 deaths per 1,000 live births in 1990 to 23 in 2009. The average decrease is 1.7% a year, much slower than for maternal mortality (2.3% per year). Direct causes of death include sepsis, which is reported to account for 6% to 15% of the newborn deaths (that is, 200,000 to 500,000 newborns) **[60] [61]**.

Water quality

In addition to the research on water quality and maternal health mentioned earlier, there are a small number of studies on water quality and neonatal survival. Because fertilizers are applied early in the growing season and residues may subsequently seep into water through soil run-off, the concentrations of agrichemicals in water vary seasonally. A study in India found an association between the presence of fertilizer chemicals in water in the month of conception and infant mortality, particularly neonatal mortality. Similar studies in South Africa and Colombia suggest that 10% increase in water toxins from fertilizers is significantly associated with about a 15 percent increase in infant mortality within the first month **[70]**.

Hand washing and clean deliveries

Edmond (2010) writing in the *Journal of Pediatric Medicine* notes that there is strong evidence that hand washing can reduce neonatal sepsis and infection rates. Hand washing by birth attendants and mothers were reported in one study to increase newborn survival rates by up to 44% **[62]**, and in another in Bangladesh to decrease neonatal tetanus rates by 36% **[63,62]** and in Pakistan by 56% **[64]**. Hand washing by birth attendants before delivery in another study in Tanzania reduced neonatal mortality rates by 19% **[51]**. Research in southern Nepal, showed that among newborns where both the birth attendant and mothers washed hands with soap, the risk of neonatal death was 41% lower. The benefits of hand washing in the study seemed to be greater among newborns who are at greater risk, for example, babies having low birth weight **[62]**. Another piece of research found that the use of soap to wash hands before delivery reduced the risk of cord infection by 49%. This study noted: "Many infants (92 percent) are born at home, and almost all are exposed to substantial infectious challenge during the first days of life. In the absence of topical cord antisepsis, hand washing with soap and water before assisting at delivery may reduce the risk of cord infection; in general, continued emphasis should be placed on promoting this important and simple intervention in community health programs" **[65] [18]**.

However, Blencowe et al (2011) commented on the quality of the evidence, in a systematic review of multiple databases, on the relation of clean birth and postnatal care practices to neonatal deaths from sepsis and tetanus. They found: "The overall quality of evidence for impact of clean birth and postnatal newborn care practices reviewed on cause-specific mortality is very low. However as there is strong biological plausibility and this is an accepted standard of care, and randomized controlled trials would be considered unethical…". The authors then had 30 experts examine the evidence. The conclusion of this panel was that about 30% of the neonatal mortality from tetanus was reduced by clean practices at home, by 38% in a health facility and by 40% through clean postnatal care **[66]**.

Clean cord cutting and tying: Infected cords cause neonatal deaths. In rural Nepal, failure to wash hands before cutting the cord or use of dirty cloths on the umbilical cord were associated with 60% and 70% increased risk of cord infection, respectively. Moreover, failure to use a boiled or sterilized blade led to a 2.3-fold increase in risk of cord infections **[44]**. Tradition and culture play a role in birthing procedures, particularly during deliveries at home. For example, related to care of the umbilical cord, studies in various countries note that many things are applied to cut the umbilical cord: clarified butter, ashes, oil, herbs and/or cow dung (parts of India, Pakistan, Kenya, Tanzania) **[67] [68,69] [69] [64] [29]**. Trying to change these customs to dry cord care, where nothing is applied to the cord (or only an antiseptic), can meet with considerable resistance.

When not to use water

After birth, as an exception to the general prescription that water improves health, bathing is not usually recommended for the newborn child under normal circumstances. WHO suggests no bathing of the newborn at least 6 hours after birth to minimize the risk of hypothermia (cold stress). One study found that newborns having immediate skin-to-skin contact with their mothers were 36% less likely to have umbilical cord infection after adjustment for other factors. The hypothesis put forward was that skin-to-skin contact with the mother could reduce the risk of cord infection by increasing the growth normal skin flora **[65]**.

photo: ©Klaas Drupsteen

Modifying traditional and improved practices

"In Uganda among the group in this study, immediate bathing after birth and placing the newborn on the mother was not acceptable as the baby, it is believed, is born dirty—a belief apparently shared by those around the mothers-- relatives, fathers, mothers-in-law, TBAs. The risk to hypothermia was not appreciated. Therefore a modified strategy was developed that seemed more acceptable: wiping with a damp cloth or utilising a cloth between the baby and mother skin."

Source: Byaruhanga, 2011

6. The mother: knowledge and practice for safe pregnancy and birth

The high rates of maternal mortality and morbidity, even though much is preventable, indicate the complexity of this issue. In certain cases, women "…prioritise social norms over biological problems" [71]. Good accessibility of clinics and skilled personnel are needed, but it is also important to take into account the community perspectives regarding maternal health, health seeking behaviours and decision-making powers within the community [71]. While there is a positive relationship between maternal education and health service use [72], overall change in behaviour and practices, especially in domestic daily life, requires agents of change within the broader community (men, older women, community leaders). Reaching and involving communities in adopting good practices regarding hand washing and other WASH practices in maternal health are a challenging but essential aspect in reducing maternal mortality [73].

Antenatal care

In many countries, women have heavy workloads and are involved with these up to the delivery time **[25] [71]**. One of the roles of antenatal education is to help women prepare better for delivery, to help them learn about risk factors and danger signs, to plan for having trained attendants at the delivery and rapid emergency help if needed. Antenatal education also provides the opportunity to learn more, including more about safe hygiene, water and sanitation during and after pregnancy. Thus, the antenatal visit can, at least theoretically, activate the link between improved WASH and maternal health **[5]**.

To make this link, however, the quality of education and service in the antenatal clinic must be adequate. For example, research in Zambia showed that only 15% of women who visited the antenatal clinic had adequate knowledge about the risk factors and/or danger signs of pregnancy **[74]**; and two studies in Tanzania and Kenya showed that only about half those attending the antenatal clinic received health education **[75] [76]**. Conversely, the Zambian study showed that 2½ times more women who know the risk factors well made use of the clinic delivery services compared to the group of women who did not **[74]**.

Who decides? Factors influencing maternal health related to WASH

Antenatal care and maternal health interventions usually focus on the woman as the prime controller of reproductive health. However, the woman's control over her own health can vary considerably. She may share decision-making power with others or, indeed, have little say over basic expenditures and important health decisions such as having birth, provision of water and sanitation facilities or seeking emergency help. For example, research by Stekelenburg et al (2004) in Zambia found that in 47% of cases women themselves decide where to deliver, in 14% the parents, in 11% the husband, in 9% relatives in general and in 3% the traditional birth attendant **[74] [77]**.

In many societies older women or grandmothers traditionally have considerable influence on maternal and child health decisions at the household level such as when to attend the antenatal clinic and where birth takes place **[78]**. Jensen describes research in Ghana showing that older female relatives have a special role in relation to childbirth and after delivery take care for the child for 7 days or so, also showing the new mother how to wash, feed and care for the baby. Additionally, this gives the mother time for recovering from the delivery **[79]**. The influence of men on reproductive health is complex. Men are often important gatekeepers of reproductive health care even though they may lack knowledge about it. Men are excluded from the actual process of childbirth due to cultural norms, yet being decision makers in many families they have the power to decide if a woman is brought to the hospital for care **[71]**.

Thus, power over maternal care may not be held not by the individual woman but rather by male family members, older women, elders, or by the wider community. However, traditional arrangements are also shifting, although at different speeds and in different ways, tending to empower women over their own health and that of their children **[80]**.

These decision-making and resource-allocation powers related to maternal health have their parallel in household water, sanitation and hygiene. As Krukkert shows with reference to Nepal, men are not usually the target of hygiene promotion efforts even though they have a major voice in purchases and decisions about investments in and designs of latrines, when to invest in and where to locate water points. This gap between the focus of promotion efforts and control of decisions appears in one form or another in many countries, with the result that interventions promoting hygiene and sanitation for men are attracting more attention **[81]**. With respect to sanitation and hygiene investments,

Things the mother (and those around her) should know and practice about water, sanitation, hygiene and safe delivery.

WASH projects in Nepal (SNV) and Bangladesh (BRAC) are now developing hygiene promotion targeted specifically on men as they often are primary decision-makers about construction of toilets, new water points and even soap purchases **[81,80]**.

About WASH in general

- Use water from safe sources
- Use and keep the toilet clean and use footwear
- Wash hands with soap after using the toilet, before eating and before cooking

About preparation for birth

- Wash your body, particularly area between legs (between birth canal and anus)
- Have clean clothes to wear for yourself and the baby
- Have at least 4 antenatal checks/visits: for basic information on WASH
- Have skilled personal (nurse, doctor, official midwife) and deliver at the clinic or hospital
- For births at home and in the clinic, have
  - Clean water available for cleaning mother and, much later the baby
  - Clean hands: for both attendant and mother washed with soap (or disinfectant) and water
  - New or properly sterilised razor and ties
  - Clean area for delivery

After delivery

- Have contact with the baby after birth (bathing the baby immediately is not needed and can be dangerous)
- Breastfeed exclusively until babies reach 6 months of age (no additional supplementation such as water, juices, or solids). Breast milk has enough water (88% water) and meets a baby's water requirements, even in hot climates
- Feed the baby the first breast milk as this, the colostrum, is not "dirty," but helps to protect the baby

7. Hospital and home care personnel: knowledge and practice

Trend toward professionalism and outreach

The reduction of the maternal mortality rate in developing countries by a third since 1990 is, in part, attributable to the growth of the health systems, specifically, the increase in skilled birth attendants and emergency care. Roughly 2 out of 5 women were able to have professional help at childbirth in 1992 while 16 years later, about 2 in three **[1] [24]**.

Another development which has worked to improve both maternal and child health has been the community health approach, that is, outreach programmes from the health system into the community. These usually work in one or two ways: firstly, selected local residents are trained as community health workers and are provided with a limited supply of materials and a mandate for improved child, maternal and community health; and, secondly, health extension workers in the clinics and health centres are deployed into communities. These cadres, in addition to health care, often also have a mandate for promoting hygiene and sanitation, for example, promoting the building of safe, closed wells, hygienic latrines, improving refuse disposal, vector control, improved hand washing and personal hygiene. At this point, the WASH and health sectors come together. Brocklehurst of UNICEF (2010) observes: "When such community-based health staff are told to give priority to hygiene and sanitation and are adequately supported, the results can be remarkable."

Another feature of some community health programmes is that the trained community level workers visit pregnant women and women with newborn infants to treat neonatal problems and link the women to the formal health system. Although community case management has been successful in improving health status, it is not easy to maintain and is often neglected due to resource constraints, which results in many health workers being confined to clinics and health centres without sufficient outreach **[82] [25] [67] [83]**.

Resource and personnel constraints

In 2010, WHO stated that the main obstacle to progress toward better health for mothers remains the lack of skilled personnel, in particular, a global shortage of qualified health workers within facilities that are easily accessible in terms of geography and cost. In 2010, it was estimated that by 2015 another 330,000 midwives would be needed to achieve universal coverage of mothers with skilled birth attendance **[5]**. A low health personnel-to-population ratio is a chronic issue particularly in Sub-Saharan Africa and rural areas **[84] [23] [24]**.

Substandard provision of care can also inhibit its use. Several studies deal with problems of equipment and supplies in hospitals and clinics, meaning that the three main causes of maternal morbidity and mortality (haemorrhage, sepsis and obstructed labour) cannot be adequately treated at all rural health centres **[25]**. Some studies also deal with the quality of care, on the assumption that people will want to come to clinics that give timely and respectful service with adequate medicines and clean facilities. However, the quality of facility-based maternal services is not consistently high. Complaints about neglect and poor treatment in hospitals, poorly understood reasons for certain procedures, plus the health care workers' views that women are ignorant, may also help explain the unwillingness of women to give birth in health facilities or to seek care for complications **[26] [25]**.

> Maternity care can be disrespectful and inhumane [94].
>
> Clinical officers, midwives, and nurses in health centers may not be competent in identifying and managing maternal and newborn complications. Staff are not well paid, often unsupervised, and morale may be low.
>
> WHO Partnership for Maternal, Newborn & Child Health (2007)

Koblinsky (2006) reports on studies in Benin, Jamaica, Ecuador, Nigeria, Ivory Coast suggesting that professional health workers were incompetent or treatment was not appropriate or timely. In a study in Ghana, as few as 17% of births in health facilities at the primary level met criteria of good clinical practice. Thus, even though more women are accessing care with health professionals in facilities at childbirth, a proportion of these still do not receive adequate health care **[27] [28] [24] [29]**. Supervision and management need special attention as interventions in their own right **[83]**.

Water, sanitation and hygiene in medical facilities

Health centres and hospitals should have consistent or at least predictable running water, clean toilets, safe refuse disposal, clean beds and areas for birthing **[27]**. Running water

is preferred, of course, over storage in barrels and tanks; water-seal toilets (which separate human faecal matter from contact with flies and humans) are preferred to pit latrines. Unfortunately this is not always the reality. For example, in one of the only comprehensive studies that could be found, the Ministry of Health in Uganda stated that poor and inadequate sanitation and lack of water in health units was a major cause of dissatisfaction, especially in rural government health facilities. Toilets were very dirty and unhygienic, something that is complicated by the fact that the public have not developed a culture for using toilets: people defecate in the open even when pit latrines are available. In most of the Kampala City Council health centres there was little running water in toilets, inadequate garbage disposal and few cleaners **[85]**. This situation is not unique to Uganda, although it seems that such sanitary monitoring may be rare or may not be made public.

A challenge in government health care systems is the disjunction between construction of water and sanitation facilities, which is often organized centrally or by other departments, and their repair/maintenance, which is often a local responsibility to which few resources or attention may be given **[85]**. Interestingly, in Malaysia and Sri Lanka, a World Bank study found that the provision and maintenance of functional basic services for hygiene and WASH in health centres - and the convenient location of clinics - were among the elements that helped these nations achieve early and rapid improvement in maternal health **[12]**. Karlsen has argued that reliable water supply and toilets is an indicator of basic services for health facilities **[72]**.

Traditional Birth Attendants

Traditional birth attendants (TBAs) are the lowest, often untrained tier of birth attendants in maternal health care. They work at roughly one third of all births, a proportion that continues to decrease, however **[8]**. In the medical world there has been a lively debate about whether investments should be made in traditional birth attendants (TBAs) **[86] [87] [74]**.

The traditional birth attendants do not form a homogeneous group: some are trained, but most are not; some have well established businesses, but most attend only a few births a year; most work from home, but some work in health facilities when there is a shortage of skilled care providers **[74]**. An exhaustive literature review of maternal health Bangladesh showed that the trained TBA's knowledge of hygiene is much better than practice. In the study, the TBA's self-reports about hand washing were good but many performed repeated vaginal examinations (for example, up to 40 per pregnancy) with unwashed hands, to decide if it was time for delivery **[77]**.

Training with supervision

Bhutta (2005), Rowe (2005) and Koblinsky (2006) report on studies in sub-Saharan Africa where training of TBAs about clean delivery and early referral to the formal health care system resulted in decreases in neonatal complications and deaths. However, the training of TBAs in countries where the community commonly used their services apparently had strong impacts on maternal health outcomes only when it was supported by functioning referral systems and good working relationships with the formal health care systems. Training in isolation is not sufficient; however, the TBA is difficult to train and supervise, as she is community-based and often somewhat invisible as a part-time practitioner of her trade.

Things the health professional should know and practice related to water, sanitation, hygiene and maternal health.

- Clean birthing protocols (including the "six cleans"). Also clean hands and medical clothing.
- Clean health facility: Maintain and manage water, sanitation and hygiene facilities and materials in the clinic or hospital. Clean birthing and patient beds/rooms.
- Informative and respectful communication with mothers, families of all ethnic and economic backgrounds. During antenatal sessions and hospital/clinic stays, health staff should communicate in organized and clear manner on a small number of key WASH-related issues.
- Routines and equipment in place for clean, appropriate and rapid emergency responses.

What TBAs need to know

Ways in which the TBAs can reduce the risk of death or long-term illness in home delivery include:

- Detection of genital tract infection that is present prior to labour;
- Risk detection and recognition of signs of infection or ruptured membranes;
- Care seeking and referrals of all pregnant women for antenatal care and delivery.

Experience with clean delivery kits

To ensure safe delivery, beginning in the late 1980s, clean delivery kits were developed for use by TBAs, typically containing materials that contribute to clean delivery practices such as a plastic sheet, pads, clean razor blade and cord ties with user instructions. All kits contain soap for hand washing. In some programmes the kits have been provided for free, or a small fee, to the pregnant women together with health education at antenatal sessions. In other cases, the kits are provided to or purchased by the TBA with training based on the principles of the "six cleans" recognized by WHO.

Evidence about the effectiveness of the kits is mixed. Hundley et al (2011) undertook a survey of experience with 21 birth kits used in 50 different countries, many of which were part of a package of interventions. The findings are that, although birth kits are available, evidence regarding implementation in the home is limited and difficult to measure. Impact assessment on maternal health has given varied results when it has been undertaken **[88]**. Behaviour change communication and education appear to be exceptionally important to promote clean delivery **[89]**. In contrast to the Hundley study, another recent study (Seward et al, 2012) used logistic regression to explore the association between neonatal mortality and clean delivery kits in more than 19,000 home births in rural India, Nepal and Bangladesh. Seward et al. found an association between the use of clean delivery practices including hand washing with a significant reduction in neonatal mortality **[95]**.

8. Aligning maternal and newborn health with WASH

From point of view of linking WASH interventions to maternal health, responsibility is held across Ministries potentially creating hurdles to linking the two sectors. However, the apparent invisibility of the issue is a barrier in itself. While medical staff at the local level often participate in hygiene promotion and sanitation programmes, above this level there seems to be little joint policy or programming strategy. Within the large WASH sector, maternal health services and hygiene promotion for maternal health are seldom if ever to be found [31].

Most countries have various policies and strategies and road maps relating to maternal and newborn health. These issues can also be found in policies related to other issues such as human resources for health and education; however, there is often a lack of alignment between policies. Although most countries have separate policies and guidelines on WASH may be found, there is lack of a multi-sectorial approach (involving health, WASH and possibly education).

The Partnership for Maternal, Newborn & Child Health recently (2011) undertook a global review of 142 interventions meant to improve maternal, newborn and child health. The review identified only one essential intervention related to WASH, specifically, hygienic cord and skin care for newborns **[97]**. This reflects the lack of alignment or evidence-based linkages between maternal health and WASH, as stated earlier.

On the other hand, Countdown to 2015 considers water and sanitation an important factor in maternal and newborn health. It reports the data for improved drinking water coverage and improved sanitation coverage for the 72 low and middle income 'countdown' countries, that need to make progress on maternal and newborn health. The attention to water and sanitation through this Countdown initiative that concentrates primarily on reporting progress for MDGs 4 and 5 will hopefully stimulate a more multi-sectorial approach to maternal, newborn and child health.

Relevant Policy Frameworks for Alignment

Global Strategy for Women's and Children's Health
In 2010, UN Secretary-General Ban Ki-moon initiated a global movement and agenda for action to improve the health of women and children around the world. It calls for integrated interventions whereby partners coordinate efforts to finance country-led health plans and address issues that impact on health, including sanitation and safe drinking water.

World Health Assembly Resolution 64.24 on Drinking Water, Sanitation and Health
In 2011 the 64th World Health Assembly adopted resolution 64.24 that (among others) urges member states to develop and strengthen, with all stakeholders, national public health strategies so that they highlight the importance of safe drinking water, sanitation and hygiene as the basis for primary prevention.

Universal Access to Water and Sanitation by 2020
During the 4th United Nations Conference on the Least Developed Countries in 2011, it was agreed to set the target of universal access to safe drinking water and basic sanitation by 2020. Governments and donor countries should support the target of Universal Access by 2020 by ensuring that sufficient funding for water, sanitation and hygiene is allocated and reaches most vulnerable communities to achieve Universal Access by 2020.

photo: ©Huib van Wersch

9. What needs to be done?

In this section, the evidence marshaled in this paper is reviewed to identify some possible programmatic responses that may help reduce maternal and neonatal mortality and morbidity. Some of these require continuing effort in programming within one sector such as WASH, health, education; while others call for strengthening the bonds across sectors.

Within the WASH sector

Specifically, for the WASH (water, sanitation and hygiene) sector, we have seen some evidence that there are health benefits for maternal well-being from safe water quality, free from chemical and bacterial contamination. In terms of programming, this implies the need for **effective water service delivery**, including testing of water sources for basic chemical and bacterial quality. **Water testing** is identified here as it helps target the programming, can be very effective element for advocacy and mobilization and, as well, is often insufficiently emphasized. Targets for water testing should include, for example, areas where drinking water is provided by shallow wells and areas with known chemical contamination. Further, a commitment to long-term promotion of hygiene practices is needed focusing on maintaining the quality of water from source to mouth, including safe home storage and transport.

To reduce the risks of helminthic infestation and resulting anaemia for pregnant women, **consistent use of hygienic latrines** is crucial, by all members of the household and community. In this sanitation effort, some countries have been more successful than others. Those with lower coverage in Sub-Saharan Africa and Asia should be targeted. Some need, not new policies, but perhaps **greater political will** at the national level to ensure safe sanitation for poor populations. Among these may be included large countries such as India, Indonesia and Nigeria, which according to the WHO/UNICEF Joint Monitoring Program have, respectively, 34%, 54% and 31% coverage with improved sanitation.

The potential risk for the pregnant women carrying water implies that **water points should be conveniently located** near the household. Convenient locations also mean that greater quantities of water are used for personal hygiene. However, convenient locations for water points are not always feasible. Perhaps an additional entry point may be: who carries the water. This is traditionally a woman's task in many countries. Some programs in Bangladesh have advocated **having men carry water**, in the context of the greater distances required to get water which is arsenic free. Interestingly, in the BRAC WASH programme, the motivation given seems to relate to traditional values, that is, the safety of the woman against what is called 'eve-teasing' when they must walk far to collect safe water. It is not known what, if any, the impact of this community advocacy has been; however, this does indicate that campaigns within the context of on-going WASH programs to reduce the physical burden on (pregnant) women can be undertaken.

Hand hygiene is extremely important during the birth delivery and the neonatal period. In the WASH sector, increasing attention has been paid to handwashing with soap and water, often through national social marketing campaigns in a range of countries as varied as Uganda, Panama, Ecuador, Vietnam, Indonesia and Scotland. The 18th of October has been designated by UNICEF and its partners as Global Handwashing Day, with activities in more than 80 countries. Within the health sector, handwashing has also been the subject of advocacy and research in both industrialized and developing countries[2]. However, changing handwashing practices world-wide will require both a **long time frame and continuing commitment** implying, among other things, that it should remain a feature in hygiene promotion within WASH programming as well as in health education, in general, and antenatal education in particular.

Within the (maternal and newborn) health sector

One implication of the findings is that **educational/promotional aspects relating to WASH and health** (especially maternal and newborn) should be improved. This will involve more than one-sided health messaging (Information, Education and Communication) and will require Behavioral Change Communication (BCC) activities that are action oriented and participatory leading to sustainable change. The focus should include the childbearing woman and those around her who influence decision making such as husbands, mothers-in-law, elders, female leaders and traditional authoritative leaders.

Hygienic and functional WASH facilities in the formal and informal health care setting are needed. It is the task of governments and policy makers to develop minimal standards for health facilities that include adequate water and sanitation facilities with a practical maintenance systems. It may be possible to monitor WASH standards through one or two simple indicators that could be added to routine health information management systems that are present or being developed in most countries. This would inform health authorities in a timely way when there are problems.

Another important area is the **hygienic practice of clinic and hospital personnel**. It is clear that there is often a gap between the **knowledge** and **practice** of clinic and hospital staff. Steps towards addressing this problem need to take place during pre-service education/training in order to transfer knowledge about

[2] *See, for example, http://www.cdc.gov/handhygiene/*

the relationship between WASH and good maternal and newborn health outcomes to health workers. This should continue through in-service training in order to keep the issues 'on the radar' when staff are on the job, focusing on staff being more conscientious about hygiene and cleanliness. Another way of addressing this issue is to emphasize hygienic facilities and practices during the existing periodic supervision visits carried out by health management teams or authorities.

Besides clinic and hospital staff, it is also important that **community based health providers** are also trained in hygiene and cleanliness. As reported earlier, most community health worker programs and some TBA training programs include clean practices in the core training. In the past there was little interaction between these groups and formal health providers but there is currently a shift towards embedding these groups within the formal health sector **[96]**. This often involves (supportive) supervision of community-based providers by staff. This is another development that might encourage the awareness and practice of hygiene by the community based health workers who provide with maternal and newborn health care.

Clean birth kits have been shown to help improve health outcomes of newborns, as noted earlier. However, having kits does not guarantee that adequate hand washing practice as shown by data from India **[95]**. **Continuous education, mentoring and supervision of the community based providers** using these kits might lead to better understanding and use of the supplies provided and in turn lead to better hand washing (and other clean delivery) practices.

Within the education sector

The rapid increase in the enrolment of girls in upper primary and secondary school provides an excellent **opportunity for reproductive health and menstrual hygiene education**. In general, the **maintenance of water supply, toilets and hand washing facilities** in schools is overlooked, requiring sustained commitment and continuing interest of educational authorities. The aim of intervention, with educational authorities and Ministries, would be to ensure use and maintenance together with education. This should also involve implementation of hygiene practices in school such as hand washing before eating.

Legislation and reproductive health

It appears that current data in some countries vastly underestimates the problem of unsafe and unhygienic induced abortion. Estimates from UNFPA as well as experience from countries such as Romania indicate that **legalizing abortion - or making it available under safe and hygienic conditions through regulation -** would quickly reduce the rates of mortality and morbidity among women. Therefore adapting relevant legislation or regulation that may reduce maternal mortality should be looked into in other settings as well.

Cross-sectoral collaboration

There are existing community-based and non-governmental groups that could serve as channels to promote hygiene, safe water and sanitation for maternal and neonatal health. At the local level, in rural communities, there is often cooperation among health, sanitation, hygiene promotion and education personnel. For example, local WASH personnel work to provide water and sanitation facilities for schools. Open Defecation Free (ODF) and other sanitation programmes frequently involve local health personnel for mobilization and sanitation promotion. In rural communities, village water and sanitation committees relate to or even include health personnel members in many communities. It should be noted that these ubiquitous village committees are mandated by policy in countries such as India, Bangladesh, Tanzania, Zambia and so on. Thus, it would logically seem possible to include a **focus on promotion of maternal health in water and sanitation committees**. It would be interesting to try this out, with suitable monitoring, on a small scale. However, this local level collaboration is not usually matched by regional or national collaboration among ministries. Thus, to infuse maternal health promotion at scale in WASH programmes would perhaps first require demonstrating the effectiveness of such an approach followed by attempts to scale up through national institutions.

In addition, many NGOs and external donors are involved in both maternal health and WASH programming. Consideration should be given to linking the two programmatically, **reducing the compartmentalization of programming** within these organizations.

Research

It has been noted repeatedly that there is a lack of robust research, assessment and programme evaluation related to the intersection of the WASH and maternal health sectors. Some suggestions for further research include:

- (Pilot) studies on the **impact of water, sanitation and hygiene on maternal mortality and morbidity** at household and/or community level.
- Further study of the influence of socio-cultural perspectives, identifying the **barriers for behaviour change and potential change agents within communities**, in relation to maternal health and WASH. Assessments and pilots would be useful of the most appropriate, cost-effective, and sustainable **clean delivery strategies** in community and rural settings. This could include TBA practices and their links to the formal medical setting. Better evaluation is needed, for example, of the actual use and impact of clean delivery kits that include education components on maternal

10. Conclusion

health outcomes **[89]**.

- **Rapid assessements of current water and sanitary conditions in health facilities.** The dissemination of evidence about current conditions could help catalyse efforts to improve facilities and their maintenance. Additionally, research should be undertaken on the impact of improved water and sanitation in health facilities on maternal health outcomes. This should also include a focus on safe disposal of medical waste at health facilities.

The review in *Getting it Right* has shown the complementarity of WASH and maternal health as well as highlighting how little these themes are addressed collectively in research, interventions and programs.

Hygiene and cleanliness are basic concepts in health care. They are included in most health promotion and health worker training programs. However, there appears to be a gap between education, knowledge and practice. Health information and behavior/practice change are essential to ensuring cleaner environments for better health. Effective WASH programs could work to help communities better understand the advantages of clean water and environment for maternal and child health. Effective behavioural change communication is salient to supporting individuals to improve their practices, especially pregnant women and their families. Health professionals should consistently provide hygienic services and need the support of health systems for this. The global crisis in human resources for health has resulted in more lower level cadres and health volunteers taking on more responsibilities relating to maternal and newborn health. These groups receive short training and need to be mentored and supported in the field to ensure that they provide clean practices.

Health systems and WASH sector institutions must work together to support for clean water and sanitary facilities at home, school and in the clinic to enable communities and maternal health providers to live and practice according to the principles of WASH. Government and NGOs play a large role in this and should ensure that WASH elements are incorporated into maternal and newborn health programs. As well as vice versa, whereby in WASH interventions particular attention is paid to their impact on childbearing women and their children.

In summary, there is some information available and evidence about the benefits of water and sanitation to improve health in general and about specific interventions that could improve maternal health. These two areas have not been sufficiently addressed as complimentary themes in global development programming. More collaboration between the two sectors could improve the lives of childbearing women and their children in the future.

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Colophon

Getting it Right
Improving maternal health through water, sanitation & hygiene

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