

#### 4. STRATEGIES FOR REDUCING NEONATAL DEATHS.

**Lawn JE, Manandhar A, Haws RA, Darmstadt GL. Reducing one million child deaths from birth asphyxia--a survey of health systems gaps and priorities. Health Res Policy Syst. 2007 May 16;5:4.**

BACKGROUND: Millions of child deaths and stillbirths are attributable to birth asphyxia, yet limited information is available to guide policy and practice, particularly at the community level. We surveyed selected policymakers, programme implementers and researchers to compile insights on policies, programmes, and research to reduce asphyxia-related deaths. METHOD: A questionnaire was developed and pretested based on an extensive literature review, then sent by email (or airmail or fax, when necessary) to 453 policymakers, programme implementers, and researchers active in child health, particularly at the community level. The survey was available in French and English and employed 5-point scales for respondents to rate effectiveness and feasibility of interventions and indicators. Open-ended questions permitted respondents to furnish additional details based on their experience. Significance testing was carried out using chi-square, F-test and Fisher's exact probability tests as appropriate. RESULTS: 173 individuals from 32 countries responded (44%). National newborn survival policies were reported to exist in 20 of 27 (74%) developing countries represented, but respondents' answers were occasionally contradictory and revealed uncertainty about policy content, which may hinder policy implementation. Respondents emphasized confusing terminology and a lack of valid measurement indicators at community level as barriers to obtaining accurate data for decision making. Regarding interventions, birth preparedness and essential newborn care were considered both effective and feasible, while resuscitation at community level was considered less feasible. Respondents emphasized health systems strengthening for both supply and demand factors as programme priorities, particularly ensuring wide availability of skilled birth attendants, promotion of birth preparedness, and promotion of essential newborn care. Research priorities included operationalising birth preparedness, effectively evaluating pregnancy risk in the community, ensuring roles for traditional birth attendants (TBAs) that link them with the health system, testing the cost-effectiveness of various community cadres for resuscitation, and developing a clear case definition for case management and population monitoring. CONCLUSION: **Without more attention to improve care and advance birth asphyxia research, the 2 million deaths related to asphyxia, plus associated maternal deaths, will remain out of reach of effective care, either skilled or community level, for many years to come.**

PMID: 17506872 [PubMed]

**Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE.**

**Continuum of care for maternal, newborn, and child health: from slogan to service delivery. Lancet. 2007 Oct 13;370(9595):1358-69.**

The continuum of care has become a rallying call to reduce the yearly toll of half

a million maternal deaths, 4 million neonatal deaths, and 6 million child deaths. The continuum for maternal, newborn, and child health usually refers to continuity of individual care. Continuity of care is necessary throughout the lifecycle (adolescence, pregnancy, childbirth, the postnatal period, and childhood) and also between places of caregiving (including households and communities, outpatient and outreach services, and clinical-care settings). We define a population-level or public-health framework based on integrated service delivery throughout the lifecycle, and propose eight packages to promote health for mothers, babies, and children. These packages can be used to deliver more than 190 separate interventions, which would be difficult to scale up one by one. The packages encompass three which are delivered through clinical care (reproductive health, obstetric care, and care of sick newborn babies and children); four through outpatient and outreach services (reproductive health, antenatal care, postnatal care and child health services); and one through integrated family and community care throughout the lifecycle. Mothers and babies are at high risk in the first days after birth, and the lack of a defined postnatal care package is an important gap, which also contributes to discontinuity between maternal and child health programmes. Similarly, because the family and community package tends not to be regarded as part of the health system, few countries have made systematic efforts to scale it up or integrate it with other levels of care. **Building the continuum of care for maternal, newborn, and child health with these packages will need effectiveness trials in various settings; policy support for integration; investment to strengthen health systems; and results-based operational management, especially at district level.**

PMID: 17933651 [PubMed - indexed for MEDLINE]

**Kerber K, Lawn JE, Bamford L, Moodley J, Pattinson R, Patrick M, Stephen C, Velaphi S. Every death counts: use of mortality audit data for decision making to save the lives of mothers, babies, and children in South Africa. Lancet. 2008 Apr 12;371(9620):1294-304.**

South Africa is one of the few developing countries with a national confidential inquiry into maternal deaths. 164 health facilities obtain audit data for stillbirths and neonatal deaths, and a new audit network does so for child deaths. Three separate reports have been published, providing valuable information about avoidable causes of death for mothers, babies, and children. These reports make health-system recommendations, many of which overlap and are intertwined with the scarcity of progress in addressing HIV/AIDS. The leaders of these three reports have united to prioritise actions to save the lives of South Africa's mothers, babies, and children. The country is off-track for the health-related Millennium Development Goals. Mortality in children younger than 5 years has increased, whereas maternal and neonatal mortality remain constant. This situation indicates the challenge of strengthening the health system because of high inequity and HIV/AIDS. **Coverage of services is fairly high, but addressing the gaps in quality and equity is essential to increasing the number of lives saved. Consistent leadership and accountability to address**

**crosscutting health system and equity issues, and to prevent mother-to-child transmission of HIV, would save tens of thousands of lives every year. Audit is powerful, but only if the data lead to action.**

PMID: 18406864 [PubMed - indexed for MEDLINE]

**Bryce J, Daelmans B, Dwivedi A, Fauveau V, Lawn JE, Mason E, Newby H, Shankar A, Starrs A, Wardlaw T. Countdown to 2015 for maternal, newborn, and child survival: the 2008 report on tracking coverage of interventions. Countdown Coverage Writing Group; Countdown to 2015 Core Group, Lancet. 2008 Apr 12;371(9620):1247-58.**

BACKGROUND: The Countdown to 2015 for Maternal, Newborn, and Child Survival initiative monitors coverage of priority interventions to achieve the Millennium Development Goals (MDG) for reduction of maternal and child mortality. We aimed to report on 68 countries which have 97% of maternal and child deaths worldwide, and on 22 interventions that have been proven to improve maternal, newborn, and child survival. METHODS: We selected countries with high rates of maternal and child deaths, and interventions with the most potential to avert such deaths. We analysed country-specific data for maternal and child mortality and coverage of selected interventions. We also tracked cause-of-death profiles; indicators of nutritional status; the presence of supportive policies; financial flows to maternal, newborn, and child health; and equity in coverage of interventions. FINDINGS: Of the 68 priority countries, 16 were on track to meet MDG 4. Of these, seven had been on track in 2005 when the Countdown initiative was launched, three (including China) moved into the on-track category in 2008, and six were included in the Countdown process for the first time in 2008. Trends in maternal mortality that would indicate progress towards MDG 5 were not available, but in most (56 of 68) countries, maternal mortality was high or very high. Coverage of different interventions varied widely both between and within countries. Interventions that can be routinely scheduled, such as immunisation and antenatal care, had much higher coverage than those that rely on functional health systems and 24-hour availability of clinical services, such as skilled or emergency care at birth and care of ill newborn babies and children. Data for postnatal care were either unavailable or showed poor coverage in almost all 68 countries. **The most rapid increases in coverage were seen for immunisation, which also received significant investment during this period.** INTERPRETATION: Rapid progress is possible, but much more can and must be done. Focused efforts will be needed to improve coverage, especially for priorities such as contraceptive services, care in childbirth, postnatal care, and clinical case management of illnesses in newborn babies and children.

PMID: 18406859 [PubMed - indexed for MEDLINE]

**Bhutta ZA, Darmstadt GL, Hasan BS, Haws RA. Community-based interventions for improving perinatal and neonatal health outcomes in developing countries: a review of the evidence. Pediatrics. 2005 Feb;115(2 Suppl):519-617.**

**BACKGROUND:** Infant and under-5 childhood mortality rates in developing countries have declined significantly in the past 2 to 3 decades. However, 2 critical indicators, maternal and newborn mortality, have hardly changed. World leaders at the United Nations Millennium Summit in September 2000 agreed on a critical goal to reduce deaths of children <5 years by two thirds, but this may be unattainable without halving newborn deaths, which now comprise 40% of all under-5 deaths. Greater emphasis on wide-scale implementation of proven, cost-effective measures is required to save women's and newborns' lives. Approximately 99% of neonatal deaths take place in developing countries, mostly in homes and communities. A comprehensive review of the evidence base for impact of interventions on neonatal health and survival in developing-country communities has not been reported. **OBJECTIVE:** This review of community-based antenatal, intrapartum, and postnatal intervention trials in developing countries aimed to identify (1) key behaviors and interventions for which the weight of evidence is sufficient to recommend their inclusion in community-based neonatal care programs and (2) key gaps in knowledge and priority areas for future research and program learning. **METHODS:** Available published and unpublished data on the impact of community-based strategies and interventions on perinatal and neonatal health status outcomes were reviewed. Evidence was summarized systematically and categorized into 4 levels of evidence based on study size, location, design, and reported impact, particularly on perinatal or neonatal mortality. The evidence was placed in the context of biological plausibility of the intervention; evidence from relevant developed-country studies; health care program experience in implementation; and recommendations from the World Health Organization and other leading agencies. **RESULTS:** A paucity of community-based data was found from developing-country studies on health status impact for many interventions currently being considered for inclusion in neonatal health programs. However, review of the evidence and consideration of the broader context of knowledge, experience, and recommendations regarding these interventions enabled us to categorize them according to the strength of the evidence base and confidence regarding their inclusion now in programs. This article identifies a package of priority interventions to include in programs and formulates research priorities for advancing the state of the art in neonatal health care. **CONCLUSIONS:** ***This review emphasizes some new findings while recommending an integrated approach to safe motherhood and newborn health.*** The results of this study provide a foundation for policies and programs related to maternal and newborn health and emphasizes the importance of health systems research and evaluation of interventions. The review offers compelling support for using research to identify the most effective measures to save newborn lives. It also may facilitate dialogue with policy makers about the importance of investing in neonatal health.

PMID: 15866863 [PubMed - indexed for MEDLINE]

**Bahl R, Martines J, Ali N, Bhan MK, Carlo W, Chan KY, Darmstadt GL, Hamer DH, Lawn JE, McMillan DD, Mohan P, Paul V, Tsai AC, Victora CG, Weber MW, Zaidi AK, Rudan I. Research priorities to reduce global**

**mortality from newborn infections by 2015. *Pediatr Infect Dis J.* 2009 Jan;28(1 Suppl):S43-8.**

BACKGROUND: Newborn infections are responsible for approximately one-third of the estimated 4.0 million neonatal deaths that occur globally every year. Appropriately targeted research is required to guide investment in effective interventions, especially in low resource settings. Setting global priorities for research to address neonatal infections is essential and urgent. METHODS: The Department of Child and Adolescent Health and Development of the World Health Organization (WHO/CAH) applied the Child Health and Nutrition Research Initiative (CHNRI) priority-setting methodology to identify and stimulate research most likely to reduce global newborn infection-related mortality by 2015. Technical experts were invited by WHO/CAH to systematically list and then use standard methods to score research questions according to their likelihood to (i) be answered in an ethical way, (ii) lead to (or improve) effective interventions, (iii) be deliverable, affordable, and sustainable, (iv) maximize death burden reduction, and (v) have an equitable effect in the population. The scores were then weighted according to the values provided by a wide group of stakeholders from the global research priority-setting network. FINDINGS: On a 100-point scale, the final priority scores for 69 research questions ranged from 39 to 83. Most of the 15 research questions that received the highest scores were in the domain of health systems and policy research to address barriers affecting existing cost-effective interventions. The priority questions focused on promotion of home care practices to prevent newborn infections and approaches to increase coverage and quality of management of newborn infections in health facilities as well as in the community. While community-based intervention research is receiving some current investment, rigorous evaluation and cost analysis is almost entirely lacking for research on facility-based interventions and quality improvement. INTERPRETATION: **Given the lack of progress in improving newborn survival despite the existence of effective interventions, it is not surprising that of the top ranked research priorities in this article the majority are in the domain of health systems and policy research. We urge funding agencies and investigators to invest in these research priorities to accelerate reduction of neonatal deaths, particularly those due to infections.**

PMID: 19106763 [PubMed - indexed for MEDLINE]

**Chopra M, Daviaud E, Pattinson R, Fonn S, Lawn JE. Saving the lives of South Africa's mothers, babies, and children: can the health system deliver? *Lancet.* 2009 Sep 5;374(9692):835-46. Epub 2009 Aug 24.**

South Africa is one of only 12 countries in which mortality rates for children have increased since the baseline for the Millennium Development Goals (MDGs) in 1990. Continuing poverty and the HIV/AIDS epidemic are important factors. Additionally, suboptimum implementation of high-impact interventions limits programme effectiveness; between a quarter and half of maternal, neonatal, and child deaths in national audits have an avoidable health-system factor contributing to the death. Using the LiST model, we estimate that 11,500 infants'

lives could be saved by effective implementation of basic neonatal care at 95% coverage. Similar coverage of dual-therapy prevention of mother-to-child transmission with appropriate feeding choices could save 37,200 children's lives in South Africa per year in 2015 compared with 2008. These interventions would also avert many maternal deaths and stillbirths. The total cost of such a target package is US\$1.5 billion per year, 24% of the public-sector health expenditure; the incremental cost is \$220 million per year. Such progress would put South Africa squarely on track to meet MDG 4 and probably also MDG 5. **The costs are affordable and the key gap is leadership and effective implementation at every level of the health system, including national and local accountability for service provision.**

PMID: 19709729 [PubMed - indexed for MEDLINE]

**Lee AC, Lawn JE, Cousens S, Kumar V, Osrin D, Bhutta ZA, Wall SN, Nandakumar AK, Syed U, Darmstadt GL. Linking families and facilities for care at birth: What works to avert intrapartum-related deaths? Int J Gynaecol Obstet. 2009 Aug 28. [Epub ahead of print]**

BACKGROUND: Delays in receiving effective care during labor and at birth may be fatal for the mother and fetus, contributing to 2 million annual intrapartum stillbirths and intrapartum-related neonatal deaths each year. OBJECTIVE: We present a systematic review of strategies to link families and facilities, including community mobilization, financial incentives, emergency referral and transport systems, prenatal risk screening, and maternity waiting homes. RESULTS: There is moderate quality evidence that community mobilization with high levels of community engagement can increase institutional births and significantly reduce perinatal and early neonatal mortality. Meta-analysis showed a doubling of skilled birth attendance and a 35% reduction in early neonatal mortality. However, no data are available on intrapartum-specific outcomes. Evidence is limited, but promising, that financial incentive schemes and community referral/transport systems may increase rates of skilled birth attendance and emergency obstetric care utilization; however, impact on mortality is unknown. Current evidence for maternity waiting homes and risk screening is low quality. CONCLUSIONS: **Empowering communities is an important strategy to reduce the large burden of intrapartum complications. Innovations are needed to bring the poor closer to obstetric care, such as financial incentives and cell phone technology. New questions need to be asked of "old" strategies such as risk screening and maternity waiting homes. The effect of all of these strategies on maternal and perinatal mortality, particularly intrapartum-related outcomes, requires further evaluation.**

PMID: 19815201 [PubMed - as supplied by publisher]

**Lawn JE, Kinney M, Lee AC, Chopra M, Donnay F, Paul VK, Bhutta ZA, Bateman M, Darmstadt GL. Reducing intrapartum-related deaths and disability: Can the health system deliver? Int J Gynaecol Obstet. 2009;**

BACKGROUND: Each year 1.02 million intrapartum stillbirths and 904000 intrapartum-related neonatal deaths (formerly called "birth asphyxia") occur,

closely linked to 536000 maternal deaths, an estimated 42% of which are intrapartum-related. OBJECTIVE: To summarize the results of a systematic evidence review, and synthesize actions required to strengthen healthcare delivery systems and home care to reduce intrapartum-related deaths. METHODS: For this series, systematic searches were undertaken, data synthesized, and meta-analyses carried out for various aspects of intrapartum care, including: obstetric care, neonatal resuscitation, strategies to link communities with facility-based care, care within communities for 60 million non-facility births, and perinatal audit. We used the Lives Saved Tool (LiST) to estimate neonatal deaths prevented with relevant interventions under 2 scenarios: (1) to address missed opportunities for facility and home births; and (2) assuming full coverage of comprehensive emergency obstetric care and emergency newborn care. Countries were first grouped into 5 Categories according to level of neonatal mortality rate and examined, and then priorities were suggested to reduce intrapartum-related deaths for each Category based on health performance and possible lives saved. RESULTS: There is moderate GRADE evidence of effectiveness for the reduction of intrapartum-related mortality through facility-based neonatal resuscitation, perinatal audit, integrated community health worker packages, and community mobilization. The quality of evidence for obstetric care is low, requiring further evaluation for effect on perinatal outcomes, but is expected to be high impact. Over three-quarters of intrapartum-related deaths occur in settings with weak health systems marked by low coverage of skilled birth attendance (<50%), low density of skilled human resources (<0.9 per 1000 population) and low per capita spending on health (<US \$20 per year). By providing comprehensive emergency obstetric care and emergency newborn care for births already occurring in facilities, 327200 intrapartum-related neonatal deaths could be averted globally, and with full (90%) coverage, 613000 intrapartum-related neonatal deaths could be saved, primarily in high mortality settings. CONCLUSION: **Even in high-performance settings, there is scope to improve intrapartum care and especially reduce impairment and disability. Addressing missed opportunities for births already occurring in facilities could avert 36% of intrapartum-related deaths. Improved quality of care through drills and audit are promising strategies. However, the majority of deaths occur in poorly performing health systems requiring urgent strategic planning and investment to scale up effective care at birth, neonatal resuscitation, and community mobilization as well as to develop, adapt, and introduce tools, technologies, and task shifting to reach the poorest.**

PMID: 19815205 [PubMed - as supplied by publisher]

**Pattinson R, Kerber K, Waiswa P, Day LT, Mussell F, Asiruddin S, Blencowe H, Lawn JE. Perinatal mortality audit: Counting, accountability, and overcoming challenges in scaling up in low- and middle-income countries. Int J Gynaecol Obstet. 2009;**

BACKGROUND: In high-income countries, national mortality audits are associated with improved quality of care, but there has been no previous

systematic review of perinatal audit in low- and middle-income settings. OBJECTIVES: To present a systematic review of facility-based perinatal mortality audit in low- and middle-income countries, and review information regarding community audit. RESULTS: Ten low-quality evaluations with mortality outcome data were identified. Meta-analysis of 7 before-and-after studies indicated a reduction in perinatal mortality of 30% (95% confidence interval, 21%-38%) after introduction of perinatal audit. The consistency of effect suggests that audit may be a useful tool for decreasing perinatal mortality rates in facilities and improving quality of care, although none of these evaluations were large scale. Few of the identified studies reported intrapartum-related perinatal outcomes. Novel experience of community audit and social autopsy is described, but data reporting mortality outcome effect are lacking. There are few examples of wide-scale, sustained perinatal audit in low-income settings. Two national cases studies (South Africa and Bangladesh) are presented. Programmatic decision points, challenges, and key factors for national or wide scale-up of sustained perinatal mortality audit are discussed. As a minimum standard, facilities should track intrapartum stillbirth and pre-discharge intrapartum-related neonatal mortality rates. CONCLUSION: **The effect of perinatal audit depends on the ability to close the audit loop; without effectively implementing the solutions to the problems identified, audit alone cannot improve quality of care.**

PMID: 19815206 [PubMed - as supplied by publisher]

**Opondo C, Ntoburi S, Wagai J, Wafula J, Wasunna A, Were F, Wamae A, Migiro S, Irimu G, English M. Are hospitals prepared to support newborn survival? - An evaluation of eight first-referral level hospitals in Kenya. Trop Med Int Health. 2009 Oct;14(10):1165-72. Epub 2009 Aug 19.**

OBJECTIVE: To assess the availability of resources that support the provision of basic neonatal care in eight first-referral level (district) hospitals in Kenya. METHODS: We selected two hospitals each from four of Kenya's eight provinces with the aim of representing the diversity of this part of the health system in Kenya. We created a checklist of 53 indicator items necessary for providing essential basic care to newborns and assessed their availability at each of the eight hospitals by direct observation, and then compared our observations with the opinions of health workers providing care to newborns on recent availability for some items, using a self-administered structured questionnaire. RESULTS: The hospitals surveyed were often unable to maintain a safe hygienic environment for patients and health care workers; staffing was insufficient and sometimes poorly organised to support the provision of care; some key equipment, laboratory tests, drugs and consumables were not available while patient management guidelines were missing in all sites. CONCLUSION: **Hospitals appear relatively poorly prepared to fill their proposed role in ensuring newborn survival. More effective interventions are needed to improve them to meet the special needs of this at-risk group.**

PMID: 19695001 [PubMed - indexed for MEDLINE]

**Seale AC, Mwaniki M, Newton CR, Berkley JA. Maternal and early onset neonatal bacterial sepsis: burden and strategies for prevention in sub-Saharan Africa. Lancet Infect Dis. 2009 Jul;9(7):428-38.**

Maternal and child health are high priorities for international development. Through a Review of published work, we show substantial gaps in current knowledge on incidence (cases per live births), aetiology, and risk factors for both maternal and early onset neonatal bacterial sepsis in sub-Saharan Africa. Although existing published data suggest that sepsis causes about 10% of all maternal deaths and 26% of neonatal deaths, these are likely to be considerable underestimates because of methodological limitations. Successful intervention strategies in resource-rich settings and early studies in sub-Saharan Africa suggest that the burden of maternal and early onset neonatal bacterial sepsis could be reduced through simple interventions, including antiseptic and antibiotic treatment. **An effective way to expedite evidence to guide interventions and determine the incidence, aetiology, and risk factors for sepsis in sub-Saharan Africa would be through a multiarmed factorial intervention trial aimed at reducing both maternal and early onset neonatal bacterial sepsis in sub-Saharan Africa.**

PMID: 19555902 [PubMed - indexed for MEDLINE]

**Accorsi S, Kedir N, Farese P, Dhaba S, Racalbutto V, Seifu A, Manenti F. Poverty, inequality and health: the challenge of the double burden of disease in a non-profit hospital in rural Ethiopia. Trans R Soc Trop Med Hyg. 2009 May;103(5):461-8. Epub 2009 Jan 20.**

This study was aimed at describing disease patterns in a rural zone of Oromiya region, Ethiopia through a retrospective analysis of discharge records for 22,377 inpatients of St. Luke Hospital, Wolisso, Ethiopia in the period 2005-2007. The leading cause of admission was childbirth, followed by injuries, malaria and pneumonia. Injuries were the leading cause of in-hospital deaths, followed by pneumonia, malaria, cardiovascular disease and AIDS. Vulnerable groups (infants, children and women) accounted for 73.3% of admissions. Most of the disease burden resulted from infectious diseases, the occurrence of which could be dramatically reduced by cost-effective preventive and curative interventions. Furthermore, a double burden of disease is already emerging at the early stage of the epidemiological transition, with a mix of persistent, emerging and re-emerging infectious diseases and increasing prevalence of chronic conditions and injuries. This will lead to fundamental changes in the volume and costly service utilization patterns. The challenge is to address the double burden of disease, while focusing on poverty-related conditions and targeting vulnerable groups. **Monitoring disease and service utilization patterns through routine hospital information systems can provide sustainable, low-cost support for evidence-based health practice.**

PMID: 19157475 [PubMed - indexed for MEDLINE]

**Edmond KM, Quigley MA, Zandoh C, Danso S, Hurt C, Owusu Agyei S, Kirkwood BR. Aetiology of stillbirths and neonatal deaths in rural Ghana: implications for health programming in developing countries. Paediatr Perinat Epidemiol. 2008 Sep;22(5):430-7.**

In developing countries many stillbirths and neonatal deaths occur at home and cause of death is not recorded by national health information systems. A community-level verbal autopsy tool was used to obtain data on the aetiology of stillbirths and neonatal deaths in rural Ghana. Objectives were to describe the timing and distribution of causes of stillbirths and neonatal deaths according to site of death (health facility or home). Data were collected from 1 January 2003 to 30 June 2004; 20,317 deliveries, 696 stillbirths and 623 neonatal deaths occurred over that time. Most deaths occurred in the antepartum period (28 weeks gestation to the onset of labour) (33.0%). However, the highest risk periods were during labour and delivery (intrapartum period) and the first day of life. Infections were a major cause of death in the antepartum (10.1%) and neonatal (40.3%) periods. The most important cause of intrapartum death was obstetric complications (59.3%). There were significantly fewer neonatal deaths resulting from birth asphyxia in the home than in the health facilities and more deaths from infection. Only 59 (20.7%) mothers of neonates who died at home reported that they sought care from an appropriate health care provider (doctor, nurse or health facility) during their baby's illness. The results from this study highlight the importance of studying community-level data in developing countries and the high risk of intrapartum stillbirths and infectious diseases in the rural African mother and neonate. **Community-level interventions are urgently needed, especially interventions that reduce intrapartum deaths and infection rates in the mother and infant.**

PMID: 18782251 [PubMed - indexed for MEDLINE]

**Bhutta ZA, Darmstadt GL, Haws RA, Yakoob MY, Lawn JE. Delivering interventions to reduce the global burden of stillbirths: improving service supply and community demand. BMC Pregnancy Childbirth. 2009 May 7;9 Suppl 1:S7.**

**BACKGROUND:** Although a number of antenatal and intrapartum interventions have shown some evidence of impact on stillbirth incidence, much confusion surrounds ideal strategies for delivering these interventions within health systems, particularly in low-/middle-income countries where 98% of the world's stillbirths occur. Improving the uptake of quality antenatal and intrapartum care is critical for evidence-based interventions to generate an impact at the population level. This concluding paper of a series of papers reviewing the evidence for stillbirth interventions examines the evidence for community and health systems approaches to improve uptake and quality of antenatal and intrapartum care, and synthesises programme and policy recommendations for how best to deliver evidence-based interventions at community and facility levels, across the continuum of care, to reduce stillbirths. **METHODS:** We systematically searched PubMed and the Cochrane Library for abstracts pertaining to community-based and health-systems strategies to increase uptake and quality of antenatal and

intrapartum care services. We also sought abstracts which reported impact on stillbirths or perinatal mortality. Searches used multiple combinations of broad and specific search terms and prioritised rigorous randomised controlled trials and meta-analyses where available. Wherever eligible randomised controlled trials were identified after a Cochrane review had been published, we conducted new meta-analyses based on the original Cochrane criteria. RESULTS: In low-resource settings, cost, distance and the time needed to access care are major barriers for effective uptake of antenatal and particularly intrapartum services. A number of innovative strategies to surmount cost, distance, and time barriers to accessing care were identified and evaluated; of these, community financial incentives, loan/insurance schemes, and maternity waiting homes seem promising, but few studies have reported or evaluated the impact of the wide-scale implementation of these strategies on stillbirth rates. Strategies to improve quality of care by upgrading the skills of community cadres have shown demonstrable impact on perinatal mortality, particularly in conjunction with health systems strengthening and facilitation of referrals. Neonatal resuscitation training for physicians and other health workers shows potential to prevent many neonatal deaths currently misclassified as stillbirths. Perinatal audit systems, which aim to improve quality of care by identifying deficiencies in care, are a quality improvement measure that shows some evidence of benefit for changes in clinical practice that prevent stillbirths, and are strongly recommended wherever practical, whether as hospital case review or as confidential enquiry at district or national level. CONCLUSION: Delivering interventions to reduce the global burden of stillbirths requires action at all levels of the health system. Packages of interventions should be tailored to local conditions, including local levels and causes of stillbirth, accessibility of care and health system resources and provider skill. Antenatal care can potentially serve as a platform to deliver interventions to improve maternal nutrition, promote behaviour change to reduce harmful exposures and risk of infections, screen for and treat risk factors, and encourage skilled attendance at birth. Following the example of high-income countries, improving intrapartum monitoring for fetal distress and access to Caesarean section in low-/middle-income countries appears to be key to reducing intrapartum stillbirth. In remote or low-resource settings, families and communities can be galvanised to demand and seek quality care through financial incentives and health promotion efforts of local cadres of health workers, though these interventions often require simultaneous health systems strengthening. **Perinatal audit can aid in the development of better standards of care, improving quality in health systems. Effective strategies to prevent stillbirth are known; gaps remain in the data, the evidence and perhaps most significantly, the political will to implement these strategies at scale.**

PMID: 19426470 [PubMed - indexed for MEDLINE]

**Haws RA, Yakoob MY, Soomro T, Menezes EV, Darmstadt GL, Bhutta ZA.**

**Reducing stillbirths: screening and monitoring during pregnancy and labour. BMC Pregnancy Childbirth. 2009 May 7;9 Suppl 1:S5.**

BACKGROUND: Screening and monitoring in pregnancy are strategies used by

healthcare providers to identify high-risk pregnancies so that they can provide more targeted and appropriate treatment and follow-up care, and to monitor fetal well-being in both low- and high-risk pregnancies. The use of many of these techniques is controversial and their ability to detect fetal compromise often unknown. Theoretically, appropriate management of maternal and fetal risk factors and complications that are detected in pregnancy and labour could prevent a large proportion of the world's 3.2 million estimated annual stillbirths, as well as minimise maternal and neonatal morbidity and mortality. METHODS: The fourth in a series of papers assessing the evidence base for prevention of stillbirths, this paper reviews available published evidence for the impact of 14 screening and monitoring interventions in pregnancy on stillbirth, including identification and management of high-risk pregnancies, advanced monitoring techniques, and monitoring of labour. Using broad and specific strategies to search PubMed and the Cochrane Library, we identified 221 relevant reviews and studies testing screening and monitoring interventions during the antenatal and intrapartum periods and reporting stillbirth or perinatal mortality as an outcome. RESULTS: We found a dearth of rigorous evidence of direct impact of any of these screening procedures and interventions on stillbirth incidence. Observational studies testing some interventions, including fetal movement monitoring and Doppler monitoring, showed some evidence of impact on stillbirths in selected high-risk populations, but require larger rigorous trials to confirm impact. Other interventions, such as amniotic fluid assessment for oligohydramnios, appear predictive of stillbirth risk, but studies are lacking which assess the impact on perinatal mortality of subsequent intervention based on test findings. Few rigorous studies of cardiotocography have reported stillbirth outcomes, but steep declines in stillbirth rates have been observed in high-income settings such as the U.S., where cardiotocography is used in conjunction with Caesarean section for fetal distress. CONCLUSION: **There are numerous research gaps and large, adequately controlled trials are still needed for most of the interventions we considered. The impact of monitoring interventions on stillbirth relies on use of effective and timely intervention should problems be detected. Numerous studies indicated that positive tests were associated with increased perinatal mortality, but while some tests had good sensitivity in detecting distress, false-positive rates were high for most tests, and questions remain about optimal timing, frequency, and implications of testing.** Few studies included assessments of impact of subsequent intervention needed before recommending particular monitoring strategies as a means to decrease stillbirth incidence. In high-income countries such as the US, observational evidence suggests that widespread use of cardiotocography with Caesarean section for fetal distress has led to significant declines in stillbirth rates. Efforts to increase availability of Caesarean section in low-/middle-income countries should be coupled with intrapartum monitoring technologies where resources and provider skills permit.

PMID: 19426468 [PubMed - indexed for MEDLINE]

**El Amin S, Langhoff-Roos J, Bødker B, Bakr AA, Ashmeig AL, Ibrahim SA, Lindmark G. Introducing qualitative perinatal audit in a tertiary hospital in Sudan. Health Policy Plan. 2002 Sep;17(3):296-303.**

In a 3-month period, May to August 2000, the perinatal mortality rate at Omdurman Maternity Hospital (OMH), Sudan, was 8.2%. Two groups of perinatal deaths, intrapartum deaths of non-malformed infants and neonatal deaths of mature infants above 34 weeks, both considered to be potentially avoidable by improved care, were in excess when compared with other regions. It was therefore decided to perform in-depth assessment of cases in these two groups. An interdisciplinary internal audit was designed in collaboration with two external obstetricians. The audit activity was preceded by a 2-day workshop at the hospital. Individual assessments based on 43 detailed narratives were followed by regular consensus meetings. This structure seemed useful for interdisciplinary discussions, and the audit process resulted in several specific suggestions for quality improvement in data collection, interdisciplinary collaboration, and obstetric and neonatal care. The present audit activity is not very resource demanding and therefore a good starting point for quality assurance in a developing country. However, since adverse outcome audit only focuses on selected cases and may encourage interventions without considering the full impact on the population, it should not stand alone. **Audit of perinatal deaths should be combined with other quantitative and qualitative quality assessment activities for improvement of perinatal care.**

PMID: 12135996 [PubMed - indexed for MEDLINE]

**Mancey-Jones M, Brugha RF. Using perinatal audit to promote change: a review. Health Policy Plan. 1997 Sep;12(3):183-92.**

Close to half of all infant deaths world-wide now occur in the first week of life, almost all in developing countries, and the perinatal mortality rate (PNMR) is used as an indicator of the quality of health service delivery. Clinical audit aims to improve quality of care through the systematic assessment of practice against a defined standard, with a view to recommending and implementing measures to address specific deficiencies in care. Perinatal outcome audit evaluates crude or cause-specific PNMRs, reviewing secular trends over several years or comparing rates between similar institutions. However, the PNMR may not be a valid, reliable and sensitive indicator of quality of care at the institutional level in developing countries because of variations in the presenting case-mix, various confounding non-health service factors and the small number of deaths which occur. Process audit compares actual practice with standard (best) practice, based on the evidence of research or expert consensus. Databases reviewing the management of reproductive health problems in developing countries are currently being prepared so as to provide clinicians and health service managers with up-to-date information to support the provision of evidence-based care. Standard practice should be adapted and defined in explicit management guidelines, taking into account local resources and circumstances. Forms of process audit include the review of care procedures in cases which have resulted in a pre-defined adverse outcome, known as 'sentinel event audit'; and the review

of all cases where a particular care activity was received or indicated, known as 'topic audit'. These are complementary and each depends on the quality of recorded data. The forum for comparing observed practice with the standard may be external, utilising an 'expert committee', or internal, in which care providers audit their own activities. Local internal audit is more likely to result in improvements in care if it is conducted in a structured and culturally sensitive way, and if all levels of staff are involved in reviewing activities and in formulating recommendations. **However, further research is needed to identify the factors which determine the effectiveness and sustainability of perinatal audit in different developing country settings.**

PIP: Almost half of all infant deaths worldwide occur during the first week of life, almost all in developing countries. The perinatal mortality rate (PNMR) is used as an indicator of the quality of health service delivery. Clinical audits are conducted with the goal of improving the quality of care through the systematic assessment of practice against a defined standard, leading to the recommendation and implementation of measures to address specific deficiencies in care. Perinatal outcome audits evaluate crude or cause-specific PNMRs, reviewing secular trends over several years or comparing rates between similar institutions. The PNMR, however, may not be a valid, reliable, and sensitive indicator of quality of care at the institutional level in developing countries due to variations in the presenting case-mix, confounding non-health service factors, and the small number of deaths which occur. Process audits compare actual practice with standard practice, based upon evidence of research or expert consensus. The authors discuss auditing perinatal care outcomes and processes, mechanisms for conducting perinatal audits, formulating recommendations, implementing change and reassessing practice, and the impact of perinatal audits in developing countries.

PMID: 10173399 [PubMed - indexed for MEDLINE]

**Kilonzo A, Kouletio M, Whitehead SJ, Curtis KM, McCarthy BJ. Improving surveillance for maternal and perinatal health in 2 districts of rural Tanzania. Am J Public Health. 2001 Oct;91(10):1636-40.**

OBJECTIVES: As part of a community-based reproductive health project in rural Tanzania, a maternal and perinatal health care surveillance system was established to monitor pregnancy outcomes. This report presents preliminary results. METHODS: Village health workers were trained to collect data during health education visits to pregnant and postpartum women. Maternal and fetal or infant survival or deaths were tracked on a community monitoring board. RESULTS: Among 904 pregnancies, the fetoneonatal mortality rate was 69.4 deaths per 1000 live births and fetal deaths; 4 maternal deaths occurred. Intrapartum and early neonatal deaths of infants with birthweights of 1500 g or greater represented a large proportion of deaths. CONCLUSIONS: **These preliminary results will be used to prioritize project interventions, including increasing access to skilled delivery care.**

PMID: 11574326 [PubMed - indexed for MEDLINE]

**Evjen-Olsen B, Olsen OE, Kvåle G. Achieving progress in maternal and neonatal health through integrated and comprehensive healthcare services - experiences from a programme in northern Tanzania. Int J Equity Health. 2009 Jul 30;8:27.**

**ABSTRACT: BACKGROUND:** An integrated and comprehensive hospital/community based health programme is presented, aimed at reducing maternal and child mortality and morbidity. It is run as part of a general programme of health care at a rural hospital situated in northern Tanzania. The purpose was through using research and statistics from the programme area, to illustrate how a hospital-based programme with a vision of integrated healthcare may have contributed to the lower figures on mortality found in the area. Such an approach may be of interest to policy makers, in relation to the global strategy that is now developed in order to meet the MDGs 4 and 5. **PROGRAMME SETTING:** The hospital provides reproductive and child health services, PMTCT-plus, comprehensive emergency obstetric care, ambulance, radio and transport services, paediatric care, an HIV/AIDS programme, and a generalised healthcare service to a population of approximately 500 000. **PROGRAMME DESCRIPTION AND OUTCOMES:** We describe these services and their potential contribution to the reduction of the maternal and neonatal mortality ratios in the study area. Several studies from this area have showed a lower maternal mortality and neonatal mortality ratio compared to other studies from Tanzania and the national estimates. Many donor-funded programmes focusing on maternal and child health are vertical in their framework. However, the hospital, being the dominant supplier of health services in its catchment area, has maintained a horizontal approach through a comprehensive care programme. The total cost of the comprehensive hospital programme described is 3.2 million USD per year, corresponding to 6.4 USD per capita. **CONCLUSION:** Considering the relatively low cost of a comprehensive hospital programme including outreach services and the lower mortality ratios found in the catchment area of the hospital, we argue that donor funds should be used for supporting horizontal programmes aimed at comprehensive healthcare services. Through a strengthening of the collaboration between government and voluntary agency facilities, with clinical, preventive and managerial capabilities of the health facilities, the programmes will have a more sustainable impact and will achieve greater progress in the reduction of maternal and neonatal mortality, as opposed to vertical and segregated programmes that currently are commonly adopted for averting maternal and child deaths. ***Thus, we conclude that horizontal and comprehensive services of the type described in this article should be considered as a prerequisite for sustainable health care delivery at all policy and decision-making levels of the local, national and international health care delivery pyramid.***

PMID: 19642990 [PubMed – in process]

**Sépou A, Yanza MC, Nguembi E, Dotte GR, Nali MN. Analysis of transfers in the Gynecology and Obstetrics Department of Bangui Hospital. Sante. 2000 Nov-Dec;10(6):399-405.**

During a study carried out over twelve months in the National Reference Center for Gynecology and Obstetrics at Bangui Hospital, we recorded 1,369 cases of evacuation in a total 5,020 admissions to the department. This corresponds to a frequency of 27.3%. In 73.8% of cases, this intervention was performed for obstetric reasons. It was justified in 73.1% of cases, and 96.5% of the justified interventions were for obstetric reasons. The unjustified interventions led to a normal delivery in 97% of cases. Errors in diagnosis were detected in 16.5% of the cases. In terms of prognosis, we recorded 91 deaths in the perinatal period (96 per thousand live births) and 37 maternal deaths (of the 39 recorded in the department), accounting for 94.9% of all maternal deaths, with a mortality rate of 2.7% for women undergoing uterine evacuation. Infant mortality was higher in cases of late intervention. **The most frequent causes of death of the mothers were hemorrhagia on delivery, severe infection, rupture of the uterus and the tearing of soft tissues.**

PMID: 11226936 [PubMed - indexed for MEDLINE]

**Vaahtera M, Kulmala T, Ndekha M, Koivisto AM, Cullinan T, Salin ML, Ashorn P. Antenatal and perinatal predictors of infant mortality in rural Malawi. Arch Dis Child Fetal Neonatal Ed. 2000 May;82(3):F200-4.**

BACKGROUND: The slow pace in the reduction of infant mortality in sub-Saharan Africa has partially been attributed to the epidemic of human immunodeficiency virus (HIV) infection. To facilitate early interventions, antenatal and perinatal predictors of 1st year mortality were identified in a rural community in southern Malawi. METHODS: A cohort of 733 live born infants was studied prospectively from approximately 24 gestation weeks onwards. Univariate analysis was used to determine relative risks for infant mortality after selected antenatal and perinatal exposures. Multivariate modelling was used to control for potential confounders. FINDINGS: The infant mortality rate was 136 deaths/1000 live births. Among singleton newborns, the strongest antenatal and perinatal predictors of mortality were birth between May and July, maternal primiparity, birth before 38th gestation week, and maternal HIV infection. Theoretically, exposure to these variables accounted for 22%, 22%, 17%, and 15% of the population attributable risk for infant mortality, respectively. INTERPRETATION: The HIV epidemic was an important but not the main determinant of infant mortality. **Interventions targetting the offspring of primiparous women or infants born between May and July or prevention of prematurity would all have considerable impact on infant survival.**

PMID: 10794786 [PubMed - indexed for MEDLINE]

**Leach A, McArdle TF, Banya WA, Krubally O, Greenwood AM, Rands C, Adegbola R, de Francisco A, Greenwood BM. Neonatal mortality in a rural area of The Gambia. Ann Trop Paediatr. 1999 Mar;19(1):33-43.**

Childhood mortality in Upper River Division, The Gambia is high, 99 per 1000

mid-year population, and 27% of deaths occur in the neonatal period. The aims of the present study were to describe patterns of neonatal death and to identify risk factors. Cause of death was investigated using a neonatal post-mortem questionnaire, and a population-based, matched case-control study was conducted to identify potential risk factors. The neonatal mortality rate in Upper River Division was 39 per 1000 live births (95% CI 36.8-41.2). The rates in the early and late neonatal periods were 21.0 (19.4-22.6) and 18.0 (16.5-19.5), respectively. Infection accounted for 57% of all deaths. In the early neonatal period, 30% of deaths were due to prematurity. Only 55% of babies who died presented for treatment and 84% died at home. Risk factors for neonatal death were primiparity (OR 2.18), previous stillbirth (OR 3.19), prolonged labour (OR 2.80) and pre-lacteal feeding (OR 3.38). A protective effect was seen in association with delivery by a trained traditional birth attendant (OR 0.34) and the application of shea nut butter, a traditional medicine, to the cord stump (OR 0.07). **This study has identified the need to understand the reasons underlying the widespread use of pre-lacteal feeds and the barriers to health service use in this community in order to plan effective interventions.**

PMID: 10605518 [PubMed - indexed for MEDLINE]

**Wilkinson D. Reducing perinatal mortality in developing countries. Health Policy Plan. 1997 Jun;12(2):161-5.**

The perinatal mortality rate (PNMR) is a key health status indicator. It is multifactorial in aetiology and is significantly influenced by the quality of health care. While there is an ethical imperative to act to improve quality of care when deficiencies are apparent, the lack of controls--when an intervention is applied to an entire service--makes it difficult to infer a causal relationship between the intervention and any subsequent change in PNMR. However, by specifically measuring avoidable perinatal deaths (those due to error or omission on the part of the health service), this limitation is partially overcome, and the impact of the intervention can be more rigorously evaluated. This paper reports the impact of perinatal audit in a rural African health district between 1991 and 1995. A total of 21,112 consecutive births were studied: the average number of deliveries increased by 31% from 325 to 424 per month. The PNMR (birth weight > or = 1000g) in 1991 was 27/1000, increased to 42/1000 in 1992, and fell steadily to 26/1000 in 1995 (40% reduction;  $p = 0.002$ ). The proportion of avoidable deaths fell from 19% in 1991 to zero in the second half of 1995 ( $p = 0.0008$ ). While factors associated with perinatal mortality are many, complex, and interrelated, this report suggests that mortality can be reduced significantly in resource-poor settings by improving quality of health care. **Including the measurement of avoidable deaths in perinatal audit allows the impact of interventions to be more rigorously assessed than by simple measuring the PNMR.**

PIP: This study determines the perinatal mortality rates (PNMR) in Hlabisa Maternity Hospital and eight village clinics in KwaZulu/Natal, South Africa, during May 1991 to December 1995. The PNMR is the number of stillbirths and the number of deaths before discharge per 1000 total births. Avoidable perinatal

death is death determined to be directly due to an error or omission on the part of the health service. Interventions aimed to increase the quality of care and reduce avoidable perinatal mortality. Interventions included structural and functional changes in the maternity services throughout the district, using protocols for care, and conducting in-service training. Hlabisa Hospital and the eight clinics saw 21,112 births during the study's time period. The average monthly number of deliveries increased from 325 in 1991 to 424 in 1995. 653 perinatal deaths occurred. The PNMR for the 8-month period in 1991 was 27/1000. PNMR was 36/1000 in the first half of 1992, 42/1000 in the second half, and declined to 26/1000 thereafter. 19% of deaths were avoidable in 1991; zero deaths were avoidable in 1995. The proportion of births in clinics was 35% of the total births throughout the time period. Perinatal deaths in clinics declined from 17% in 1991 to 6.3% in the second half of 1995. This study indicates that quality of care improvements are possible, despite increased workload. Two elements were considered crucial in the early stages of the intervention: clinic staff's adoption of the concept of district-wide services and opportunity to refer any cases to neighboring hospitals. Avoidable deaths were reduced by 61%, despite a 16% increase in workload. The initial rise in PNMR is attributed to the shift to managing high-risk cases in hospitals. PNMR decline is attributed to the continuous and rigorous audit of services and to the use of the concept of avoidable deaths for monitoring quality of care.

PMID: 10168198 [PubMed - indexed for MEDLINE]

**Cutland CL, Madhi SA, Zell ER, Kuwanda L, Laque M, Groome M, Gorwitz R, Thigpen MC, Patel R, Velaphi SC, Adrian P, Klugman K, Schuchat A, Schrag SJ; PoPS Trial Team. Chlorhexidine maternal-vaginal and neonate body wipes in sepsis and vertical transmission of pathogenic bacteria in South Africa: a randomised, controlled trial. Lancet. 2009 Dec 5;374(9705):1909-16. Epub 2009 Oct 19.**

**BACKGROUND:** About 500,000 sepsis-related deaths per year arise in the first 3 days of life. On the basis of results from non-randomised studies, use of vaginal chlorhexidine wipes during labour has been proposed as an intervention for the prevention of early-onset neonatal sepsis in developing countries. We therefore assessed the efficacy of chlorhexidine in early-onset neonatal sepsis and vertical transmission of group B streptococcus. **METHODS:** In a trial in Soweto, South Africa, 8011 women (aged 12-51 years) were randomly assigned in a 1:1 ratio to chlorhexidine vaginal wipes or external genitalia water wipes during active labour, and their 8129 newborn babies were assigned to full-body (intervention group) or foot (control group) washes with chlorhexidine at birth, respectively. In a subset of mothers (n=5144), we gathered maternal lower vaginal swabs and neonatal skin swabs after delivery to assess colonisation with potentially pathogenic bacteria. Primary outcomes were neonatal sepsis in the first 3 days of life and vertical transmission of group B streptococcus. Analysis was by intention to treat. The trial is registered with ClinicalTrials.gov, number NCT00136370. **FINDINGS:** Rates of neonatal sepsis did not differ between the groups (chlorhexidine 141 [3%] of 4072 vs control 148 [4%] of 4057; p=0.6518). Rates of

colonisation with group B streptococcus in newborn babies born to mothers in the chlorhexidine (217 [54%] of 401) and control groups (234 [55%] of 429) did not differ (efficacy -0.05%, 95% CI -9.5 to 7.9). INTERPRETATION: **Because chlorhexidine intravaginal and neonatal wipes did not prevent neonatal sepsis or the vertical acquisition of potentially pathogenic bacteria among neonates, we need other interventions to reduce childhood mortality.**

PMID: 19846212 [PubMed - indexed for MEDLINE]

**Lumbiganon P, Thinkhamrop J, Thinkhamrop B, Tolosa JE. Vaginal chlorhexidine during labour for preventing maternal and neonatal infections (excluding Group B Streptococcal and HIV). Cochrane Database Syst Rev. 2004 Oct 18;(4):CD004070.**

BACKGROUND: The incidence of chorioamnionitis occurs in between 8 to 12 women for every 1000 live births and 96% of the cases of chorioamnionitis are due to ascending infection. Following spontaneous vaginal delivery, 1% to 4% of women develop postpartum endometritis. The incidence of neonatal sepsis is 0.5% to 1% of all infants born. Maternal vaginal bacteria are the main agents for these infections. It is reasonable to speculate that prevention of maternal and neonatal infections might be possible by washing the vagina and cervix with an antibacterial agent for all women during labour. Chlorhexidine belongs to the class of compounds known as the bis-biguanides. Chlorhexidine has antibacterial action against a wide range of aerobic and anaerobic bacteria, including those implicated in peripartal infections. OBJECTIVES: To evaluate the effectiveness and side-effects of chlorhexidine vaginal douching during labour in reducing maternal and neonatal infections (excluding Group B Streptococcal and HIV). SEARCH STRATEGY: We searched the Cochrane Pregnancy and Childbirth Group trials register (July 2003), the Cochrane Central Register of Controlled Trials (The Cochrane Library, Issue 4, 2002), MEDLINE (from 1966 to 2002), EMBASE (from 1980 to 2002), CINAHL (from 1982 to 2002) and LILACS (from 1982 to 2002). SELECTION CRITERIA: Randomized or quasi-randomized trials comparing chlorhexidine vaginal douching during labour with placebo or other vaginal disinfectant to prevent (reduce) maternal and neonatal infections (excluding Group B Streptococcal and HIV). DATA COLLECTION AND ANALYSIS: Two reviewers independently assessed trial eligibility and quality, extracted and entered the data into the RevMan software and interpreted the data. A third reviewer analysed and interpreted the data. The fourth reviewer also interpreted the data. MAIN RESULTS: Three studies (3012 participants) were included. There was no evidence of an effect of vaginal chlorhexidine during labour in preventing maternal and neonatal infections. Although the data suggest a trend in reducing postpartum endometritis, the difference was not statistically significant (relative risk 0.83; 95% confidence interval 0.61 to 1.13). REVIEWERS' CONCLUSIONS: **There is no evidence to support the use of vaginal chlorhexidine during labour in preventing maternal and neonatal infections.** There is a need for a well-designed randomized controlled trial using appropriate concentration and volume of vaginal chlorhexidine irrigation solution and with adequate sample size.

PMID: 15495077 [PubMed - indexed for MEDLINE]

**Wiysonge CS, Shey MS, Shang JD, Sterne JA, Brocklehurst P. Vaginal disinfection for preventing mother-to-child transmission of HIV infection. *Cochrane Database Syst Rev.* 2005 Oct 19;(4):CD003651.**

BACKGROUND: Mother-to-child transmission (MTCT) of HIV infection is one of the most tragic consequences of the HIV epidemic, especially in resource-limited countries, resulting in about 650 000 new paediatric HIV infections each year worldwide. The paediatric HIV epidemic threatens to seriously undermine decade-old child survival programmes. OBJECTIVES: To estimate the effect of vaginal disinfection on the risk of MTCT of HIV and infant and maternal mortality and morbidity, as well as tolerability of vaginal disinfection in HIV-infected women. SEARCH STRATEGY: We searched the Cochrane Controlled Trials Register, Cochrane Pregnancy and Childbirth Register, PubMed, EMBASE, AIDSLINE, LILACS, AIDSTRIALS, and AIDSDRUGS, using standardised methodological filters for identifying trials. We also searched reference lists of identified articles, relevant editorials, expert opinions and letters to journal editors, and abstracts and proceedings of relevant conferences, and contacted subject experts and pharmaceutical companies. There were no language restrictions. SELECTION CRITERIA: Randomised trials or clinical trials comparing vaginal disinfection during labour with placebo or no treatment, in known HIV-infected pregnant women. Trials had to include an estimate of the effect of vaginal disinfection on MTCT of HIV and or infant and maternal mortality and morbidity. DATA COLLECTION AND ANALYSIS: Three authors independently assessed trial eligibility and quality, and extracted data. Meta-analysis was performed using the Yusuf-Peto modification of Mantel-Haenszel's fixed effect method. MAIN RESULTS: Only two trials that included 708 patients met the inclusion criteria. The effect of vaginal disinfection on the risk of MTCT of HIV (OR 0.93, 95% CI 0.65 to 1.33), neonatal death (OR 1.38, 95% CI 0.30 to 6.33), and death after the neonatal period (OR 1.45, 95% CI 0.47 to 4.45) is uncertain. There was no evidence that vaginal disinfection increased adverse effects in mothers (OR 1.15, 95% CI 0.41 to 3.22), and evidence from one trial showed that adverse effects decreased in neonates (OR 0.14, 95% CI 0.07 to 0.31). AUTHORS' CONCLUSIONS: Currently, there is no evidence of an effect of vaginal disinfection on the risk of MTCT of HIV. ***Given its simplicity and low cost, there is need for a large well-designed and well-conducted randomised controlled trial to assess the additive effect of vaginal disinfection on the risk of MTCT of HIV in antiretroviral treated women.***

PMID: 16235334 [PubMed - indexed for MEDLINE]

**Sule SS, Onayade AA. Community-based antenatal and perinatal interventions and newborn survival. *Niger J Med.* 2006 Apr-Jun;15(2):108-14.**

BACKGROUND: As part of the millennium development goal (MDG) 4 to reduce by two-thirds the mortality rate among children under five, neonatal mortality rate (NMR) needs to be reduced by half. This is a selective review of the literature of

the morbidity and mortality patterns among newborns as well as cost-effective interventions and community aspects of newborn care. METHODS: Documented causes of morbidity and mortality among newborns were examined in the overall context of developing and developed countries. Cost-effective interventions that have been proven to be inexpensive with evidence or potential to save newborns' lives by international agencies concerned with health, journals and other publications were reviewed. Community aspects of newborn care and what is required at the individual, household and community levels to reduce neonatal morbidity and mortality were also reviewed. RESULTS: A score of recent publications by the World Health Organization (WHO), Save-the-Children, United Nations Children's Fund (UNICEF), journals, and other scientific publications reported consistently that neonatal mortality constitute 40-70% of deaths in infancy and that 99% of these deaths occurred in developing countries, with highest neonatal mortality rates (NMRs) in sub-Saharan Africa. The global burden of newborn illness shows that a disparity of up to 30-folds exists between countries with highest and lowest NMRs. Four million babies die in developing countries and about 42% of these deaths are due to infections. Other major causes include perinatal asphyxia (21%), birth injuries (11%), prematurity and low birth weight (10%) and congenital abnormalities (11%). It was also observed that two-thirds of the deaths in the neonatal period occur in the first week; among these deaths, two-thirds occurred within the first 24 hours. Review findings also revealed that an integrated, proven and cost-effective intervention such as the mother-baby packages incorporated into a functional and sustainable healthcare delivery system and improved household practices will save newborns' lives. Reports showed that to achieve meaningful development, neonatal mortality will need to be reduced in developing countries. CONCLUSION: **Programmes that are necessary for the reduction in neonatal morbidity and mortality rates are for countries to employ rational mix of quality clinical services, effective public health measures and inexpensive community-based interventions in public and private sectors and to scale-up known cost-effective interventions.**

PMID: 16805163 [PubMed - indexed for MEDLINE]

**Adam T, Lim SS, Mehta S, Bhutta ZA, Fogstad H, Mathai M, Zupan J, Darmstadt GL Cost effectiveness analysis of strategies for maternal and neonatal health in developing countries. BMJ. 2005 Nov 12;331(7525):1107.**

OBJECTIVE: To determine the costs and benefits of interventions for maternal and newborn health to assess the appropriateness of current strategies and guide future plans to attain the millennium development goals. DESIGN: Cost effectiveness analysis. SETTING: Two regions classified by the World Health Organization according to their epidemiological grouping: Afr-E, those countries in sub-Saharan Africa with very high adult and high child mortality, and Sear-D, comprising countries in South East Asia with high adult and high child mortality. DATA SOURCES: Effectiveness data from several sources, including trials, observational studies, and expert opinion. For resource inputs, quantities came from WHO guidelines, literature, and expert opinion, and prices from the WHO

choosing interventions that are cost effective database. MAIN OUTCOME MEASURES: Cost per disability adjusted life year (DALY) averted in year 2000 international dollars. RESULTS: The most cost effective mix of interventions was similar in Afr-E and Sear-D. These were the community based newborn care package, followed by antenatal care (tetanus toxoid, screening for pre-eclampsia, screening and treatment of asymptomatic bacteriuria and syphilis); skilled attendance at birth, offering first level maternal and neonatal care around childbirth; and emergency obstetric and neonatal care around and after birth. Screening and treatment of maternal syphilis, community based management of neonatal pneumonia, and steroids given during the antenatal period were relatively less cost effective in Sear-D. Scaling up all of the included interventions to 95% coverage would halve neonatal and maternal deaths. CONCLUSION: **Preventive interventions at the community level for newborn babies and at the primary care level for mothers and newborn babies are extremely cost effective, but the millennium development goals for maternal and child health will not be achieved without universal access to clinical services as well.**

PMID: 16282407 [PubMed - indexed for MEDLINE]

**Darmstadt GL, Walker N, Lawn JE, Bhutta ZA, Haws RA, Cousens S. Saving newborn lives in Asia and Africa: cost and impact of phased scale-up of interventions within the continuum of care. Health Policy Plan. 2008 Mar;23(2):101-17. Epub 2008 Feb 11.**

BACKGROUND: Policy makers and programme managers require more detailed information on the cost and impact of packages of evidenced-based interventions to save newborn lives, particularly in South Asia and sub-Saharan Africa, where most of the world's 4 million newborn deaths occur. METHODS: We estimated the newborn deaths that could be averted by scaling up 16 interventions in 60 countries. We bundled the interventions in a variety of existing maternal and child health packages according to time period of delivery and service delivery mode, and calculated the additional running costs of implementing these interventions at scale (90% coverage) in sub-Saharan Africa and South Asia. The phased introduction and expansion of interventions was modelled to represent incremental strategies for scaling up neonatal care in developing country health systems. RESULTS: Increasing coverage of 16 interventions to 90% could save 0.59-1.08 million lives in South Asia annually at an additional cost of US dollars 0.90-1.76 billion. In sub-Saharan Africa, 0.45-0.80 million lives saved would cost US dollars 0.68-1.32 billion. Additional costs for increased antenatal interventions are low, but given relatively high baseline coverage and lower impact, fewer additional newborn lives can be saved through this package (5-10%). Intrapartum care has higher impact (19-34% of deaths averted) but is costly (US dollars 1.66-3.25 billion). Postnatal family-community care, with potential for high impact at low cost (10-27%, US dollars 0.38-0.75 billion), has been neglected. A first phase of scaling up care in 36 high (NMR 30-45) and 15 very high (NMR >45) mortality countries would cost approximately US dollars 0.56-1.10 and US dollars 0.09-0.17 billion annually, respectively, and would avert 15-32% and 13-29% of

neonatal deaths, respectively, in these countries. Full coverage with all interventions in the 51 high and very high mortality countries would cost US dollars 2.23-4.37 billion, and avert 38-68% of neonatal deaths (1.13-2.05 million), at an extra cost per death averted of US dollars 1100-3900. CONCLUSIONS: **Low-cost, effective newborn health interventions can save millions of lives, primarily in South Asia and sub-Saharan Africa. Modelling costs and impact of intervention packages scaled up incrementally as health systems capacity increases can assist programme planning and help policy makers and donors identify stepwise targets for investments in newborn health.**

PMID: 18267961 [PubMed - indexed for MEDLINE]

**Chomba E, McClure EM, Wright LL, Carlo WA, Chakraborty H, Harris H. Effect of WHO newborn care training on neonatal mortality by education. *Ambul Pediatr.* 2008 Sep-Oct;8(5):300-4. Epub 2008 Jul 7.**

BACKGROUND: Ninety-nine percent of the 4 million neonatal deaths per year occur in developing countries. The World Health Organization (WHO) Essential Newborn Care (ENC) course sets the minimum accepted standard for training midwives on aspects of infant care (neonatal resuscitation, breastfeeding, kangaroo care, small baby care, and thermoregulation), many of which are provided by the mother. OBJECTIVE: The aim of this study was to determine the association of ENC with all-cause 7-day (early) neonatal mortality among infants of less educated mothers compared with those of mothers with more education. METHODS: Protocol- and ENC-certified research nurses trained all 123 college-educated midwives from 18 low-risk, first-level urban community health centers (Zambia) in data collection (1 week) and ENC (1 week) as part of a controlled study to test the clinical impact of ENC implementation. The mothers were categorized into 2 groups, those who had completed 7 years of school education (primary education) and those with 8 or more years of education. RESULTS: ENC training is associated with decreases in early neonatal mortality; rates decreased from 11.2 per 1000 live births pre-ENC to 6.2 per 1000 following ENC implementation ( $P < .001$ ). Prenatal care, birth weight, race, and gender did not differ between the groups. Mortality for infants of mothers with 7 years of education decreased from 12.4 to 6.0 per 1000 ( $P < .0001$ ) but did not change significantly for those with 8 or more years of education (8.7 to 6.3 per 1000,  $P = .14$ ). CONCLUSIONS: ENC training decreases early neonatal mortality, and the impact is larger in infants of mothers without secondary education. **The impact of ENC may be optimized by training health care workers who treat women with less formal education.**

PMID: 18922503 [PubMed - indexed for MEDLINE]

**Thairu L, Pelto G. Newborn care practices in Pemba Island (Tanzania) and their implications for newborn health and survival. *Matern Child Nutr.* 2008 Jul;4(3):194-208.**

Newborn mortality accounts for about one-third of deaths in children under five. Neglecting this problem may undermine the fourth Millennium Development Goal of reducing child mortality by two-thirds by 2015. This study was conducted in

Tanzania, where an estimated 32/1000 infants die within the first 28 days. Our objective was to describe newborn care practices and their potential impact on newborn health. We interviewed two purposive samples of mothers from Pemba Island, a predominantly Muslim community of Arab-African ethnicity, and one of Tanzania's poorest. The first sample of mothers (n = 12) provided descriptive data; the second (n = 26) reported actual practice. We identified cultural beliefs and practices that promote early initiation of breastfeeding and bonding, including 'post-partum seclusion'. We also identified practices which are potentially harmful for newborn health, such as bathing newborns immediately after delivery, a practice motivated by concerns about 'ritual pollution', which may lead to newborn hypothermia and premature breast milk supplementation (e.g. with water and other fluids) which may expose newborns to pathogens. Some traditional practices to treat illness, such as exposing sick newborns to medicinal smoke from burning herbs, are also of concern. It is unclear whether the practice of massaging newborns with coconut oil is harmful or beneficial. Interventions to reduce neonatal mortality need to identify and address the cultural rationales that underlie negative practices, as well as reinforce and protect the beliefs that support positive practices. ***The results suggest the need to improve use of health services through improving health worker communication skills and social management of patients, as well as by lowering healthcare costs.***

PMID: 18582353 [PubMed - indexed for MEDLINE]

**Pattinson RC, Bergh AM, Malan AF, Prinsloo R. Does kangaroo mother care save lives? J Trop Pediatr. 2006 Dec;52(6):438-41. Epub 2006 Jul 5.**

To assess the impact of the introduction of kangaroo mother care (KMC) in hospitals using the Perinatal Problem Identification Programme (PPIP) in South Africa, a survey was conducted of the PPIP sentinel sites in South Africa requesting information on the practice of KMC in the hospital and if practised, when it had been initiated. Data on live births and the neonatal deaths of infants weighing between 1000 and 1999 g for each institution were obtained from the national PPIP database and, where applicable, divided into two periods, before and after the introduction of KMC. The practice of KMC and PPIP data could be combined for 40 of the hospitals that had responded to the survey. Of these, eight hospitals had not initiated KMC by January 2005, 21 had PPIP data for a period after KMC had commenced and 11 had PPIP data for periods before and after the introduction of KMC. The neonatal death rate (NNDR) for all hospitals with no KMC or before the introduction of KMC was 88.14/1000 live births, whereas the NNDR for hospitals with KMC or after the introduction of KMC was 71.43/1000 live births [relative risk (RR) 0.81; 95% confidence interval (CI) 0.72-0.91]. For the 11 hospitals that had reliable PPIP data for periods before and after the initiation of KMC, the NNDR was 87.72/1000 live births before KMC and 60.76/1000 live births after KMC had been introduced (RR 0.62; 95% CI 0.53-0.73). ***The large and significant reduction in the NNDR of neonates weighing between 1000 and 1999 g was associated with the introduction of KMC.***

PMID: 16822797 [PubMed - indexed for MEDLINE]

**Pattinson RC. Why babies die--a perinatal care survey of South Africa, 2000-2002. S Afr Med J. 2003 Jun;93(6):445-50.**

OBJECTIVE: To identify the major causes of perinatal mortality in South Africa. SETTING: Seventy-three state hospitals throughout South Africa representing metropolitan areas, cities and towns and rural areas. METHOD: Users of the Perinatal Problem Identification Programme (PPIP) amalgamated their data to provide descriptive information on the causes of perinatal death and the avoidable factors, missed opportunities and substandard care in South Africa. RESULTS: A total of 8,085 perinatal deaths among babies weighing 1,000 g or more were reported from 232,718 births at the PPIP user sites. The perinatal mortality rates for the metropolitan, city and town, and rural groupings were 36.2, 38.6 and 26.7/1,000 births, respectively. The neonatal death rate was highest in the city and town group (14.5/1,000 live births) followed by the rural and metropolitan groups (11.3 and 10.0/1,000 live births respectively). The low birth weight rate was highest in the metropolitan group (19.6%), followed by the city and town group (16.5%) and the rural group (13.0%). The most common primary cause of perinatal death in the rural group was intrapartum asphyxia and birth trauma (rate 6.92/1,000 births) followed by spontaneous preterm delivery (5.37/1,000 births). The most common primary cause of death in the city and town group was spontaneous preterm delivery (6.79/1,000 births) followed by intrapartum asphyxia and birth trauma (6.21/1,000 births) and antepartum haemorrhage (5.7/1,000 births). The metropolitan group's most common primary causes were antepartum haemorrhage (7.14/1,000 births), complications of hypertension in pregnancy (5.09/1000 births) and spontaneous preterm labour (4.01/1,000 births). Unexplained intrauterine deaths were the most common recorded primary obstetric cause of death in all areas. Complications of prematurity and hypoxia were the most common final causes of neonatal death in all groups. CONCLUSION: **Intrapartum asphyxia, birth trauma, antepartum haemorrhage, complications of hypertension in pregnancy and spontaneous preterm labour account for more than 80% of the primary obstetric causes of death.**

PMID: 12916385 [PubMed - indexed for MEDLINE]

**Pattinson RC. Challenges in saving babies--avoidable factors, missed opportunities and substandard care in perinatal deaths in South Africa. S Afr Med J. 2003 Jun;93(6):450-5.**

OBJECTIVE: To identify the most common avoidable factors, missed opportunities and substandard care in perinatal care in South Africa. SETTING: Seventy-three state hospitals throughout South Africa representing metropolitan areas, cities and towns, and rural areas. METHOD: Users of the Perinatal Problem Identification Programme (PPIP) amalgamated their data to provide descriptive information on the causes of perinatal death and the avoidable factors, missed opportunities and substandard care in South Africa. RESULTS: A total of 8,085 perinatal deaths among babies weighing 1,000 g or more were reported from 232,718 births at the PPIP sentinel sites. Avoidable factors, missed

opportunities and substandard care were reported to be patient-related (between 31.5% and 47.5% of deaths), due to administrative problems (between 10.1% and 31.1% of deaths), and due to health worker-related problems (between 28.4% and 36.0% of deaths) in the metropolitan and rural areas respectively. Figures for cities and towns lay between these ranges. Deaths due to intrapartum asphyxia and birth trauma were thought to be clearly preventable within the health system in 63.1%, 34.4% and 35.7% of cases in the metropolitan areas, cities and towns, and rural areas respectively. Deaths due to hypertension and antepartum haemorrhage were thought to be clearly preventable within the health system in 18.7%, 15.4% and 20.0% of cases in the metropolitan areas, cities and towns, and rural areas respectively. Far fewer preventable deaths were recorded in the spontaneous preterm labour category. CONCLUSION: **Concentration on the remediable priority problems identified (namely labour management, resuscitation of the asphyxiated neonate, and care of the premature neonate) makes the reduction of perinatal mortality in South Africa feasible and inexpensive.**

PMID: 12916386 [PubMed - indexed for MEDLINE]

**Lawn JE, Rudan I, Rubens C. Four million newborn deaths: is the global research agenda evidence-based? Early Hum Dev. 2008 Dec;84(12):809-14. Epub 2008 Oct 1.**

Four million neonates die each year. These deaths are mostly in low-income countries, but neonatal mortality and morbidity are also a priority burden in high-income countries. Epidemiological evidence suggests newborn research would prioritise the poorest families; birth and the first days of life; major causes particularly infections, preterm birth and asphyxia; and include preventive strategies as well as improved care. However research investment is not commensurate to burden, and there is a mismatch with current research priorities. South Asia and sub Saharan Africa, with 75% of the burden, expend around US\$20 million per year on newborn research, a fraction of what is spent on a smaller proportion of health problem in rich countries. We propose a research pipeline of description, discovery, development of solutions and delivery of research with scale-up to reach the poorest families. Listing research options and applying quantitative scoring enables systematic, transparent research prioritisation. **As well as a research pipeline, a "people pipeline" is required to generate research capacity in low-income countries.**

PMID: 18829188 [PubMed - indexed for MEDLINE]

**Paul VK. The current state of newborn health in low income countries and the way forward. Semin Fetal Neonatal Med. 2006 Feb;11(1):7-14. Epub 2005 Dec 22.**

Of the 4 million neonatal deaths that occur worldwide each year 99% of these occur in developing countries. South Asia and sub-Saharan Africa regions account for two thirds of the global burden. Skilled professionals attend only 35% deliveries in South Asia and 41% in sub-Saharan Africa. Known, affordable interventions delivered through a rational mix of outreach, family/community and

clinical services can reduce over 70% of all neonatal deaths. The Millennium Development Goal of reducing the mortality of children under 5 years by two thirds by the year 2015 from the 1990 baseline would require a substantial reduction in neonatal mortality in the next decade. **For this, the low and middle-income countries must urgently review their existing programs, and design and implement improved, integrated action plans for maternal, newborn and child health. International community, including the academics, institutions and professional bodies in developed countries can play a crucial role to make this mission a success.**

PMID: 16376622 [PubMed - indexed for MEDLINE]

**Barennes H, Tahi FM. [No solution for neonatal mortality in sub-saharan Africa? Evaluation and perspectives in the urban environment of Niamey, Niger] Sante. 1995 Nov-Dec;5(6):335-40.**

Niger has one of the highest mortality rates of infants (222/1000) and children under five years old (318/1000), with 15% of them suffering from malnutrition. Yet, neonatal mortality was not considered as the top priority of public health in Niger, where 85 to 90% of the deliveries succeed without any medical care and 70% of the population live more than 10 kilometers from the nearest medical center. Also, in the African countries which have adopted expensive neonatal care centers following the occidental model, the lethality rate is high and maintenance is difficult. Thus, alternative strategies should be considered to reduce the neonatal mortality, according to the local possibilities. This was carried out in Niamey, the capital of Niger. A retrospective study of the activities in the pediatric and obstetric wards was carried out from 1985 to 1992. This was associated with a descriptive prospective survey of a sample of 149 pregnant women followed from the first prenatal consultation to the end of the neonatal period. Results showed that possibilities exist in Niamey to reduce neonatal mortality. The concentration of medical personnel was high compared to the rest of the country, and the health infrastructure was diversified. However, the knowledge of neonatal care was lacking. Use of prenatal care was high and deliveries at home without medical assistance concerned only 14.3% of the total births. Mortality observed in the obstetrical ward (6.7/1000) corresponded to less than a quarter of the estimated neonatal mortality (28.6/1000). Neonatal mortality in the pediatric ward was high (43.8%), predominantly on the first day of admittance (45% of the deaths), especially for the low birth weights (under 2,500 g) (62.4%). These figures underline the necessity to improve the care of the newborns and to link prenatal prevention, obstetrical care and pediatrics. The prospective survey showed that although the ratio of prenatal visits per woman was high (3.8), the quality of the care was inadequate. Correct newborn care was rare and no examination could detect or prevent complications during the short stay of less than 24 hours in the obstetrical ward. To lower the neonatal mortality, service could be improved concerning the material conditions of prenatal consultations, reorientation of prenatal consultations towards detection, correct treatment of the risk factors of neonatal mortality, obstetrical screening and care, and training of the midwives. **The adoption of inexpensive measures was**

**suggested, including the training of pediatric nurses in each maternity ward, screening and treatment of newborns at risk in small units integrated within the obstetrical ward, and the requirement of a consultation before the traditional feast of giving names, which occurs on the seventh day of life in Niger. These measures were considered as priorities before considering construction of expensive neonatal centers and assume the participation of the public health personnel and policy makers. Some of these suggestions are now being implemented.**

PMID: 8784534 [PubMed - indexed for MEDLINE]

**Haws RA, Yakoob MY, Soomro T, Menezes EV, Darmstadt GL, Bhutta ZA. Reducing stillbirths: screening and monitoring during pregnancy and labour. BMC Pregnancy Childbirth. 2009 May 7;9 Suppl 1:S5.**

BACKGROUND: Screening and monitoring in pregnancy are strategies used by healthcare providers to identify high-risk pregnancies so that they can provide more targeted and appropriate treatment and follow-up care, and to monitor fetal well-being in both low- and high-risk pregnancies. The use of many of these techniques is controversial and their ability to detect fetal compromise often unknown. Theoretically, appropriate management of maternal and fetal risk factors and complications that are detected in pregnancy and labour could prevent a large proportion of the world's 3.2 million estimated annual stillbirths, as well as minimise maternal and neonatal morbidity and mortality. METHODS: The fourth in a series of papers assessing the evidence base for prevention of stillbirths, this paper reviews available published evidence for the impact of 14 screening and monitoring interventions in pregnancy on stillbirth, including identification and management of high-risk pregnancies, advanced monitoring techniques, and monitoring of labour. Using broad and specific strategies to search PubMed and the Cochrane Library, we identified 221 relevant reviews and studies testing screening and monitoring interventions during the antenatal and intrapartum periods and reporting stillbirth or perinatal mortality as an outcome. RESULTS: We found a dearth of rigorous evidence of direct impact of any of these screening procedures and interventions on stillbirth incidence. Observational studies testing some interventions, including fetal movement monitoring and Doppler monitoring, showed some evidence of impact on stillbirths in selected high-risk populations, but require larger rigorous trials to confirm impact. Other interventions, such as amniotic fluid assessment for oligohydramnios, appear predictive of stillbirth risk, but studies are lacking which assess the impact on perinatal mortality of subsequent intervention based on test findings. Few rigorous studies of cardiotocography have reported stillbirth outcomes, but steep declines in stillbirth rates have been observed in high-income settings such as the U.S., where cardiotocography is used in conjunction with Caesarean section for fetal distress. CONCLUSION: There are numerous research gaps and large, adequately controlled trials are still needed for most of the interventions we considered. **The impact of monitoring interventions on stillbirth relies on use of effective and timely intervention should problems be detected.** Numerous studies indicated that positive tests were associated

with increased perinatal mortality, but while some tests had good sensitivity in detecting distress, false-positive rates were high for most tests, and questions remain about optimal timing, frequency, and implications of testing. Few studies included assessments of impact of subsequent intervention needed before recommending particular monitoring strategies as a means to decrease stillbirth incidence. In high-income countries such as the US, observational evidence suggests that widespread use of cardiotocography with Caesarean section for fetal distress has led to significant declines in stillbirth rates. Efforts to increase availability of Caesarean section in low-/middle-income countries should be coupled with intrapartum monitoring technologies where resources and provider skills permit.

PMID: 19426468 [PubMed - indexed for MEDLINE]