

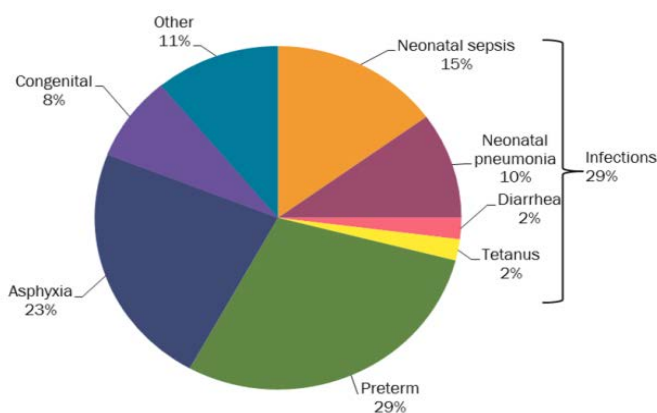
# BETTER INTRAPARTUM PRACTICES TO REDUCE NEWBORN INFECTION

## The Problem of Newborn Infection

Thirty-six percent of under-five deaths occur in the first four weeks of life (neonatal period), accounting for more than three and a half million deaths annually.<sup>1</sup> Of these, almost one million deaths occur from infection during the first week of life, and a large percentage of them are preventable. Infections are the main cause of neonatal death, accounting for nearly 30% of the total (see figure below). This brief examines how to reduce newborn infections through better intrapartum practices.

The practices of clinicians caring for women during labor and birth can both contribute to or help prevent infections in the mother and the baby.

Sepsis is a severe infection that spreads throughout the body. It is a major cause of maternal mortality, accounting for approximately 15% of maternal deaths globally.<sup>2</sup> Moreover, since the health of the mother and health of the baby are inextricably linked, maternal sepsis is linked to newborn sepsis in a potentially fatal connection.



Source: Lawn JE, Kerber K, Enweronu-Laryea C and Cousens S. 2010.

Newborn sepsis is usually categorized as:

- Early onset sepsis (EONS), which presents within the first 72 hours of life, is usually caused by pathogens present in the maternal genital tract and is acquired during the course of labor
- Late onset sepsis (LONS), which presents after the first 72 hours of life, is usually caused by pathogens present in the hospital, home or community and is acquired during or after the delivery

Because newborns have an immature immune system that gradually develops over time, they lack the normal microbial flora of non-pathogenic organisms. Their systems can easily become colonized with harmful pathogens encountered in the maternal genital tract and in their environment. Specific pathogens that cause hospital-acquired newborn infection vary by geographic region and even within facilities. Common pathogens known to cause sepsis in many parts of the world include *Klebsiella*, *E. coli*, *Staphylococcus aureus*, and Group B *Streptococcus*.<sup>3,4</sup> Less is known about the pathogens responsible for newborn sepsis at home births. For all childbirth settings, the same intrapartum practices can contribute to reducing the risk of early onset sepsis.

#### **Intrapartum practices that *reduce* infection:**

- Prompt diagnosis and treatment of prolonged labor
- Use of partograph
- Hand hygiene, high-level disinfection (HLD) gloves
- The “Six Cleans”
- Minimization of vaginal examinations
- Prevention, prompt diagnosis and treatment of chorioamnionitis

#### **Intrapartum practices that promote infection and must be *avoided*:**

- Routine vaginal examinations at shift change
- Multiple vaginal examinations
- Vaginal examinations after rupture of membranes
- Shaving of the genital area
- Enemas

## **Intrapartum Conditions and Practices That *Increase* the Likelihood of Newborn Sepsis**

The burden of EONS is highest in the poorest communities of low- and middle-income countries. In these settings, most births and deaths still occur at home, and are often not recorded, resulting in a severe lack of data about incidence of neonatal sepsis in the developing world. Because EONS is usually acquired during the course of labor and is associated with maternal infection and/or unhygienic birth practices, this brief examines a number of labor- and birth-related conditions and practices that can increase the likelihood of early newborn sepsis. Although LONS is associated with pathogens acquired either in the home or hospital environment, it may also be linked with birth practices.<sup>5</sup>

Chorioamnionitis is a maternal infection strongly associated with prolonged rupture of membranes and long labors. It is usually of bacterial origin in the amniotic sac, fetal membranes and/or amniotic fluid. If untreated, chorioamnionitis can result in severe infection of the mother’s uterus, and transmission to the newborn can be fatal to both. Specific events during labor can predispose the mother to chorioamnionitis. These include: 1) premature rupture of the membranes (PROM) – either spontaneous or artificial – at more than 18 hours before the birth; 2) prolonged labor of more than 24 hours; 3) more than three vaginal exams during labor; and/or 4) any unclean vaginal exam during labor.<sup>6,7</sup>

Cesarean deliveries or assisted vaginal births with forceps or vacuum extractor also increase the risk of maternal infection. Practices that cause breaks in the perineal tissue and surrounding skin, such as routine genital shaving, should also be avoided. Routine enemas cause discomfort to the woman, do not prevent maternal or neonatal infection, do not shorten labor,<sup>8</sup> and may contribute to contamination of the vaginal canal. Women who have compromised health or are suffering from other conditions (e.g., severe anemia, malaria, HIV) are at greater risk of becoming infected.

The fetal membranes form a protective sac around the fetus providing a sterile environment within the amniotic cavity. Organisms described above are sometimes able to penetrate the sterile environment causing chorioamnionitis. When the membranes are ruptured, a portal for infection of the fetus is created. The commonly observed practice of frequent vaginal exams by each of the staff caring for a woman during labor increases the risk of infection for the mother and fetus even when the membranes are not ruptured. Situations that are likely to lead to multiple examinations include routine examinations at change of shift, training of students, and failure to use the partograph (described below).

Chorioamnionitis is associated with preterm labor and birth. Although the focus of this brief is full-term infants, sepsis is even more life-threatening for preterm and low birth weight infants.

Low birth weight infants and preterm babies born before 37 weeks' gestation have an incidence of infection three- to ten-fold higher than full-term, normal weight babies.<sup>9</sup> Therefore, special care must be taken to protect the preterm or low birth weight infant from exposure to pathogens during labor, birth and the postpartum period.

## Intrapartum Practices That Reduce the Risk of Newborn Sepsis

Although some causes of maternal and neonatal infection can be prevented or treated during the antenatal period, many practices during labor and birth can reduce the risk of early onset infection in the newborn.

### Hygiene

Basic infection prevention practices (e.g., hand hygiene, cleaning/disinfection of delivery surfaces and equipment/supplies, and high-level disinfection [HLD] or sterilization of reused equipment/supplies) remain key to infection prevention. Systems and protocols for the disposal of contaminated waste should be included as part of standard infection prevention practices.

The most common way that infections are transmitted in health care facilities is on health care workers' hands. Health care-associated infections are common causes of illness and even death in rich and poor countries alike.<sup>10</sup> It has been known for more than 150 years that handwashing prevents infections between a provider and a patient. Providers who fail to wash their hands before every vaginal exam as well as providers who do not use HLD gloves can introduce harmful organisms through the vaginal canal and into the uterus. Unhygienic environments such as unclean linens and contaminated surfaces including beds and tables also increase the risk of infection. Operative and assisted births also provide the means for introduction of organisms that reside on unsterile instruments, equipment and gloves. High rates of newborn infections in hospitals may lead to negative impressions by women and communities, further reducing the number of women choosing facility births.<sup>11</sup> Whether births are in homes or in facilities, infection of the newborn is a serious but often preventable problem.<sup>12</sup> All staff, including cleaners, must be involved in infection prevention efforts.

Handwashing is an essential infection prevention measure whether in a facility or in the community. In rural Nepal, birth attendant handwashing was related to a statistically significant lower mortality rate among neonates (adjusted relative risk [RR] = 0.81; 95% confidence interval [CI], 0.66-0.99).<sup>13</sup> Also in Nepal, a study on handwashing at home births found the adjusted risk of newborn cord infection was 27% (95% CI: 17-36) lower among infants where the birth assistant washed her hands with soap before delivery.<sup>14</sup>

A 2009 review found evidence that infections in facilities can be reduced by 40% with adequate hand hygiene.<sup>15</sup> Clean birth kits that have been shown to reduce neonatal sepsis include a clean, unused razor blade to cut the cord, a clean surface for the delivery, clean cord ties and a bar of soap.<sup>16</sup> Although clean birth kits were developed for non-facility births, all settings for childbirth require excellent hygiene, and clean birth kits brought to the facility by the mother may be a way to reduce neonatal sepsis in settings where hygiene standards are lacking.



In order to further reduce infections, unused HLD gloves must be used consistently for each vaginal exam. Feces or other contaminants should be cleaned from the perineum prior to the vaginal exam and in preparation for birth. All instruments that are used for mother or baby must be HLD or sterilized. In addition, the surface of the birthing or exam table must be thoroughly cleaned after each delivery with a disinfectant solution to prevent the spread of organisms between clients.

### **A Memory Aid for Birth Attendants Lists “The Six Cleans”:**

- Clean hands – vigilant handwashing and HLD gloves are essential for vaginal exams or when handling the baby
- Clean perineum – feces should be wiped away and the perineum washed prior to the birth (mother can shower or bathe)
- Nothing unclean introduced into vagina – hands, herbs or other substances
- Clean delivery surface – a plastic cover is appropriate for home births; at facilities, the delivery surface should be cleaned and then wiped with a 0.05% solution of chlorine after each use
- Clean cord cutting instrument – at home, a razor blade or scissors should be boiled for 20 minutes before use
- Clean cord care – the cord should be tied with a clean tie or clamp, nothing should be put on the cord, and it should be kept clean and dry at all times

Towels or cloths used for drying and wrapping the baby must be washed and clean. Vigilant adherence to these hygiene measures will help reduce the risk of maternal and newborn infection. The use of clean delivery kits and the “Six Cleans” in non-facility births is associated with a reduction in both maternal and newborn infection.<sup>16,17</sup>

### **Vaginal Exams**

In addition to observing hygiene measures for vaginal exams, the care provider should limit the number of vaginal exams to those that are indicated by the progress of labor rather than routinely conducting exams as frequently as every hour or two or when staff change shift. As previously noted, multiple vaginal exams in labor increase the risk of chorioamnionitis. To further decrease the risk of infection, exams should not be conducted on a woman whose membranes have ruptured if she is not in labor. Only a sterile speculum exam should be conducted on such a client, and that should be limited to a single evaluation to confirm rupture of membranes. As a further precaution, providers should not push the tip of the examining finger through the cervix until active labor is established or the decision to induce occurs, even when membranes are intact.

### **Partograph**

The partograph is a graphic tool that tracks the progress of labor as well as the condition of the mother and fetus to facilitate safe and effective decision-making concerning management of labor. The use of the partograph to monitor and guide decision-making in labor has been shown to reduce cesarean deliveries, improve early interventions for prolonged labor and improve neonatal outcomes in low-resource settings.<sup>18</sup> One of the greatest contributors to perinatal infection is prolonged labor, and use of the partograph with its timelines for alert and action makes prompt diagnosis more likely. Partograph guidelines limit vaginal exams to once every four hours, thus reducing opportunities to introduce pathogens into the vagina or cervix. The partograph also reduces prolonged labor, assisted vaginal delivery and emergency cesarean sections – three factors that increase the risk of sepsis.<sup>19</sup>

### **Antibiotics**

When rupture of membranes has been prolonged for 18 hours or more without the birth occurring, the use of prophylactic antibiotics is necessary to prevent chorioamnionitis, puerperal sepsis and newborn sepsis. Risk of infection increases as the duration of ruptured membranes lengthens.<sup>20</sup> Chorioamnionitis occurs during labor, and providers should be suspicious if a woman develops a fever in labor, or if a marked increase in the fetal heart rate, uterine tenderness and foul odor of the amniotic fluid occur. Therefore, it is important to diagnose the condition early when suspected. Prompt diagnosis and immediate treatment of chorioamnionitis

with antibiotics is essential to properly treat the mother and to prevent sepsis in the newborn. Initiating antibiotics as early as possible, without waiting to obtain cultures, significantly improves the outcome for the neonate.<sup>21</sup> A combination of IV ampicillin and gentamicin is typically used for treating chorioamnionitis and preventing neonatal sepsis.

Although early onset Group B *Streptococcus* (GBS) sepsis in the newborn is rare, such infection does occur. Clinical data indicate that 15-45% of healthy women are colonized with GBS, and newborns can acquire the organism in utero or during delivery from the maternal genital tract. However, only 1-2% of colonized neonates go on to develop invasive GBS disease.<sup>22</sup> To prevent GBS infection of the newborn, antibiotics should be given to all women in labor who have tested positive to GBS screening after 35 weeks of gestation, who previously gave birth to an infant with invasive GBS disease, who are giving birth at more than 37 weeks' gestation, or who have a fever of 100.4 degrees Fahrenheit or 38.0 degrees Celsius (as well as to those with PROM or chorioamnionitis as described above). The treatment recommended by the U.S. Centers for Disease Control and Prevention (CDC) is penicillin G: 5 million units IV initial dose, then 2.5-3.0 million units IV every four hours until the birth; or ampicillin: 2 g IV initial dose, then 1 g IV every four hours until the birth.<sup>23</sup> When penicillin, ampicillin or cefazolin prophylaxis was administered for four or more hours before delivery to women delivering at more than 37 weeks' gestation, antibiotic prophylaxis was 78% (95% CI: 44-91) effective in preventing early-onset GBS disease (CDC, unpublished data, 2009).

### Immediate Newborn Care: Breastfeeding, Cord Care and Eye Care

Appropriate care of the newborn at the time of delivery can also contribute to reducing newborn infection. Early initiation of exclusive breastfeeding is a natural way to provide antibodies that will protect the newborn from both intestinal and respiratory tract infections and help develop the immature immune system. Pneumonia and diarrhea remain major causes of neonatal death, and clinical evidence indicates that both are reduced with exclusive breastfeeding.<sup>24</sup> Likewise, breastfeeding can help protect from the introduction of various contaminated substances that can occur during artificial feeds or during pre-lacteal ritual ingestion.

A substantial proportion of newborn deaths from sepsis are from cord infections, most commonly related to unclean cutting and tying of the umbilical cord.<sup>25</sup> Infants with neonatal tetanus, which kills 165,000 infants globally each year, often have a concomitant cord infection,<sup>26</sup> which points to a common cause (i.e., unclean delivery and cord care practices). Clean cord care at birth and in the days following birth is an effective measure in preventing cord infections and neonatal tetanus.

Clean cord care at birth and in the days following birth is effective in preventing cord infections and *Tetanus neonatorum*. Strategies to reduce the risk of neonatal tetanus and cord infections include promoting clean delivery, clean cord care and increasing tetanus toxoid immunization coverage in women of reproductive age. Clean cord care practices at birth include washing hands with clean water and soap before delivery and cutting and tying the cord, laying the newborn on a clean surface and cutting the cord with a sterile instrument, and using a clean tie or clamp on the cord, combined with tetanus toxoid immunization during pregnancy. In rural Nepal, newborn mortality was reduced by 19% when the birth attendant washed his/her hands before assisting at the birth.<sup>27</sup> Furthermore, there is a growing body of evidence concerning the application of a solution of chlorhexidine to the umbilical stump to substantially reduce newborn infection and mortality.<sup>28</sup> An international group of experts met to review the evidence and develop recommendations that are consistent with WHO's guidance.<sup>29</sup> This group concluded that chlorhexidine (4%) can be applied daily to the umbilical cord stump during the first week of life for newborns who are born at home in settings with high neonatal mortality (NMR>30 per 1,000). Dry cord care is recommended for newborns in all other settings.<sup>30</sup>



Eye care at birth is intended to reduce blindness caused primarily by chlamydia and gonorrhea infections in the eye of the newborn (*Ophthalmia neonatorum* [ON]). Routine, immediate postpartum care of the newborn should include wiping fluids and mucus from the newborn's eyes and instilling an antiseptic eye solution or ointment. The prevalence of ON varies considerably around the world, but 1,000-4,000 newborn babies become blind every year because of ON. Most countries use povidone-iodine, tetracycline 1% or erythromycin 0.5% ointment to prevent ON. It must be noted that although antibiotic eye ointment is effective for gonorrhea, it is less effective for chlamydia. For both, the most important way to reduce infection in newborns is by screening and treating mothers in pregnancy and by observing newborns for symptoms.<sup>31</sup>

## Program Considerations for Implementing Intrapartum Practices That Reduce Risk of Neonatal Sepsis

Any facility-wide or nationwide program with a goal to reduce newborn mortality rates must develop procedures and protocols to guide practices during labor and birth. To develop protocols, clinical outcome data is required to inform decision-making. Information that programs should ideally collect in order to make informed, evidence-based decisions in program design and implementation include:

- Incidence of newborn infection
- Incidence of chorioamnionitis
- Local pathogens cultured from the amniotic fluid of mothers with chorioamnionitis
- Local pathogens cultured from the infected newborn
- Antibiotics used in treatment of chorioamnionitis, and information about any emerging resistance
- Antibiotics used in the treatment of newborn infection, and any emerging resistance

Communities also share in the responsibility of developing supportive practices and behaviors that contribute to decreasing maternal and newborn infections. Women, husbands, community birth attendants, other care givers and key community members must understand and support the principles and practices described above under "Hygiene." Communities should be motivated to be involved in birth preparedness planning in order to ensure that the necessary supplies for infection prevention are available for every home birth. When women and communities understand the danger signs and routes for infection in pregnant women, such as recognizing PROM and the importance of seeking care immediately, they can actively help prevent infection in the newborn. Community mobilization and behavior change communication strategies are powerful means for ensuring that labor practices and care-seeking behavior of women reduce the risk of infection in newborns. Mothers and their families should also know of the importance of provider hand-washing, limited vaginal examinations and use of HLD gloves when examinations are done. When consumers expect health providers to practice hand hygiene, it is more likely to occur.

The mother and newborn form a dyad, and the well-being of the mother during pregnancy and at the time of birth directly determines the well-being of the newborn from conception to birth. Any efforts, whether programmatic or clinical, to reduce sepsis in the newborn must address the conditions and practices that surround labor and birth.

- <sup>1</sup> Lawn JE, Kerber K, Enweronu-Laryea C and Cousens S. 2010. 3.6 million neonatal deaths—what is progressing and what is not? *Seminars in Perinatology* 34(6): 371-386.
- <sup>2</sup> Ibid.
- <sup>3</sup> Klebsiella and E. coli are found in the maternal intestinal tract; GBS is found in the mother's vagina and urinary tract, S aureus is found on the skin.
- <sup>4</sup> Zaidi AK, Thaver D, Ali SA and Khan TA. 2009. Pathogens associated with sepsis in newborns and young infants in developing countries. *Pediatric Infectious Disease Journal* 28(1 Suppl): S10-18.
- <sup>5</sup> Ganatra HA, Stoll BJ and Zaidi AKM. 2010. International perspective on early-onset neonatal sepsis. *Clinical Perinatology* 37: 501-523.
- <sup>6</sup> Dutta S, Reddy R, Sheikh S, Kalra J, Ray P and Narang A. 2010. Intrapartum antibiotics and risk factors for early onset sepsis. *Arch Dis Child Fetal Neonatal Ed* 95(2): F99-103.
- <sup>7</sup> Tita AT and Andrews WW. 2010. Diagnosis and management of clinical chorioamnionitis. *Clinical Perinatology* 37(2): 339-354.
- <sup>8</sup> Reveiz L, Gaitán HG and Cuervo LG. 2007. Enemas during labour. *Cochrane Database System Review*. Oct 17(4): CD000330.
- <sup>9</sup> Lawn JE, Wilczynska-Ketende K and Cousens SN. 2006. Estimating the causes of 4 million neonatal deaths in the year 2000. *International Journal of Epidemiology* 35: 706-718.
- <sup>10</sup> Allegranzi B and Pittet D. 2009. Role of hand hygiene in healthcare-associated infection prevention. *J Hosp Infect* 73(4): 305-315. Epub Aug 31.
- <sup>11</sup> Zaidi AK, Huskins WC, Thaver D et al. 2005. Hospital-acquired neonatal infections in developing countries. *Lancet* 365(9465): 1175-1188.
- <sup>12</sup> Edmond B and Zaidi A. 2010. New approaches to preventing, diagnosing and treating neonatal sepsis. *PLoS Medicine* 7(3) : e1000213.
- <sup>13</sup> Rhee V et al. 2008. Maternal and birth attendant hand washing and neonatal mortality in southern Nepal. *Archives of Pediatric and Adolescent Medicine* 162(7): 603-608.
- <sup>14</sup> Mullany L et al. 2007. Risk factors for umbilical cord infection among newborns of Southern Nepal. *American Journal of Epidemiology* 165(2): 203-211.
- <sup>15</sup> Kampf G, Löffler H and Gastmeier P. 2009. Hand hygiene for the prevention of nosocomial infections. *Deutsches Ärzteblatt International* 106(40): 649-655.
- <sup>16</sup> Winani S, Wood S, Coffey P, Chirwa T, Mosha F and Changanalucha J. 2007. Use of a clean delivery kit and factors associated with cord infection and puerperal sepsis in Mwanza, Tanzania. *Journal of Midwifery and Women's Health* 98: 252-268.
- <sup>17</sup> Darmstadt GL, Hassan M, Balsara ZP, Winch PJ, Gipson R and Santosham M. 2009. Impact of clean delivery-kit use on newborn umbilical cord and maternal puerperal infections in Egypt. *J Health Popul Nutr* 27(6): 746-754.
- <sup>18</sup> Haws RA, Yakoob MY, Soomro T, Menezes EV, Darmstadt GL and Bhutta ZA. 2009. Reducing stillbirths: Screening and monitoring during pregnancy and labour. *BMC Pregnancy Childbirth* 9(Suppl 1): S5.
- <sup>19</sup> World Health Organization maternal health and safe motherhood programme. 1994. World Health Organization partograph in management of labor. *Lancet*. Vol. 343, pp. 1399-1404.
- <sup>20</sup> Tran SH et al. 2008. Length of rupture of membranes in the setting of premature rupture of membranes at term and infectious maternal morbidity. *American Journal of Obstetrics & Gynecology* 198(6): 700.e1-700.e5.
- <sup>21</sup> Snyder M and Jamieson B. 2007. What treatment approach to intrapartum maternal fever has the best fetal outcomes. *Journal of Family Practice* 56(5): 401-402.
- <sup>22</sup> Woods C and Levy C. 2010. Streptococcus Group B Infection. eMedicine from WebMD. Updated May 17. <http://emedicine.medscape.com/article/229091-overview> accessed on March 21, 2011.
- <sup>23</sup> CDC. 2010. Prevention of perinatal Group B Streptococcal Disease: Revised guidelines, 2010. *MMWR Recommendations and Reports*. 51(RR10): 1-32.
- <sup>24</sup> Black RE, Cousens S, Johnson HL, Lawn JE, Rudan I, Bassani DG, Jha P, Campbell H, Walker CF, Cibulskis R, Eisele T, Liu L, Mathers C; Child Health Epidemiology Reference Group of WHO and UNICEF. 2010. Global, regional, and national causes of child mortality in 2008: A systematic analysis. *Lancet* 375(9730): 1969-1987.
- <sup>25</sup> Ganatra HA, Stoll BJ and Zaidi AKM. 2010 International perspective on early-onset neonatal sepsis. *Clinical Perinatology* 37: 501-523.
- <sup>26</sup> Lawn JE, Kerber K, Enweronu-Laryea C and Massee Bateman O. 2009. Newborn survival in low resource settings—are we delivering? *BJOG: An International Journal of Obstetrics and Gynaecology* 116(Suppl 1): 49-59.
- <sup>27</sup> Rhee V, Mullany LC, Khatri SK, Katz J, LeClerq SC, Darmstadt GL and Tielsch JM. 2008. Maternal and birth hand washing and neonatal mortality in southern Nepal. *Archives of Pediatrics and Adolescent Medicine* 162(7): 603-608.
- <sup>28</sup> Mullany L, Darmstadt G, Khatri S, et al. Topical applications of CHX to the umbilical for prevention of omphalitis and neonatal mortality in southern Nepal: a community-based, cluster-randomized trial. *Lancet*. 2006;367:910-918.
- <sup>29</sup> Mullany L, Darmstadt G, Katz J, et al. Risk of mortality subsequent to umbilical cord infection among newborns of southern Nepal: cord infection and mortality. *The Pediatric Infectious Disease Journal*. 2009;28(1):17-20.
- <sup>30</sup> Zupan J, Garner P, Omari AAA. Topical umbilical cord care at birth. *Cochrane Database of Systematic Reviews* 2007, Issue 4. Art. No.: CD001057. DOI: 10.1002/14651858.CD001057.pub2.
- <sup>31</sup> WHO. Care of the umbilical cord: a review of the evidence. 1999. WHO/RHT/MSM/98.4.
- Capurro. H. Topical umbilical cord care at birth: RHL commentary (last revised: 30 September 2004). *The WHO Reproductive Health Library*; Geneva: World Health Organization
- <sup>30</sup> Chlorhexidine Technical Committee (USAID, Johns Hopkins School of Public Health, MCHIP, PATH, Save the Children, Saving Newborn Lives. September 2011. *Chlorhexidine for Umbilical Cord Care: Evidence Base and the Way Forward*. Nepalgunj, Nepal.
- <sup>31</sup> Darling EK and McDonald H. 2010. A meta-analysis of the efficacy of ocular prophylactic agents used for the prevention of gonococcal and chlamydial ophthalmia neonatorum. *Journal of Midwifery and Women's Health* (4): 319-327.