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Community-Based Intervention Packages for Reducing Maternal Morbidity and Mortality and Improving Neonatal Outcomes

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COMMUNITY-BASED INTERVENTION PACKAGES FOR REDUCING MATERNAL MORBIDITY AND MORTALITY AND IMPROVING NEONATAL OUTCOMES[i]

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ACRONYMS

3ie	International Initiative for Impact Evaluation
ANC	Ante- Natal Care
BCC	Behaviour Change Communication
BF	Breast Feeding
BLDS	British Library for Development Studies
BNCP	Birth and Newborn Care Preparedness
C2	Campbell Collaboration
CHERG	Child Health Epidemiology Reference Group
CHW	Community Health Worker
CI	Confidence Interval
cRCTs	clustered Randomised Controlled Trials
CMR	Child Mortality Rate
DALYs	Disability-Adjusted Life Years
ENMR	Early Neonatal Mortality Rate
HCW	Health Care Worker
IDEAS	Internet Documents in Economics Access Service
JOLIS	World Bank and IMF library catalogue
KMC	Kangaroo Mother Care
LNMR	Late Neonatal Mortality Rate
LHW	Lady Health Worker
LILACs	Latin American and Caribbean Literature on Health Sciences Database
MCH-FP	Maternal, Child Health and Family Planning
MDG	Millennium Development Goal
MMR	Maternal Mortality Rate
MNH	Maternal and Newborn Heath
NMR	Neonatal Mortality Rate
PMR	Perinatal Mortality Rate
PNC	Post Natal Care
PPH	Post Partum Haemorrhage
RCTs	Randomised Controlled Trials
RR	Relative Ratio
SBA	Skilled Birth Attendant
TBA	Traditional Birth Attendant
TT	Tetanus Toxoid
TTBAs	Trained Traditional Birth Attendants
UTBA	Untrained Traditional Birth Attendants
WHO	World Health Organization

SUMMARY

Background: While maternal, infant and under-five child mortality rates in developing countries have declined significantly in the past two to three decades, newborn mortality rates have reduced much more slowly. It is recognized that almost half of the newborn deaths can be prevented by scaling up evidence-based available interventions such as tetanus toxoid immunisation to mothers, clean and skilled care at delivery, newborn resuscitation, exclusive breastfeeding, clean umbilical cord care and management of infections in newborns. However, many of these require facility based and outreach services. It has also been stated that a significant proportion of these mortalities and morbidities could potentially be addressed by developing community-based packages of interventions which should be supplemented by developing and strengthening linkages with the local health systems. Some of the recent community based studies of interventions targeting women of reproductive age have shown variable impacts on maternal outcomes and hence it is uncertain if these strategies have consistent benefit across the continuum of maternal and newborn care.

Objectives: To assess the effectiveness of community-based intervention packages in reducing maternal and neonatal morbidity and mortality; and improving neonatal outcomes.

Methods: A comprehensive search was conducted of published and unpublished materials. Studies were identified for inclusion which employed rigorous impact evaluation techniques, using experimental (randomised assignment) and quasi-experimental methods, and which evaluated the effectiveness of community-based intervention packages in reducing maternal and neonatal mortality and morbidities and improving neonatal outcomes. Two review authors independently assessed trial quality and extracted the data. The review has been conducted to Campbell/Cochrane Collaboration standards of systematic review, as well as drawing on a programme theory in the analysis.

Results: The review included 27 experimental and quasi-experimental trials, covering a wide range of interventional packages in which health workers received additional training in maternal and newborn care. The data from these trials were incorporated using generic inverse variance method in which logarithms of risk ratio estimates were used along with the standard error of the logarithms of risk ratio estimates. Our review did not show any significant reduction in maternal mortality (RR 0.77; 95% CI: 0.59 to 1.02). However, significant reduction was observed in maternal morbidity (RR 0.75; 95% CI 0.61 to 0.92), neonatal mortality (RR 0.73; 95% CI 0.65 to 0.82), stillbirths (RR 0.89; 95% CI 0.78 to 1.02) and perinatal mortality (RR 0.82; 95% CI 0.72 to 0.93) as a consequence of implementation of community-based interventional care packages. The interventions also increased the referrals to health facility for pregnancy related complication by 41 per cent (RR 1.41; 95% CI 1.24 to 1.62), and improved the rates of early breastfeeding by 83 per cent (RR 1.83; 95% CI 1.20 to 2.77). We assessed our primary outcomes for publication bias, but no such asymmetry was observed on the funnel plot.

Conclusions: Our review offers encouraging evidence of the value of integrating maternal and newborn care in community settings through a range of interventions which can be packaged effectively for delivery through a range of community health workers and health promotion groups. While the importance of skilled delivery and facility based services for maternal and newborn care cannot be denied, there is sufficient evidence to scale up community-based care through packages which can be delivered by a range of community-based workers.

1. INTRODUCTION

The Millennium Development Goal for maternal health (MDG 5) calls for a reduction in maternal mortality by two-thirds by the year 2015.[ii] The estimates of maternal mortality suggest that 342,900 (uncertainty interval 302,100 to 394,300) maternal deaths occurred worldwide in 2008, and that more than 50 per cent of these deaths occurred in six countries (India, Nigeria, Pakistan, Afghanistan, Ethiopia, and the Democratic Republic of the Congo) (Bhutta 2010). The maternal mortality ratio for sub-Saharan Africa was estimated at nearly 600 maternal deaths per 100,000 live births, almost twice that of South Asia, four times as high as in Latin America and the Caribbean, and nearly 50 times higher than in industrialised countries (Hojan 2010). Most of these maternal deaths seem to occur between the third trimester and the first week after the end of pregnancy (Ronsmans C and W J Graham, 2006), particularly during childbirth and the first and second days after birth (Hurt 2002).

Almost 80 per cent of the maternal deaths are due to direct obstetric causes including severe bleeding (haemorrhage), infection, complications of unsafe abortion, eclampsia, and obstructed labour, with other causes being related to the unfavourable conditions created by lack of access to health care, illiteracy and factors related to poverty (Hoj L et al., 2003). Many women are estimated to suffer pregnancy-related illnesses (9.5 million), near-miss events which are the life-threatening complications that women survive (1.4 million), and other potentially devastating consequences after birth (Say L et al., 2004, WHO, 2000, Ashford)The consequences of near-miss events on women themselves and their families can be substantial, and recovery can be slow, with lasting complications. An estimated 10 to 20 million women develop physical or mental disabilities every year as a result of complications or poor management (Ashford, Murray CJL and Lopez AD, 1998). The long-term consequences are not only physical, but are also psychological, social and economic (Filippi V et al., 2006).
Pregnancy-related illnesses and complications during pregnancy and delivery are associated with a significant impact on the foetus, resulting in poor pregnancy outcomes for both the mother and newborn (Walsh et al., 1994). In developing countries, almost two-thirds of births occur at home and only half are attended by a trained birth attendant (WHO, 1996).

In the 1970s the World Health Organisation promoted training of traditional birth attendants (TBAs) as a major public health strategy to reduce the burden of mortality and morbidities related to pregnancy and childbirth. However, the evidence of the impact of this strategy on maternal and neonatal outcomes is still limited (Sibley LM et al., 2007). Deaths occurring in the neonatal period (aged 0–27 days) account for 41 per cent (3.575 million) of all deaths in children younger than 5 years (Black 2010). In developing countries, most of the maternal, perinatal and late neonatal deaths and morbidities occur at home. The reasons are multi-factorial, including: poverty; lack of control on household resources and decision making power; illiteracy; lack of information regarding the availability of health services/providers; poor health status of women; poor antenatal and obstetric care, both within the community and health facilities; absence of a trained attendant at delivery; inadequate referral system for emergency obstetric care; inadequate or lack of transportation facilities; and absence of/poor linkages of health centres with the communities (Ensor T and Cooper S, 2004). The majority of maternal and neonatal deaths could be prevented with early recognition and proper implementation of required skills and knowledge (Ray and Salihu, 2004).

Soon after the Alma-Ata Declaration, arguments for selective rather than comprehensive primary health care dominated and it was then recognised that community participation was important in supporting the provision of local health services and in delivering interventions at the community level (Rosato M et al., 2008). Community participation

has long been advocated to build links with improving maternal and child health and there are several trials from south Asia which have evaluated the role of women's groups on maternal and neonatal health. In the Makwanpur trial, Nepal implemented a participatory learning cycle (in which they identify, prioritise a problem, select and implement relevant interventions and evaluate the results) through developing women's groups and found a reduction in maternal mortality by 88 per cent and neonatal mortality by 30 percent, but the same strategy in other trials has shown variable and non-significant impacts on maternal and neonatal outcomes (Azad 2010; Tripathy 2010). Other sets of studies in which services were provided to women and children in the community indicated that, at full coverage, 41 to 72 per cent of newborn deaths could be prevented by available interventions like tetanus toxoid immunization to mothers, clean and skilled care at delivery, newborn resuscitation, prevention of hypothermia, exclusive breastfeeding, clean umbilical cord care, and management of pneumonia and sepsis. Around half of this reduction is possible with community-based interventions (Darmstadt GL et al., 2005). A significant proportion of these mortalities and morbidities could also be potentially addressed by developing community-based intervention packages (package is defined as delivering more than one intervention via a different set of strategies or sub-interventions). These community-based packages should be supplemented by developing and strengthening linkages with the local health systems.

This paper assesses both the effectiveness of community-based intervention packages in reducing maternal, and neonatal morbidities and mortality and improving neonatal outcomes, as well as the impact of different strategies (home visitation, home based care, community support groups/women groups and so on) on reported outcomes. Effectiveness data are synthesised using meta-analysis.[iii]

Section 2 describes the objectives and methods used in the review, including the causal model linking community based maternal and newborn health interventions with risk of mortality. Section 3 presents the results of the study search and analysis and Section 4 concludes.

2. OBJECTIVES AND METHODS

This paper presents the results of a systematic review of the effectiveness of community-based intervention packages in reducing maternal and neonatal morbidity and mortality and improving neonatal outcomes. A protocol described the inclusion criteria, search methods and data collection and analysis used in the review (Bhutta et al, 2009). The review aimed to cover all available published and unpublished reports on the impact of community-based intervention packages on maternal, perinatal and neonatal health outcomes. We define a 'community-based intervention' as one which is delivered by any person within the community, including health care personnel or lay individuals, and implemented locally at the woman's home, village or defined community, but not in a health facility.

Intervention packages include additional training for outreach workers, namely lady health workers/visitors, community midwives, community/village health workers, facilitators or TBAs, in maternal care during pregnancy, delivery and in the postpartum period and in routine newborn care. Additional training is defined as training other than the usual training that health workers receive from their governmental or non-governmental organisation and could include a combination of training in providing basic antenatal, natal and postnatal care; preventive essential newborn care; breastfeeding counselling; management and referral of sick newborns; skills development in behaviour change communication and community mobilisation strategies to promote birth and newborn care preparedness. The training sessions are provided in lectures, supervised hands-on training in a healthcare facility and/or within the community. The control group

(in case of randomised or quasi-experimental trials) received their usual maternal and newborn care services from local government and non-governmental facilities.

2.1 Inclusion criteria

Intervention components that were eligible for review are shown in **Figure 1**. Only studies which implemented packages of health interventions (that is, more than one component intervention) were considered eligible for inclusion. Thus many single interventions delivered in the newborn period such as neonatal resuscitation alone, cord care with chlorhexidine, neonatal vitamin A dosing and so forth, were excluded.

Figure 1 Interventions from different maternal and neonatal care packages

Antenatal Interventions	Intrapartum interventions	Postnatal interventions	Others
- Promotion of routine antenatal care checkups - TT vaccination - Nutritional counselling - Iron/folate supplementation during pregnancy - Maternal health education - Promotion of institutional deliveries - Birth and newborn care preparedness	- Provision of safe delivery kit for clean delivery - Clean delivery practices - Referrals for emergency obstetric care	- Promotion of early and exclusive breastfeeding - Kangaroo mother care /thermoregulation - Newborn resuscitation - Pneumonia care management - Referrals of sick newborns - Delayed umbilical cord clamping - Injectable use of antibiotics for the management of neonatal infections - Postnatal visitation - Recognition of neonatal danger signs	- TBA/CHW training - Advocacy group meeting with community - Counselling of other family members regarding mother and newborn care - Strengthening of health care staff through training - Strengthening health care delivery system through - Provision of drugs and essential equipment

Studies eligible for inclusion included community-based, randomised, quasi-experimental controlled trials (prospective trials with contemporaneous comparison groups and with historical comparison groups), and prospective time series (pre-post interventional) studies with no control arm. Observational studies which had undergone robust evaluations using quasi-experimental methods such as case-control studies were also included. Studies also needed to report data at the individual level for either pregnant women or those of child-bearing age (15 to 49 years) taking part in a community-based intervention package. Studies in this review were included irrespective of language, publication status or location.

The interventions and packages of interventions included in this review are diverse, but in all cases their ultimate goals were to improve maternal, perinatal and neonatal mortality and morbidity. The stylised conceptual framework shown in **Figure 2** shows the theoretical linkages between, on the one hand, delivery of community-based intervention packages through training of TBAs and/or groups of lay workers or community health workers from the community, and, on the other hand, outputs and intermediate and final outcomes (impacts). Implementation modalities include behaviour change communication (BCC) and community mobilisation to promote care seeking patterns, delivery of care, and provision of referrals. Implementation strategies were

timed at antenatal, intrapartum and/or postnatal periods.

Given this causal model, studies were included in the review if they assessed primary and secondary health outcomes and measures of utilisation or access to care. Primary health outcomes included maternal and newborn mortality. Maternal mortality is defined as number of maternal deaths per live births, with maternal death defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management. Neonatal mortality is defined as the number of neonatal deaths from any cause among total live births (early neonatal mortality includes deaths in the first week of life; late neonatal mortality includes deaths from seven to 28 days of life). Perinatal mortality is defined as stillbirths and early neonatal deaths. Stillbirth is defined as foetal death after 28 weeks of gestation but before delivery of the baby's head per 1,000 total births. Secondary health outcomes included low birth weight, defined as birth weight less than 2,500 g, and complications of pregnancy, including prolonged or obstructed labour, eclampsia, postpartum haemorrhage, postpartum depression, puerperal sepsis and spontaneous abortion.
Outcomes relating to utilisation and access to care included receiving any antenatal care; iron/folate supplementation; referral to a health facility for any complication during pregnancy, delivery, or the postpartum period; institutional delivery or delivery at a health facility; birth attended by a health provider (doctor, nurse, midwife or a trained health worker); initiation of breastfeeding within one hour of birth; exclusive breastfeeding at six months of age; health care seeking for maternal and/or neonatal morbidities; and infant's weight for age and height for age z-scores at six months of age.

2.2 Study search

The electronic search strategy included electronic reference libraries of indexed and non-indexed medical journals and non-indexed journals not available in electronic libraries. The principal sources of electronic reference libraries were searched, including the Cochrane Reference Libraries, Medline, PubMed, Popline, the World Bank's JOLIS search engine, the British Library for Development Studies (BLDS), the IDEAS database of unpublished working papers, Google and Google Scholar. In addition, a detailed examination of cross-references and bibliographies of available data and publications was performed to identify additional sources of information.[iv] Our search covered the period up to January 12, 2010.

The following search strategy was modified for the various databases and search engines. ["community-based nutrition program" OR "community-based primary health care" OR "community-based program" OR "community-based perinatal care" OR "community-based neonatal care" OR "community health" OR "health worker" OR "community involvement" OR "community participation" OR "community program" OR "package" OR "behaviour change"] AND ["pregnancy" OR "women" OR "infant" OR "neonate" OR "perinatal" OR "newborn"]. We restricted the search terms to titles, abstracts and keywords.

2.3 Data collection and synthesis

Two review authors independently assessed for inclusion all the potential studies identified as a result of the search strategy, and, using a form designed to extract data from included studies, independently extracted the data. We defined study quality of randomised and quasi-experimental controlled trials as the extent to which design, methods, execution and analysis minimised bias in assessment of effectiveness, focusing on internal validity. We categorised studies as of high, medium, low (or unclear) quality (Atkins et al., 2004, Schunemann et al., 2006); adopted from (Kidney E et al., 2009)

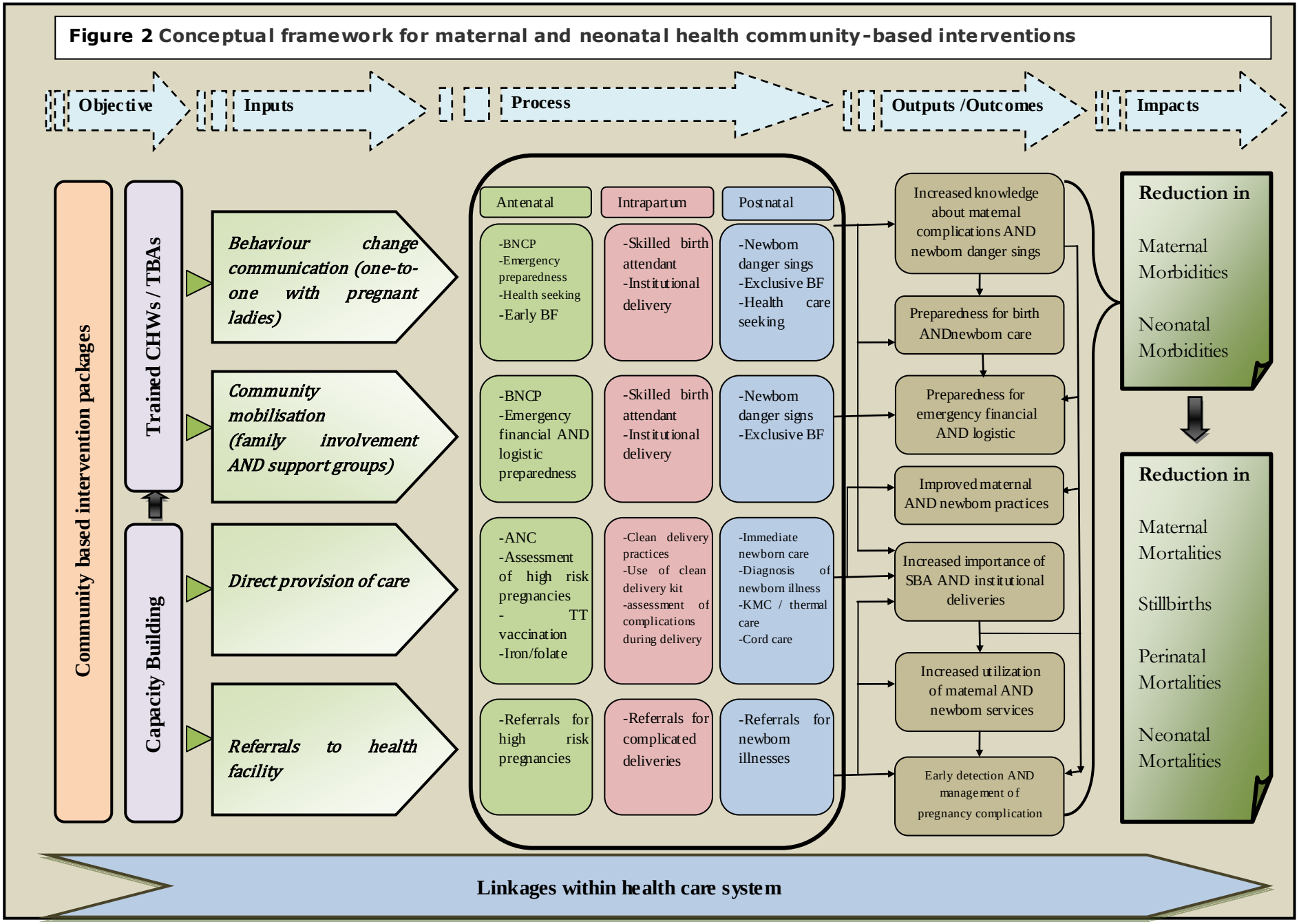
with respect to selection, performance, measurement, and attrition biases as shown in Table 1. Quality of pre-post studies with no control arm was assessed using the criteria adopted from (Loevinsohn, 1990) and described in Table 2.

Table 1 Quality assessment criteria for Randomised /Quasi-experimental Controlled Trials

	High quality	**Medium quality**	**Low quality**
1.Selection bias	Studies with randomisation, allocation concealment, and similarity of groups at baseline	RCTs with some deficiencies in randomisation e.g. lack of allocation concealment, or non-randomised studies with either similarities at baseline or use of statistical methods to adjust for any baseline differences	Non-randomised, with obvious differences at baseline, and without typical adjustment for these differences.
2.Performance bias*	Differed only in intervention, which was adhered to without contamination, groups were similar for co-intervention or statistical adjustment was made for any differences	Confounding was possible but some adjustment was made in the analysis	Intervention was not easily ascertained or groups were treated unequally other than for intervention or there was non-adherence, contamination or dissimilarities in groups and no adjustments made
3.Measurement bias	Outcome measured equally in both groups, with adequate length of follow-up, direct verification of outcome, with data to allow calculation of precision estimate	Inadequate length of follow-up or length not given	Inadequate reporting or verification of outcomes or differences in measurement in both groups
4.Attrition bias	Non systematic differences in withdrawals between groups and with appropriate imputation for missing values		Incomplete follow-up data, not intention-to-treat analysis or lacking reporting on attrition

Note: *Blinding was not a quality assessment issue as blinding of participants or caregivers to intervention types was not possible

Figure 2 Conceptual framework for maternal and neonatal health community-based interventions



BNCP = Birth and Newborn Care Preparedness; BF= Breast Feeding; KMC = Kangaroo Mother Care; SBA = Skilled birth attendant; TT = Tetanus Toxoid.

Statistical analysis was performed for each individual study and pooled analysis was carried out using generic inverse variance weighted meta-analysis and results presented in forest plots.[v] We undertook exploratory subgroup analyses of subsets of studies to generate hypotheses regarding the reasons for high levels of statistical heterogeneity, where applicable.

Table 2 Quality assessment criteria for pre-post studies without control arm

Study features*	Assessment
Study based on explicit theory	Yes/ No / Unclear
Adequate description of how educational strategy adapted to local conditions	Yes/ No / Unclear
Example given of materials or educational process	Yes/ No / Unclear
Adequate description of resources required to carry out interventions	Yes/ No / Unclear
Measure outcome before and after intervention	Yes/ No / Unclear
Measurement method same before and after	Yes/ No / Unclear
Period between education and outcome more than 1 year	Yes/ No / Unclear
Author claimed positive results for interventions	Yes/ No / Unclear
Paper included discussion of possible biases and caveats (or limitations)	Yes/ No / Unclear
Paper included *p*-values or confidence interval	Yes/ No / Unclear
Analysis employed some form of modelling such as regression	Yes/ No / Unclear
Exposure to intervention monitored	Yes/ No / Unclear

Note: *Adopted from Loevinsohn (1990)

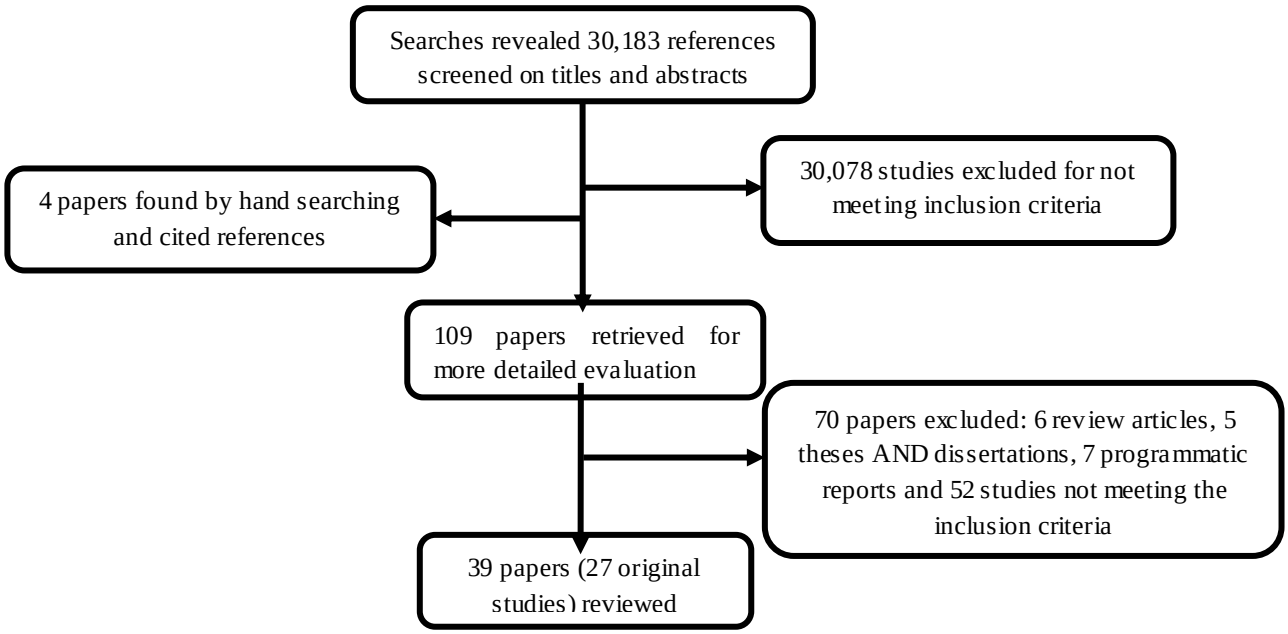
These included disaggregated analyses by type of intervention across different time periods (antenatal, intrapartum and postnatal) and different modalities (including those involving other family members though community mobilisation, those including both preventive and therapeutic packages of care, those involving community and facility care packages and those including trained traditional birth attendants). The differences in estimates from two sub-group meta-analyses were tested using the method described by (Altman and Bland, 2003).

Sensitivity analyses were performed based on the randomisation process, with quasi-experimental studies being excluded. We performed sensitivity analyses assessing the presence of adequate sequence generation and allocation concealment in the primary outcomes. Where there were 10 or more studies in the meta-analysis, reporting biases (such as publication bias) were investigated using funnel plots. If asymmetry was suggested by a visual assessment, exploratory analyses were performed to investigate it.

3. RESULTS OF SEARCH

As shown in **Figure 3**, a total of 30,183 (after removing duplicates) titles and abstracts, written in English and other languages, were identified. One hundred and nine papers were retrieved for more detailed evaluation, out of which 38 relevant papers (27original studies) were identified and included in this review. All, except one study (Bhutta 2010), were published journal articles.[vi] We included results from two intervention arms (two sub sets) of Baqui et al. (2008) and Kumar et al. (2008) and reported them as Baqui - home care (a) 2008; Baqui-com care (a) 2008 and Kumar ENC 2008 and Kumar ENC + thermospot 2008 respectively in the meta-analysis results.

Figure 3 Study selection process



3.1 Study descriptives

Individual studies are described by study type, location, design, participants, population denominator (e.g. pregnancies or live births), interventions, quality assessment, and primary and secondary outcomes in **Table 3**. Intervention packages delivered in included studies are briefly presented in **Table 4**, which summarises the characteristics of the health worker, the extent of community mobilisation, and the specific interventions provided by time period (antenatal, intrapartum and postnatal).

Table 3: Characteristics of Included Studies

Study/ Country	Intervention: Experimental arm	Intervention: Control arm	No. of participants	Quality assessment	Primary outcome(s)	Secondary outcome(s)
Clustered Randomised Controlled Trials						
Jokhio 2005 (Jokhio AH et al., 2005) **Rural Pakistan**	Trained all TBAs for improved services for enhanced referrals, antenatal care and postpartum visits, and provided them with delivery kits. TBAs were also linked with Lady Health Workers (LHWs) in the community.	TBAs were not trained and did not receive delivery kits. Routine care was delivered by LHWs.	19,557 pregnant women 19,525 deliveries	1: high; 2: high; 3: high; 4: high	No impact of intervention on mortality of mothers 30% reduction in PMR (CI: 18-41%) 31% reduction in stillbirths (17-43%) 29% reduction in NMR (17-38%)	39% reduction in haemorrhage related complication during pregnancy (CI: 21-53%) 50% increase in referrals in emergency obstetric care (19-91%)
Projahnmo I 2008 (Baqui et al., 2008, Baqui et al., 2009, Baqui and Arifeen, 2007) **Rural Bangladesh**	Home care arm received interventions for birth and newborn care preparedness, iron/folic acid supplementation, enhanced referrals AND community care arm were mobilised through group meetings with pregnant women and community leaders. Refresher training was provided to government health workers in both the intervention groups.	Comparison arm received the usual health services provided by the government, non-government organizations and private providers. Refresher training for government workers was provided.	58,588 pregnancies 46,444 live births	1: medium; 2: high; 3: high; 4: high	44% reduction in NMR (CI: 7-53%)	Improved breastfeeding initiation
Projahnmo II 2008 (Bari S et al., 2006) **Tangail, Bangladesh**	Women counselled on birth and newborn care preparedness, postnatal visits for enhanced referrals for sick newborns.	Routine care*	3,228 deliveries	1: medium; 2: high; 3: high; 4: medium		Health care seeking from qualified provider OR 2.98 (CI: 2-4.44) Referral to Project facility OR 2.9 (1.91-4.41) Health care seeking from unqualified providers decreased to 69% (53-79%)

Study/ Country	Intervention		No. of participants	Quality assessment	Primary outcome(s)	Secondary outcome(s)
	Experimental arm	Control arm				
Bhutta 2008 (Bhutta ZA et al., 2008) **Rural Pakistan**	LHWs in the interventional arm were given additional training after their usual training and they were linked with *Dais* (who were given training for newborn resuscitation and immediate newborn care); other interventions were promotion of nutritional counselling, birth and newborn care preparedness, enhanced antennal and postnatal visits; training in basic and intermediate newborn care was offered to all public-sector staff.	LHW training programme continued as usual, with regular refresher sessions, but no attempt was made to link LHWs with the *Dais*. Furthermore, special training in basic and intermediate newborn care was offered to all public-sector staff.	2,789 pregnancies 5,542 live births	1: medium; 2: high; 3: high; 4: low	No impact of intervention on maternal mortality 29% reduction in Stillbirths (CI: 11-43%) 31% reduction in NMR (13-45%) 28% reduction in PMR (15-39%)	Improvement in institutional deliveries, initiation of early and exclusive breastfeeding
Kumar 2008 (Kumar V et al., 2008, Darmstadt GL et al., 2006) **Uttar Pradesh, India**	Provision of essential newborn care, birth preparedness, enhanced referrals plus thermoregulation along with all other interventions.	Control arm received the usual services of governmental and non-governmental organizations in the area.	2,811 pregnancies in interventional arm 3,688 live births	1: medium; 2: high; 3: high; 4: high	No improvement observed in reduction in maternal mortality in intervention and control groups 50% reduction in NMR (CI: 31-64%), among these 41% decline occurred in early neonatal period (16-59%) and 68% decline occurred in late neonatal period (15-88%) 47% reduction in PMR (27-62%) 45% reduction in stillbirths (5-55%)	59% reduction in maternal complication due to prolonged labour (CI: 51-67%) and 50% decline in eclampsia related complication (4-74%) Improvement in initiation of early breastfeeding

Study/ Country	Intervention		No. of participants	Quality assessment	Primary outcome(s)	Secondary outcome(s)
	Experimental arm	Control arm				
Bhutta 2010 (Bhutta et al., 2009) **Rural Pakistan**	LHWs = Along with the basic training (for control group) they received additional training on recognition of high risk pregnancies and referral, TBAs = along with the basic training (for control group) they received additional training on promotion of LHW attendance at births.	Trained LHWs in community mobilization by building support groups, promoting use of clean delivery kits, recognition of neonatal illness and referral for care; TBAs linked with LHWs and trained on promotion and use of clean delivery kits.	5,717 pregnancies 24,085 total births	1: high; 2: high; 3: high 4: unclear	No impact of intervention on maternal mortality 20% reduction in stillbirths (CI: 10-29%) 16% reduction in perinatal mortality (9-23%) 12% reduction in neonatal mortality (1-22%) No impact on early neonatal mortality No impact observed on late neonatal mortality	24% increase in receiving at least one ANC observed (CI: 5-48%) 22% increase in birth attendance by skilled attendant (4-44%)
Manandhar 2004 (Manandhar DS et al., 2004, Osrin D and Mesko N, 2003, Wade A et al., 2006) **Makwanpur, Nepal**	Organised village women's groups in intervention areas where they hold monthly meetings to participatory design and implementation of monthly meeting to address obstetric and perinatal problems.	Routine care + improvements in equipment and training provided at all levels of the healthcare System.	6,714 pregnancies 6,125 live births	1: medium; 2: high; 3: high; 4: high	78% reduction in MMR (CI: 10-95%) 30% reduction in NMR (6-47%)	Positive behaviour change in institutional deliveries, birth attendance, clean delivery kit
Kafatos 1991 (Kafatos AG et al., 1989, Kafatos AG et al., 1991) **Florina, Greece**	Routine care at prenatal clinics and additional home visits by nurses who provided nutritional education for women in intervention group through home visits.	Routine care at prenatal clinics without home visits by nurses.	541 live births	1: medium; 2: low; 3: medium; 4: low		Reduction in low birth weight in intervention groups compared to control was 5% (P<0.04)
Srinivasan 1995 (Srinivasan V et al., 1995) **Rural South India**	In high risk intervention package group trained midwives identified high-risk pregnancies and intervened accordingly. TNG intervention package group does not include identification of high risk pregnancies.	Received general health services and no special inputs were provided by project staff.	1,623 pregnancies	1: medium; 2: high; 3: medium; 4: low		No impact of training on improvement of mortality No difference in birth weight

Study/ Country	Intervention		No. of participants	Quality assessment	Primary outcome(s)	Secondary outcome(s)
	Experimental arm	Control arm				
Tripathy 2010 (Tripathy et al., 2009) **Jharkhand AND Orissa, India**	Implemented a participatory learning cycle, through developing women's groups where they identify and prioritise maternal and newborn health problems in their community, collectively select relevant strategies to address those problems, implement the strategies, and evaluate the results.	Health committees in control clusters were formed to give community a voice in the design and management of local health services.	18,207 live births	1: medium; 2: high; 3: medium; 4: medium	No impact observed in reducing MMR 45% reduction in NMR (CI: 33 – 55%) 55% reduction in early NMR (43-64%) No impact observed in Late NMR No impact observed in reducing stillbirths 31% reduction in PMR (19-42%)	
Azad 2010 (Azad et al., 2009) **Rural Bangladesh**	Implemented a participatory learning and action cycle in which they identify and prioritise problems, then formulate strategies and lastly implement and monitor and finally evaluate the process; intervention group was again divided into two according to the whether TBAs trained for asphyxia or not.	Control group was not provided with participatory learning groups.	29,889 live births	1: medium; 2: high; 3: medium; 4: low	No impact on reducing MMR No impact of intervention observed in reducing NMR (no impact on Early NMR and late NMR) No impact on intervention observed in reducing stillbirths and perinatal deaths	No improvements observed in service delivery and newborn care outcomes
Darmstadt 2010 (Darmstadt) **Mirzapur, Bangladesh**	CHWs identified pregnant women, made antenatal home visits to promote BNCP, made postnatal home visits to assess newborns for illness and referred sick neonates.	Routine care*	9,857 live births	1: medium; 2: high; 3: low; 4: low	Adjusted mortality hazard ratio in the intervention arm, compared to the comparison arm, was 1.02 (CI: 0.80-1.30) at baseline and 0.87 (0.68-1.12) at end line. Primary causes of death were birth asphyxia (49%, 109/222) and Prematurity (26%, 58/222)	
<u>Quasi Experimental Controlled Trials</u>						
Bang 1999 (Bang AT et al., 1999, Bang AT et al., 2005b, Bang AT et al., 2005c) **Gadchiroli, India**	Trained paramedics, village HCWs and TBAs in administration of antibiotics and counselling in mother and newborn care.	Received standard government health and Integrated Child Development Services.	5,921 live births	1: low; 2: medium; 3: high; 4: low	24% reduction in NMR (CI: 5-38%) 94% reduction in CMR due to pneumonia	

Study/ Country	Intervention		No. of participants	Quality assessment	Primary outcome(s)	Secondary outcome(s)
	Experimental arm	Control arm				
Care-India 2008 (Baqui AH et al., 2008b, Baqui AH et al., 2008a) **Rural Northern India**	Antenatal intervention, birth preparedness, disposable delivery kit, newborn care, postnatal intervention vs. routine care.	Received standard government health and Integrated Child Development Services.	13,826 live births	1: low; 2: high; 3: high; 4: unclear	No impact of intervention observed in differences of mortality	Improvement observed in institutional deliveries or conducted by skilled birth attendant, initiation of early breast feeding
Syed 2006 (Syed U et al., 2006) **Rural Bangladesh**	Increased coverage of CHWs, trained health care providers and TBAs, use of clean delivery kit, antenatal and postnatal visits.	Available routine care was utilised in control area.	3,110 live births	1: low; 2: medium; 3: unclear; 4: unclear		Improvement observed in initiation of early breastfeeding
Ronsmans 1997 (Ronsmans C et al., 1997) **Matlab, Bangladesh**	MCH-FP areas (referrals for sick cases, safe delivery kit, iron and folate for mothers, family planning, management of obstetric complication etc).	Comparison area did not have MCH-FP services and was provided with routine services*	24,059 live births	1: low; 2: low; 3: unclear; 4: unclear	3% reduction in direct obstetric mortality per year (CI: 1-5%)	
Bang 2005 (Bang AT et al., 2005a) **Gadchiroli, India**	Assessed the impact of TBA training on neonatal resuscitation and home based care education on neonatal mortality.	TBAs in control areas were not additionally trained as in intervention arm, but they did receive usual training from government sources.	5,651 deliveries 5,510 live births	1: low; 2: medium; 3: high; 4: unclear	70% reduction in NMR (CI: 59-81%) 56% decline in PMR (46-68%) 49% reduction in stillbirths (31-66%)	
Greenwood 1990 (Greenwood et al., 1990) **Gambia, Africa**	Government of Gambia implemented OHC service and trained TBAs regarding clean deliveries at home, referrals for delivery and promotion of antenatal and post care among mothers.	Non-PHC areas have routine delivery service outlets like health facilities and hospitals.	1,963 pregnancies 1,843 live births	1: low; 2: low 3: medium; 4: unclear	No impact of intervention on maternal mortality 33% reduction in neonatal deaths 56% reduction in late neonatal deaths No impact of intervention on stillbirths	Increase in institutional deliveries by 56%

Study/ Country	Intervention		No. of participants	Quality assessment	Primary outcome(s)	Secondary outcome(s)
	Experimental arm	Control arm				
Alisjahbana 1995 (Alisjahbana et al., 1995) **Rural West-Java, Indonesia**	Trained TBAs for enhanced complication referrals, teaching mothers for danger signs. Improved accessibility to health care services and trained hospital doctors and nurses for appropriate care management. Distributed home based maternal and neonatal action records.	Routine services provided by government health care facilities and hospitals.	3,275 pregnancies	1: low; 2: low; 3: unclear; 4: unclear	PMR in intervention and control arms were same i.e. 0.4%	ANC in intervention arm 89.6% and in control arm 76.1% Complication during pregnancy and during postpartum period in intervention arm 66% and in control arm 62% Institutional deliveries 12% in intervention arm and 0.4% in control arm Complication during delivery in intervention arm 17% and in control arm 20%
Bhuiyan 2005* (Bhuiyan et al., 2005) **Rural Bangladesh**	Trained Skilled Birth Attendants (SBAs) who delivered ANC, PNC, newborn resuscitation and counsel mothers for newborn care management.	SBAs were not trained and community was provided with routine care*	388 deliveries	1: low; 2: low; 3: unclear; 4: unclear		Deliveries by SBAs in intervention arm were 52% while in control arm were 32%
Foord 1995 (Foord, 1995, Fox-Rushby and Foord, 1996) **Rural Gambia**	Trained TBAs, registered pregnant women, treated anaemia and infection, identified and referred all potential obstetric problems	Services were provided by government health centre	1,516 pregnant women	1: low; 2: low; 3: unclear; 4: unclear	No impact of intervention observed on maternal mortality No impact of intervention observed for reducing stillbirths No impact of intervention observed for reducing perinatal deaths	

Study/ Country	Intervention	No. of participants	Quality assessment	Primary outcome(s)	Secondary outcome(s)
Pre- Post Studies with no Control arm					
Nepal 2007 (McPherson R et al., 2007) **Rural Nepal**	Health messages, management of PPH with Misoprostol, iron/folate for women, TT doses, postnatal home visits vs. control.	2,612 live births in baseline 2,614 live births in follow-up	Y: 5; N: 1; U: 6	53% decline in NMR (P=0.004)	Improvement in birth attended by skilled birth attendants, institutional deliveries 52% of women in Banke district were prevented from PPH, 11% in Jhapa

Study/ Country	Intervention	No. of participants	Quality assessment	Primary outcome(s)	Secondary outcome(s)
Dongre 2009 (Dongre AR et al., 2009) **Rural Wardha, India**	Educate women about newborn danger signs, birth preparedness, health care seeking, and conduction of monthly village based meeting.	Not mentioned	Y: 8; N: 1; U: 3		Significant improvements seen in health care seeking from private health care providers for sick newborns
Warmi 1998 (O'Rourke K et al., 1998) **Rural Bolivia**	Impact of women's group diagnosing, designing, implementing, and evaluating community-based solution to maternal and perinatal health problems.	Not mentioned	Y: 7; N: 1; U: 4	63% reduction in PMR (CI: 27-56%)	25% increase in breastfeeding rates (25.3% pre to 50.3% post intervention)
McPherson 2006 (McPherson RA et al., 2006) **Siraha, Nepal**	Birth preparedness plan, keychain containing information on antenatal, care of mother and newborn, danger signs vs. control.	Not mentioned	Y: 6; N: 1; U: 5		Essential newborn care preparedness increased from 20-30% No improvement in early initiation of breastfeeding (P 0.06) No improvement in skilled birth attendants at birth (0.55) Odds of breastfeeding when exposed to messages was 4.2 (P<0.001)
Moran 2006 (Moran AC et al., 2006) **Rural Burkina Faso**	MNH programme of JPIEGO focused on birth preparedness, recognition of danger signs.	180 pregnant women and 180 women delivered in 12 months	Y: 7; N: 0; U: 5		Planning for delivery from skilled birth attendant increased to 26% (P<0.001)
Jamkhed 2007 (Arole R and Arole M) **Rural India**	Community empowerment, immunization, family planning, referral to project hospital.	Not mentioned	Y: 4; N: 1; U: 7		Safe delivery increased to 99% (1% in 1971 to 100% in 2004)

Quality assessment codes: 1 = selection bias; 2 = performance bias; 3 = measurement bias; 4 = attrition bias.
PMR: Perinatal Mortality Rate; NMR: Neonatal Mortality Rate; MMR: Maternal Mortality Rate; TBA: Traditional Birth Attendant; MNH: Maternal and Neonatal Health; LHW: Lady Health Worker; HCW: Health Care Worker; TNG: Tamil Nadu Government; MCH-FP: Maternal, Child Health and Family Planning; PPH: Post Partum Haemorrhage; TT: Tetanus Toxoid.
* The study was excluded from meta-analysis due to incompatibility of the measured outcomes.

Table 4: Factors associated with Success and Failures of Community-based Interventional Packages

Study			Jokhio 2005	Projahnmo I 2008	Projahnmo II 2008	Bhutta 2008
Characteristics of Health Worker and their trainings		Level of Education	10 years		10 years	
		Paid/Unpaid	Unpaid			Transport Costs
		Working full time/part time				
		From within community/outsider	Community	Community		Community
		Worker: population ratio	1:1000-5000	1:4000	1:4000	
		Part of formal/informal health sys	Informal			Informal
		Type of training: theoretical/practical training	Both	Both		Theoretical
		Duration of training	3 days	6 weeks		6 days LHW + 3 days *Dai*
		Refresher during the course of intervention	2-3 times (1d)			
		Supervised by				Regional Programme Supervisor
Health system integration		Public sector		X		X
		Private sector				
		Provision of training		X		X
		Provision of equipment and drug supplies				X
Community mobilisation		Community advocacy groups		For pregnant ladies		
		One to one counselling				
		Group counselling				X
		Mass media				
Interventions		Duration of intervention	14 months	30 months	12 months	24 months
		Coverage of intervention				
	Antenatal	Birth and newborn care preparedness	X	X	X	X
		Tetanus-toxoid immunisation		X		
		Financial and logistical preparation			X	X
		Referrals of high-risk pregnancies	X	X		X
		Provision of antenatal care	X			X
		Iron/folate supplementation		X		X
		Nutritional counselling				X
	Intrapartum	Clean delivery practices	X	X		X
		Present at birth	X			X
		Skilled attendants	X	X		X
		CHW/TBA training	TBA	TBA	TBA	TBA
	Postnatal	Postnatal visits	X	X		X
		Promotion of breastfeeding		X		X
		Neonatal case management		X	X	X
		Newborn resuscitation				
		Prevention & mngmt of hypothermia		X		X
		Referral to sick newborn			X	X
Cost		Cost per neonatal death averted		$2995		

Study			Bhutta 2010	Kumar 2008	Manandhar 2004	Kafatos 1991	Srinivasan 1995
Characteristics of Health Worker and their trainings		Level of Education		12 years		Nursing	Nursing
		Paid/Unpaid	Transport cost	$30-40/ month			
		Working full time/part time					
		From within community/outsider	Community	Community			
		Worker: population ratio			1: 7000		
		Part of formal/informal health sys	Informal			Formal	Formal
		Type of training: theoretical/practical training	Theoretical	Both	Both		
		Duration of training	5 days for LHWs + 3 days for TBAs	7 days			
		Refresher during the course of intervention	Every month				
		Supervised by	Programme supervisor		X		
Health system integration		Public sector	X		X		
		Private sector					
		Provision of training	X		X		
		Provision of equipment and drug supplies	X		X		
Community mobilisation		Community advocacy groups	Mothers and Fathers	X	Pregnant ladies		
		One to one counselling					
		Group counselling	X	X			
		Mass media					
Interventions		Duration of intervention	36 months	16 months	24 months		36 months
		Coverage of intervention	X				70%
	Antenatal	Birth and newborn care preparedness	X	X	X	X	
		Tetanus-toxoid immunisation					
		Financial and logistical preparation	X				
		Referrals of high-risk pregnancies					X
		Provision of antenatal care				X	X
		Iron/folate supplementation	X			X	X
		Nutritional counselling	X			X	
	Intrapartum	Clean delivery practices	X				
		Present at birth	X				
		Skilled attendants	X				X
		CHW/TBA training	TBA		TBA		
	Postnatal	Postnatal visits	X	X		X	X
		Promotion of breastfeeding	X	X		X	X
		Neonatal case management	X				
		Newborn resuscitation	X				
		Prevention & mngmt of hypothermia	X	X			
		Referral to sick newborn	X	X	X		X
Cost		Cost per neonatal death averted			$ 4397		

Study			Tripathy 2010	Azad 2010	Darmstadt 2010	Bang 1999	Care-India 2008
Characteristics of Health Worker and their trainings		Level of Education				5-10 years	
		Paid/Unpaid					
		Working full time/part time					
		From within community/outsider	Community	Community	Community	Community	
		Worker: population ratio	1: 1414				
		Part of formal/informal health sys					
		Type of training: theoretical/practical training					
		Duration of training	5 sessions	7 days	36 days		6 days
		Refresher during the course of intervention		Informal fortnightly	Fortnightly		
		Supervised by		District Coordinator		Doctors	
Health system integration		Public sector				X	
		Private sector					
		Provision of training					
		Provision of equipment and drug supplies				X	
Community mobilisation		Community advocacy groups	X	X	Pregnant women	X	
		One to one counselling					
		Group counselling	X	X			
		Mass media					
Interventions		Duration of intervention	36 months	36 months	24 months	36 months	24 months
		Coverage of intervention				93%	
	Antenatal	Birth and newborn care preparedness			X	X	X
		Tetanus-toxoid immunisation					
		Financial and logistical preparation					
		Referrals of high-risk pregnancies					
		Provision of antenatal care					
		Iron/folate supplementation					
		Nutritional counselling				X	X
	Intrapartum	Clean delivery practices					
		Present at birth				X	
		Skilled attendants			X		
		CHW/TBA training	TBA	TBA	TBA		
	Postnatal	Postnatal visits			X	X	X
		Promotion of breastfeeding			X		
		Neonatal case management			X	X	
		Newborn resuscitation				X	
		Prevention & mngmt of hypothermia				X	
		Referral to sick newborn			X	X	X
Cost		Cost per neonatal death averted				$ 5.3	

Study			Syed 2006	Ronsmans 1997	Bang 2005	Greenwood 1995	Alisjahbana 1995
Characteristics of Health Worker and their trainings		Level of Education			5-10 years	Illiterate	
		Paid/Unpaid	Yes		$ 1 per case		
		Working full time/part time	Full time				
		From within community/outsider		Community	Community	Community	Community
		Worker: population ratio	1: 6000				
		Part of formal/informal health sys				Informal	
		Type of training: theoretical/practical training	Both				
		Duration of training	6 days then 6 months		3 days	6 weeks	
		Refresher during the course of intervention	1 day		2 months		
		Supervised by				Nurse	
Health system integration		Public sector	X			X	
		Private sector			Called to treat illness		
		Provision of training	X				
		Provision of equipment and drug supplies					
Community mobilisation		Community advocacy groups					
		One to one counselling	X				
		Group counselling					
		Mass media					
Interventions		Duration of intervention	20 months	72 months	84 months	36 months	15 months
		Coverage of intervention			84%		
	Antenatal	Birth and newborn care preparedness	X			X	X
		Tetanus-toxoid immunisation		X			
		Financial and logistical preparation					X
		Referrals of high-risk pregnancies				X	X
		Provision of antenatal care	X				
		Iron/folate supplementation		X			
		Nutritional counselling		X	X		
	Intrapartum	Clean delivery practices	X	X		X	X
		Present at birth	X	X	X	X	X
		Skilled attendants	X	X		X	X
		CHW/TBA training	TBA			TBA	TBA
	Postnatal	Postnatal visits	X				
		Promotion of breastfeeding	X				
		Neonatal case management					
		Newborn resuscitation			X		
		Prevention & mngmt of hypothermia	X				
		Referral to sick newborn	X				X
Cost		Cost per neonatal death averted			$ 13 (bag and mask)		

Study			Bhuiyan 2005	Foord 1995	Nepal 2007	Dongre 2009	Warmi 1998
Characteristics of Health Worker and their trainings		Level of Education		Midwives and CHN			
		Paid/Unpaid		Yes			
		Working full time/part time					
		From within community/outsider	Community	Community			
		Worker: population ratio				1:1000	
		Part of formal/informal health sys		Informal			
		Type of training: theoretical/practical training					
		Duration of training		4 weeks			
		Refresher during the course of intervention		Yearly	2 days		
		Supervised by		Nurse	FHP supervisor		
Health system integration		Public sector		X			
		Private sector					
		Provision of training		X	X		
		Provision of equipment and drug supplies					
Community mobilisation		Community advocacy groups			Pregnant ladies	Pregnant ladies	
		One to one counselling		Pregnant women	X		
		Group counselling					
		Mass media			X		
Interventions		Duration of intervention		24 months	24 months	36 months	36 months
		Coverage of intervention			80%		
	Antenatal	Birth and newborn care preparedness		X	X	X	X
		Tetanus-toxoid immunisation		X	X		
		Financial and logistical preparation		X	X		
		Referrals of high-risk pregnancies		X	X		
		Provision of antenatal care		X			
		Iron/folate supplementation			X		
		Nutritional counselling		X			
	Intrapartum	Clean delivery practices		X			
		Present at birth		X			
		Skilled attendants		X			
		CHW/TBA training		TBA			X
	Postnatal	Postnatal visits		X		X	
		Promotion of breastfeeding			X	X	
		Neonatal case management					
		Newborn resuscitation					
		Prevention & mngmt of hypothermia					
		Referral to sick newborn			X	X	
Cost		Cost per neonatal death averted					

Study			McPherson 2006	Moran 2006	Jamkhed 2007
Characteristics of Health Worker and their trainings		Level of Education			Illiterate
		Paid/Unpaid			Unpaid
		Working full time/part time			
		From within community/outsider			Community
		Worker: population ratio			
		Part of formal/informal health sys			
		Type of training: theoretical/practical training			
		Duration of training			
		Refresher during the course of intervention			
		Supervised by			
Health system integration		Public sector			Project hospital
		Private sector			
		Provision of training			
		Provision of equipment and drug supplies			
Community mobilisation		Community advocacy groups			X
		One to one counselling	X		
		Group counselling			
		Mass media		X	X
Interventions		Duration of intervention	12 months	28 months	
		Coverage of intervention	54%	69%	
	Antenatal	Birth and newborn care preparedness	X	X	X
		Tetanus-toxoid immunisation			
		Financial and logistical preparation	X	X	X
		Referrals of high-risk pregnancies			
		Provision of antenatal care			
		Iron/folate supplementation			
		Nutritional counselling			X
	Intrapartum	Clean delivery practices			X
		Present at birth			
		Skilled attendants			
		CHW/TBA training			
	Postnatal	Postnatal visits			
		Promotion of breastfeeding			
		Neonatal case management			
		Newborn resuscitation			
		Prevention & mngmt of hypothermia			
		Referral to sick newborn			
Cost		Cost per neonatal death averted			

The studies reviewed were from 9 countries (**Figure 4**), representing four regions – Asia (22 studies), Africa (3 studies), European Union (1 study) and South America (1 study). Among these, only one (Kafatos AG et al., 1991) was from a developed country. The studies were also diverse and incorporated several community-based interventions packages which were not only delivered across varying time periods but with different implementation modalities.

Figure 4 Studies included in the sample by region and country (n=27)

Asia	n	Africa	n	European Union	n	South America	n
Bangladesh	7	Burkina Faso	1	Greece	1	Bolivia	1
India	8	Gambia	2				
Indonesia	1						
Nepal	3						
Pakistan	3						
Total	22		3		1		1

The vast majority of all 22 studies that targeted women during the antenatal period applied strategies for BCC that specifically involved birth and newborn care preparedness (n=20) and nutritional counselling (n=8). Out of 20 studies that incorporated any intervention in the intrapartum period, 12 limited the interventions to clean delivery practices, except for one study that utilised skilled attendants at delivery (Srinivasan V et al., 1995), while 12 of the studies attempted to train TBAs. By comparison, a little over half of studies were heavily oriented towards postnatal interventions which include thermoregulation, referrals for sick newborns and so forth, while less than a quarter applied high levels of interventions like newborn resuscitation, and injectable use of antibiotics for neonatal infections.

Studies tended to combine interventions by service delivery mode: 14 of the 26 studies imparted education by involving other family members in care and through building community support and advocacy groups; five employed both community and facility care interventions (Ronsmans C et al., 1997, Fauveau V et al., 1991, Greenwood et al., 1990, Foord, 1995, Fox-Rushby and Foord, 1996, McPherson R et al., 2007, Arole R and Arole M); and 12 trained TBAs for delivering services. There were many cases where more than one service delivery mode was utilised.

Interventions were mainly delivered by community/village health workers or by TBAs, who were part of the informal health care system; only in two instances were interventions nurse-delivered (Kafatos AG et al., 1991, Srinivasan V et al., 1995). Training of these workers varied from three days to six weeks. The ratio of CHWs to target population varied greatly. To illustrate, in two studies, each CHW was responsible for the population of 4,000 (Bari S et al., 2006, Baqui AH, 2008); in Syed et al. (2006), each CHW was responsible for the population of 6,000; in a study from Nepal, each CHW was responsible for the population of 7,000 (Manandhar DS et al., 2004); in the EKJUT project, each CHW looked after a population of over 1,400 (Tripathy et al., 2009), while in Pakistan the ratio of LHW to target population was 1:1000 (Bhutta et al., 2009, Bhutta ZA et al., 2008). More than half of all studies interlinked themselves with the existing health care system, provided refresher courses to health care staff and equipped them with essential supplies and drugs. Interventions in the antenatal period were commonly related to BNCP, promotion of breastfeeding, immunization to mothers and iron/folate supplementation. During the postnatal period, interventions commonly included referral and management of sick newborns.

In prospective time series studies with no control arm, interventions were delivered by community or village health workers. In two studies (McPherson R et al., 2007, Arole R and Arole M), interventions were linked with health care systems, and involvement of

family members and community mobilisation was part of the intervention package. The duration of interventions varied from 12 months (McPherson RA et al., 2006) to 36 months (Dongre AR et al., 2009, O'Rourke K et al., 1998).

3.2 Risk of bias in included studies

A larger group of the included studies were cluster randomised controlled trials (cRCTs) (12 studies), while 9 were quasi-experimental controlled trials and 6 studies were prospective time series studies. Among cluster randomised controlled-trials, (Jhokio AH et al., 2005), Bhutta et al. (2010), Baqui 2008 (hc and cc), and Kumar et al (2008) scored high in quality assessment criteria, while (Baqui AH, 2008) had a large number of participants. Among quasi-experimental controlled trials, Care-India (2008) scored 'high' in two quality assessment criteria among four. There were six prospective time series (pre-post intervention design) studies with no control arm which were also judged on criteria described in Table 2. Their quality assessment is reported in terms of number of times the criteria were described and assessed in the publication. (Dongre AR et al., 2009) scored particularly well on quality assessment. Two studies that fulfilled the inclusion criteria were excluded from the meta-analysis, one on the grounds of unpublished results (Darmstadt 2010), and the other because of incompatibility of the measured outcomes (Bhuiyan 2005).

4. META-ANALYSIS RESULTS

4.1 Mortality

This section presents results of the pooled quantitative synthesis of impacts using meta-analysis, and the analysis of impact heterogeneity based on sub-group analysis.[vii] The primary outcomes of this review were maternal, perinatal and neonatal mortality. Given the complexity of delivering various interventions across the continuum of maternal and newborn care via numerous modalities, we conducted a disaggregated subgroup analysis to see the effect of individual implementation strategy on mortality outcomes (Table 3). Given that the interventions were generally interlinked, the results were analyzed and interpreted based on the conceptual framework (**Figure 1**).

Maternal mortality

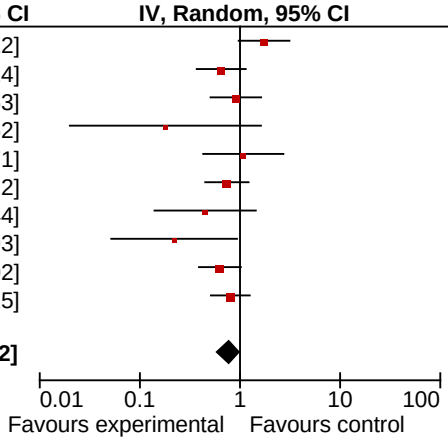
As shown in **Figure 5**, overall, the community-based intervention packages showed no significant impact on reducing maternal mortality on average (average risk ratio (RR) 0.77; 95% confidence interval (CI) 0.59 to 1.02, random effects (10 studies, n=144,956)), and the results were heterogeneous (T^2=0.07, I^2 =39% and Chi^2 p value 0.10). We therefore attempted to look for the effect of different modalities and interventions delivered at varying time periods on reducing maternal mortalities. None of the disaggregated analysis found any impact on reducing maternal mortality (Table 3). The possible reason for these insignificant findings might be inadequate sample size to detect meaningful change in maternal mortality. In addressing maternal mortality impacts, very large sample sizes are required for producing reliable estimates; as in this comparatively rare event, omission of only a few cases can have a disproportionately distorting effect on the maternal mortality ratio.

Figure 5: Overall Maternal Mortality

Community Intervention Package vs. Control

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Azad 2010	0.5538	0.298	12.4%	1.74 [0.97, 3.12]
Bhutta 2008	-0.431	0.287	12.9%	0.65 [0.37, 1.14]
Bhutta 2011	-0.094	0.296	12.5%	0.91 [0.51, 1.63]
Foord 1995	-1.715	1.121	1.5%	0.18 [0.02, 1.62]
Greenwood 1990	0.077	0.47	6.8%	1.08 [0.43, 2.71]
Jokhio 2005	-0.301	0.254	14.7%	0.74 [0.45, 1.22]
Kumar 2008	-0.801	0.594	4.7%	0.45 [0.14, 1.44]
Manandhar 2004	-1.514	0.737	3.2%	0.22 [0.05, 0.93]
Ronsmans 1997	-0.462	0.245	15.2%	0.63 [0.39, 1.02]
Tripathy 2010	-0.222	0.228	16.2%	0.80 [0.51, 1.25]
Total (95% CI)			**100.0%**	**0.77 [0.59, 1.02]**

Heterogeneity: Tau² = 0.07; Chi² = 14.73, df = 9 (P = 0.10); I² = 39%
Test for overall effect: Z = 1.82 (P = 0.07)

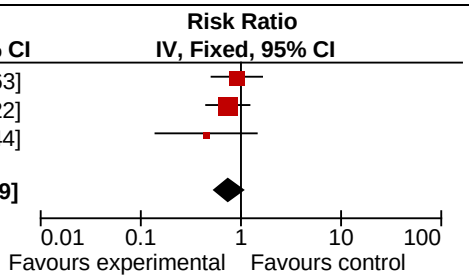


We also performed a sensitivity analysis of low risk of bias studies, that is, studies which had used adequate sequence generation and allocation concealment methods. Low risk of bias studies also demonstrated a non significant impact of community-based intervention package on maternal mortality (RR 0.76; 95%CI 0.53 to 1.09, fixed-effects (three studies, n=57,216), I² =0% and Chi² p value 0.53) (**Figure 6**).

Figure 6: Maternal Mortality: Low Risk of Bias Studies

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Fixed, 95% CI
Bhutta 2011	-0.094	0.296	38.4%	0.91 [0.51, 1.63]
Jokhio 2005	-0.301	0.254	52.1%	0.74 [0.45, 1.22]
Kumar 2008	-0.801	0.594	9.5%	0.45 [0.14, 1.44]
Total (95% CI)			**100.0%**	**0.76 [0.53, 1.09]**

Heterogeneity: Chi² = 1.17, df = 2 (P = 0.56); I² = 0%
Test for overall effect: Z = 1.47 (P = 0.14)



We found limited studies that reported maternal mortality; we therefore assessed it for small study effect (publication bias). There are several methods of assessing the occurrence of publication bias. A common approach is based on scatter plots of the treatment effect estimated by individual studies versus a measure of study size or precision (the "funnel plot"). In this graphical representation, larger and more precise studies are plotted at the top, near the combined effect size, while smaller and less precise studies will show a wider distribution below. If there is no publication bias, the studies would be expected to be symmetrically distributed on both sides of the combined effect size line. In case of publication bias, the funnel plot may be asymmetrical, since the absence of studies would distort the distribution on the scatter plot. For maternal mortality, we observed that majority of studies fell at the top and at both sides of the vertical line that indicated no obvious asymmetry and no resulted publication bias (Annex 2a).

Neonatal mortality

Community-based intervention packages were associated with a significant reduction in neonatal mortality by 27 per cent on average (average RR 0.65, 95% CI 0.68 to 0.82, random effects (12 studies, n=136,425)) and the results were heterogeneous (T^2=0.02,

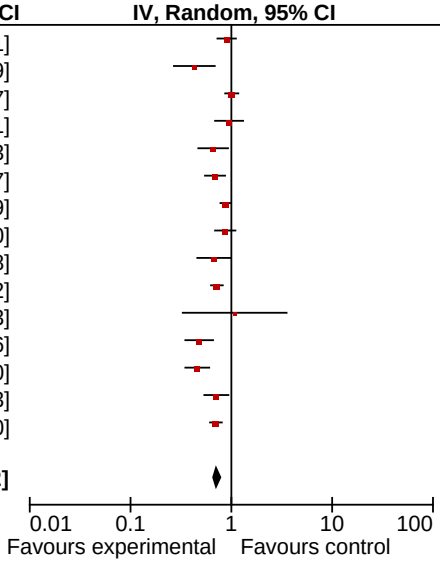
I^2=69% and Chi^2 p value <0.001) (**Figure 7**). When the impact was evaluated separately for packages that implemented both preventive and therapeutic care versus those that involved only preventive care, it was found that mortality rates were reduced by 20 per cent in the case of preventive care alone and 54 per cent when both (preventive and therapeutic care) were provided (comparison of subgroup estimates, P=0.006). Presence of support and advocacy groups and level of involvement of family members in care following community mobilization showed no major effect on reducing neonatal mortality.

Figure 7: Overall Neonatal Mortality

Community Intervention Package vs. Control

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Azad 2010	-0.105	0.107	7.8%	0.90 [0.73, 1.11]
Bang 1999	-0.844	0.238	4.0%	0.43 [0.27, 0.69]
Baqui 2008	0.0099	0.076	8.9%	1.01 [0.87, 1.17]
Baqui cc 2008	-0.051	0.163	5.9%	0.95 [0.69, 1.31]
Baqui hc 2008	-0.415	0.173	5.6%	0.66 [0.47, 0.93]
Bhutta 2008	-0.371	0.116	7.5%	0.69 [0.55, 0.87]
Bhutta 2011	-0.128	0.061	9.4%	0.88 [0.78, 0.99]
Darmstadt 2010	-0.139	0.118	7.4%	0.87 [0.69, 1.10]
Greenwood 1990	-0.4	0.192	5.1%	0.67 [0.46, 0.98]
Jokhio 2005	-0.329	0.068	9.2%	0.72 [0.63, 0.82]
Kafatos 1991	0.077	0.604	0.9%	1.08 [0.33, 3.53]
Kumar ENC 2008	-0.734	0.161	6.0%	0.48 [0.35, 0.66]
Kumar ENC+thermospot 2008	-0.777	0.139	6.7%	0.46 [0.35, 0.60]
Manandhar 2004	-0.342	0.14	6.6%	0.71 [0.54, 0.93]
Tripathy 2010	-0.352	0.068	9.2%	0.70 [0.62, 0.80]
Total (95% CI)			**100.0%**	**0.73 [0.65, 0.82]**

Heterogeneity: Tau^2 = 0.04; Chi^2 = 56.37, df = 14 (P < 0.00001); I^2 = 75%
Test for overall effect: Z = 5.26 (P < 0.00001)

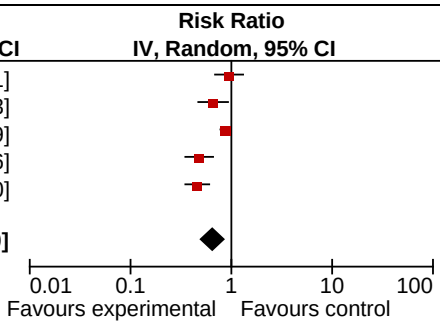


We also performed a sensitivity analysis of low risk of bias studies (which had used adequate sequence generation and allocation concealment methods) and found a significant 22 per cent reduction in neonatal mortality (RR 0.66; 95%CI 0.49 to 0.90, random-effects (four studies, n=56878) (T^2=0.10, I^2=86% and Chi^2 p value <0.001) (**Figure 8**).

Figure 8: Neonatal Mortality: Low Risk of Bias Studies

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Baqui cc 2008	-0.051	0.163	19.0%	0.95 [0.69, 1.31]
Baqui hc 2008	-0.415	0.173	18.6%	0.66 [0.47, 0.93]
Bhutta 2011	-0.128	0.061	23.1%	0.88 [0.78, 0.99]
Kumar ENC 2008	-0.734	0.161	19.1%	0.48 [0.35, 0.66]
Kumar ENC+thermospot 2008	-0.777	0.139	20.2%	0.46 [0.35, 0.60]
Total (95% CI)			**100.0%**	**0.66 [0.49, 0.90]**

Heterogeneity: Tau^2 = 0.10; Chi^2 = 29.52, df = 4 (P < 0.00001); I^2 = 86%
Test for overall effect: Z = 2.63 (P = 0.009)



We did not find any obvious asymmetry in the funnel plot for total neonatal mortality (Annex 2b).

Early neonatal mortality

As shown in Table 3, results were also significant when impact was estimated for early neonatal mortality (average RR 0.71; 95% CI 0.60 to 0.85, random-effects (eight

studies, n=88,836)), and the results were heterogeneous (T^2=0.02, I^2=59% and Chi² p value 0.02). On subgroup analysis, early neonatal deaths were reduced by 27 per cent (95% CI: 12–40%, random effects, 6 studies, n=84,915) when community support groups were in place, though differences between subgroups were insignificant (P=0.61). General preventive and therapeutic packages of care showed a beneficial effect on reducing early neonatal deaths by 61 per cent (95% CI: 76–39%, random effects, 2 studies, n=32,781) as compared to 20 per cent (95% CI: 4–34%, 6 studies, n=32,781) when preventive packages of care were delivered alone (comparison of subgroup estimates, P=0.07). This was clearly dependent on the composition of specific interventions addressing major causes of early neonatal mortality such as birth asphyxia or prematurity. Packages involving provision of referrals reduced early neonatal deaths by 36 per cent (95% CI: 12–53%, random effects, 4 studies, n=32,781) as compared to 23 per cent when referrals were not prescribed (comparison of subgroup estimates, P=0.37).

Late Neonatal Mortality

Results were significant when impact was estimated for late neonatal mortality (RR 0.72; 95% CI 0.65 to 0.80, fixed-effects (nine studies, n=107,535)), (I^2=31% and Chi² p value 0.17). On subgroup analysis, we found that late neonatal deaths were reduced by 29 per cent (95% CI: 10–45%, random effects, 6 studies, n=84,915) when community support groups were in place, though differences between subgroups were insignificant (P=0.23). General preventive and therapeutic packages of care showed a beneficial effect on reducing late neonatal deaths by 61 per cent (95% CI: 39–76%, random effects, 2 studies, n=32,781) as compared to 25 per cent (95% CI: 17–32%, 7 studies, n=32,781) when preventive packages of care were delivered alone (comparison of subgroup estimates, P=0.05). Packages involving provision of referrals reduced late neonatal deaths by 43 per cent (95% CI: 11–64%, random effects, 4 studies, n=32,781) as compared to 28 per cent when referrals were not prescribed (comparison of subgroup estimates, P=0.32).

Perinatal Mortality

Community-based intervention packages also played a role in reducing perinatal deaths by 20 per cent (average RR 0.82, 95% CI: 0.72 to 0.93, random effects (10 studies, n=110,291)), and the results were heterogeneous (T^2=0.03, I^2=82% and Chi² p value <0.0001). Building community support and advocacy groups showed an impact of 19 per cent (95% CI: 5–31%, random effects, 6 studies, n=65,268) (comparison of subgroup estimates, P=0.70) while family involvement showed a substantial and significant impact of 23 per cent (95% CI: 9–35%, random effects, n=81,879) (comparison of subgroup estimates, P=0.22) in reducing perinatal deaths. There was also an obvious direction of effect based on duration of training for health workers.

Stillbirths

Community-based interventions showed a 11 per cent average reduction in stillbirths (average RR 0.89; 95% CI 0.78 to 1.02, random effects (11 studies, n=113,821) and the results were heterogeneous (T^2=0.03, I^2=66% and Chi² p value 0.001). On sub-group analysis, building community support groups and involvement of family members did not show any impact on reducing stillbirths. The duration of training of health workers also did not have an impact on the reduction in stillbirths (RR=0.89; 95% CI: 0.76–1.10, random effects, 5 studies, n=60,941 when trained for > 1 week as compared to RR=0.83, 95% CI: 0.64–1.07, random effects, 5 studies, n=47,289 when trained for < 1 week; comparison of subgroup estimates, P=0.62).

Table 5: Mortality outcomes by different levels and varying timings of intervention

		Maternal Mortality	P-Value	Neonatal Mortality	P-Value	Early Neonatal Mortality	P-Value	Late Neonatal Mortality	P-Value	Perinatal Mortality	P-Value	Stillbirths	P-Value
Overall Impact		0.77 (0.59 – 1.02)		0.73 (0.64 – 0.83)		0.71 (0.60 – 0.85)		0.69 (0.57 – 0.82)		0.82 (0.72 – 0.93)		0.89 (0.78 – 1.02)	
Modalities of Interventional Packages													
Community support AND advocacy groups	Present	0.80 (0.53 – 1.21) 6 studies	0.62	0.70 (0.59 – 0.84) 6 studies	0.21	0.73 (0.60 – 0.88) 6 studies	0.61	0.71 (0.55 – 0.90) 6 studies	0.41	0.81 (0.69 – 0.95) 5 studies	0.70	0.93 (0.81 – 1.06) 6 studies	0.52
	Absent	0.70 (0.51 – 0.96) 4 studies		0.77 (0.62 – 0.95) 6 studies		0.62 (0.33 – 1.15) 2 studies		0.57 (0.37 – 0.88) 3 studies		0.86 (0.65 – 1.15) 5 studies		0.83 (0.59 – 1.15) 5 studies	
Involvement of family members through community mobilization	Yes	0.90 (0.53 – 1.52) 4 studies	0.42	0.67 (0.54 – 0.82) 6 studies	0.46	0.70 (0.55 – 0.88) 5 studies	0.85	0.63 (0.44 – 0.90) 5 studies	0.60	0.77 (0.65 – 0.91) 6 studies	0.22	0.84 (0.70 - 1.02) 5 studies	0.39
	No	0.70 (0.53 – 0.92) 6 studies		0.73 (0.67 – 0.79) 6 studies		0.68 (0.57 – 0.80) 3 studies		0.70 (0.58 – 0.86) 4 studies		0.90 (0.75 – 1.08) 5studies		0.96 (0.76 – 1.21) 6 studies	
Community + facility interventions	Both	0.68 (0.39 – 1.17) 3 studies	0.62										
	Community alone	0.80 (0.53 – 1.21) 6 studies											
Preventive and Therapeutic Package of Care	Both			0.52 (0.41 – 0.66) 3 studies	0.005	0.52 (0.41 – 0.66) 2 studies	0.005	0.39 (0.24 – 0.61) 2 studies	0.007				
	Preventive alone			0.80 (0.66 – 0.96) 6 studies		0.80 (0.66 – 0.96) 6 studies		0.76 (0.65 – 0.88) 7 studies					
Extent of training to CHWs	≥ 1 week	0.93 (0.60 – 1.44) 5 studies	0.49	0.93 (0.60 – 1.44) 5 studies	0.49	0.76 (0.62 – 0.93) 5 studies	0.22	0.63 (0.45 – 0.88) 5 studies	0.49	0.80 (0.68 – 0.95) 5 studies	0.31	0.89 (0.76 – 1.05) 5 studies	0.02
	< 1 week	0.74 (0.45 – 1.22) 2 studies		0.74 (0.45 – 1.22) 1 study		0.63 (0.50 – 0.79) 3 studies		0.72 (0.59 – 0.87) 3 studies		0.70 (0.58 – 0.85) 3 studies		0.83 (0.64 – 1.07) 5 studies	
Trained TBAs	Yes	0.82 (0.54 – 1.23) 7 studies	0.53	0.76 (0.68 – 0.86) 8 studies	0.08								
	No	0.69 (0.51 – 0.95) 2 studies		0.57 (0.42 – 0.77) 4 studies									
Timing of Intervention													
Referrals for high risk pregnancies (antenatal period)	Yes									0.92 (0.76 – 1.11) 6 studies	0.07	0.91 (0.71 – 1.17) 5 studies	0.94

		Maternal Mortality	P-Value	Neonatal Mortality	P-Value	Early Neonatal Mortality	P-Value	Late Neonatal Mortality	P-Value	Perinatal Mortality	P-Value	Stillbirths	P-Value
	No									0.70 (0.56 – 0.88) 4 studies		0.90 (0.77 – 1.05) 6 studies	
Provision of clean delivery practices (intrapartum period)	Yes	0.72 (0.56 – 0.93) 6 studies	0.93										
	No	0.75 (0.36 – 1.54) 4 studies											
Referrals for sick newborn (postnatal period)	Yes			0.63 (0.49 – 0.81) 5 studies	0.21	0.64 (0.47 – 0.88) 4 studies	0.37	0.57 (0.36 – 0.89) 4 studies	0.32				
	No			0.74 (0.69 – 0.81) 7 studies		0.77 (0.62 – 0.96) 4 studies		0.72 (0.61 – 0.86) 5 studies					

Results obtained from Meta-analysis and their forest plots are attached in Annex 1.

4.2 Morbidity, service delivery and utilisation

The secondary outcomes of this review were morbidity and service delivery and utilization indicators. With community counselling and community mobilization strategies, direct effects were observed in service utilisation and care seeking pattern that eventually prevented morbidly and mortality among mothers and newborns.

Maternal morbidity and complications during pregnancy

As shown in **Table 5**, community-based intervention packages managed to reduce maternal morbidity on average by 25 per cent (average RR 0.75, 95% CI: 0.61 to 0.92, random effects (4 studies, n=138,290), T^2=0.02, I^2=28% and Chi² p value 0.24). When the effect of community-based intervention was estimated for complication of pregnancy, it had no impact in reducing any of the complication during pregnancy that includes eclampsia (RR 0.74; 95% CI: 0.43 to 1.27 (one study, n=19,525)), obstructed labour (average RR=0.80; 95% CI 0.36 to 1.77, random effects (two studies, n=22,800), T^2=0.32, I^2=97% and Chi² p value <0.001), puerperal sepsis (average RR=0.57; 95% CI 0.26 to 1.27, random effects (two studies, n=22,800), T^2=0.30, I^2=89% and Chi² p value 0.003), haemorrhage (average RR=1.17; 95% CI 0.34 to 3.97, random effects (two studies, n=22,800), T^2=0.76, I^2=97% and Chi² p value <0.001) and spontaneous abortions (RR=0.81; 95% CI 0.55 to1.18 (one study, n=19,525)).

Maternal care outcomes

With regard to maternal care outcomes, community-based intervention packages had a significant impact on recipients availing any antenatal care (RR=1.24, 95% CI: 1.11–1.40, random effects, 7 studies, n=72,100) and for referral to health facility for any complication during pregnancy. (RR 1.41; 95% CI 1.24 to 1.62, fixed-effects (two studies, n=22,800)), (I^2=0% and Chi² p value 0.76).

Interventions did not significantly increase birth attendance by a health care provider overall (RR=1.45; 95% CI 0.68 to 3.12, random effects (seven studies, n=79,687), T^2=1.28, I^2=99% and Chi² p value <0.001). However, improvements observed in institutional deliveries (average RR=1.18, 95% CI 1.02 to 1.38, random effects (eight studies, n=80,579), T^2=0.11, I^2=89% and Chi² p value <0.001). Also, no improvements in iron/folate supplementation rates in pregnant women were found (RR=1.75; 95% CI: 0.97–3.17, 6 studies, random effects).There was no impact observed on healthcare seeking behaviour for neonatal morbidities (average RR=1.37; 95% CI 0.99 to 1.91, random effects (five studies, n=57,157), T^2=0.14, I^2=94% and Chi² p value <0.001), maternal morbidities (average RR=1.35; 95% CI 0.85 to 2.15, random effects (three studies, n=28,304), T^2=0.27, I^2=82% and Chi² p value 0.004) (**Table 6**).

Neonatal care outcomes

Table 7 presents a range of neonatal care outcomes. Community-based intervention packages failed to show any impact on improving mean birth weight (MD=0.01; 95% CI 0.00 to 0.02, random effects (two studies, n=1,150), I^2=0% and Chi² p value 0.83). However, they significantly increased initiation of breastfeeding within an hour of birth (average RR=1.83; 95% CI 1.20 to 2.77, random effects (six studies, n=20,627), T^2=0.06, I^2=97% and Chi² p value <0.001). An exclusive breastfeeding rate at 6 months of age was not reported in any of the studies.

Infant's weight for age and height for age

Infant's weight for age and height for age Z scores at six months of age were not

reported in any of the included studies.

Findings from pre-post studies with no control arm

Another set of studies that are included in this review lacked a control arm but provided before versus after results on a large scale. While less robust than experimental or quasi-experimental designs, these projects provide interesting effectiveness data and are analyzed separately.

A study from Nepal (McPherson R et al., 2007) reported a decrease in neonatal mortality from 18/1000 live births to 8/1000 live births after the intervention. Similarly, the study from Bolivia (O'Rourke K et al., 1998) documented a 7.3 per cent reduction in perinatal deaths resulting from implementation of a community-based intervention package. In these settings community-based intervention packages also showed impacts on increasing institutional deliveries by 4.9 per cent, and initiation of early breastfeeding within an hour of birth by 14 per cent. **Figure 9** presents the pooled analysis for the impact of these community-based intervention projects on birth attendance by skilled provider. Analysis showed a significant standard mean difference of 0.23 (95% CI: 0.02–0.44) on skilled birth attendance.

Figure 9: skilled birth attendance

Pre intervention vs. post intervention

Birth attended by skilled provider

Study or Subgroup	Mean Difference	SE	Weight	Mean Difference IV, Random, 95% CI
McPherson 2006	0.165	0.198	15.9%	0.17 [-0.22, 0.55]
Moran 2006	0.476	0.068	30.7%	0.48 [0.34, 0.61]
Nepal 2007	0.247	0.046	32.9%	0.25 [0.16, 0.34]
WARMI 1998	-0.117	0.152	20.5%	-0.12 [-0.41, 0.18]
Total (95% CI)			**100.0%**	**0.23 [0.02, 0.44]**

Heterogeneity: Tau² = 0.03; Chi² = 15.92, df = 3 (P = 0.001); I² = 81%

Test for overall effect: Z = 2.15 (P = 0.03)

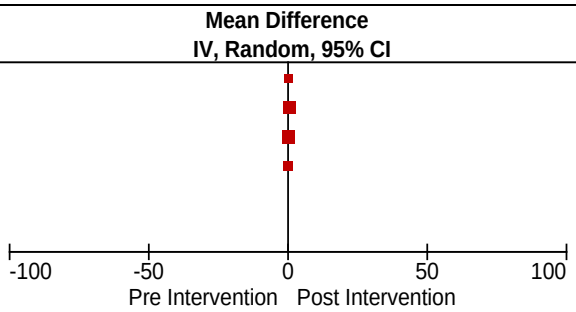


Table 6: Maternal morbidity and complication during pregnancy

			Complication of pregnancy									
	Maternal Morbidity	**P-Value**	**Haemorrhage**	**P-Value**	**Obstructed Labour**	**P-Value**	**Puerperal Sepsis**	**P-Value**	**Eclampsia**	**P-Value**	**Spontaneous Abortion**	**P-Value**
Overall Impact	0.75 (0.61 - 0.92)		1.17 (0.34 - 3.97)		0.80 (0.36 - 1.77)		0.57 (0.26 - 1.27)		0.74 (0.43 - 1.27)		0.81 (0.55 - 1.18)	
	4 studies	0.24	2 studies	<0.0001	2 studies	<0.0001	2 studies	0	1 study	-	1 study	-

Table 6: Maternal Care Outcomes

											Health Care Seeking			
	Any antenatal care	**P-Value**	**Iron/folate supplementation**	**P-Value**	**Referral to health facility**	**P-Value**	**Institutional deliveries**	**P-Value**	**Birth attended by HCP**	**P-Value**	**For Maternal Morbidities**	**P-Value**	**For Neonatal Morbidities**	**P-Value**
Overall Impact	1.24 (1.11-1.40)		1.75 (0.97-3.17)		1.41 (1.24 - 1.62)		1.18 (1.02 - 1.38)		1.45 (0.68 - 3.12)		1.35 (0.85 - 2.15)		1.37 (0.99 – 1.91)	
	7 studies	<0.001	6 studies	<0.001	2 studies	0.8	9 studies	<0.0001	7 studies	<0.0001	3 studies	0.04	5 studies	<0.0001

Table 7: Neonatal Care Outcomes

	Mean Birth Weight*	**P-Value**	**Initiation of early breastfeeding**	**P-Value**
Overall Impact	0.01 (0.00 - 0.02)		1.83 (1.20 - 2.77)	
	2 studies	0.8	7 studies	<0.00001

* mean difference, IV, Fixed

5. DISCUSSION

To the best of our knowledge, this is the first systematic review that has evaluated the effectiveness of community-based intervention packages and reported impacts on maternal, perinatal and neonatal outcomes. Prior to this review, other reviewers have generated evidence from reviewing community-based antenatal, intra-partum and postnatal interventions trials from developing countries and recommended their inclusion in community-based neonatal programmes based on their effectiveness (Bhutta 2005). Another review by Haws et al. evaluated neonatal care packages in terms of their content, impact, efficacy (implementation under ideal circumstances), effectiveness (implementation within health systems), and cost (Haws 2007) with no attempt of looking at their direct effects on reducing neonatal mortality and morbidity outcomes.

This systematic review of clustered randomised and quasi-experimental control trials and other pre-post studies provides evidence of the effectiveness of community-based intervention packages on maternal, perinatal and neonatal morbidities, mortality and improving health outcomes.

We found a paucity of eligible studies that implemented interventions (generally as care packages) specifically addressing and reporting maternal outcomes. Our meta-analysis did not find any significant impact of community-based intervention package on reducing maternal mortality. The possible reason for these insignificant findings might be inadequate sample size to detect meaningful change in maternal mortality. In addressing maternal mortality impacts, very large sample sizes are required for producing reliable estimates; as in this comparatively rare event, omission of only a few cases can have a disproportionately distorting effect on the maternal mortality ratio. However, significant reduction in maternal morbidity (by 25 per cent) was observed as a consequence of implementation of community-based interventional care packages. It was also found that referrals to health facility for pregnancy related complication increased by 41 per cent.

The evidence of the impact of community-based intervention packages is robust with consistent evidence of reduction in neonatal deaths found in the subset of studies which had employed randomised and quasi-experimental controlled designs. We observed an overall 27 per cent reduction in overall neonatal deaths from the studies reviewed, with the bulk of studies showing an impact on early neonatal deaths. Community mobilization played a vital role in reducing early neonatal deaths, possibly due to the reason that these groups focused on women in the antenatal period and focused on early newborn care and management and referrals of sick newborns. On the other hand, packages delivered by CHWs (with preventive and therapeutic components) impacted early and late neonatal deaths which is not surprising as most of these studies focused on preventive and therapeutic aspects – mainly provision of referrals, management of neonatal illnesses and infections and the majority (more than 50 per cent) of planned neonatal visits were within the first month of life (Kumar et al., 2008; Bhutta et al., 2008b; Bhutta et al., 2009; Bang et al., 1999).

The findings from this pooled analysis also demonstrate an impact of community interventions on reducing stillbirths by 11 per cent and perinatal mortality by 18 per cent. In particular, community support groups and advocacy approaches through group sessions and family involvement in care were especially effective in reducing perinatal deaths – by 19 per cent and 23 per cent respectively – compared to scenarios when community-based advocacy or support groups and family involvement in care were not involved in the intervention packages (Kumar et al., 2008, Manandhar et al., 2004; Bhutta et al., 2008b; Bhutta et al., 2009). The probable mechanism of effect is also through the direction of improved care seeking and facility births, as has been demonstrated from rural Pakistan (Bhutta et al., 2008b).

Our pooled analysis did not find a significant effect of interventions on health care

seeking for maternal illnesses; although positive impacts on health care seeking for neonatal illnesses were observed. A potential reason for this discrepancy could also be relevant cultural and perceived religious barriers to maternal care that are resilient to behaviour change communication strategies. Formative research from South Asia has reported that when maternal illness occurs, it often falls on the mother herself to recognise danger signs, and once so determined, her mother-in-law and husband are usually the bridge or barrier for care seeking between care in the home and care seeking beyond (Jackson J and Jackson-Carroll L, 1987, Mesko N et al., 2003, Syed U et al., December 2008). On the other hand, during neonatal illness, it is usually the mother who recognises symptoms and seeks care from any source, including traditional sources. Moreover, studies in our analysis focused on referrals management of early neonatal illnesses and the majority of planned visits were within the first week of life (Bang et al. 1999; Bhutta et al. 2008; Bhutta et al. 2009; Darmstadt et al. 2008). This suggests that behaviour change strategies should also target the elimination of a range of possible causes – physical, cultural, and spiritual – some of which may necessarily involve the entire family.

Packaged interventional care also improved neonatal care outcomes like breastfeeding; however, the paucity of studies precluded robust estimation of pooled effects. A meta-analysis of studies reporting initiation of breastfeeding within an hour of birth (early breastfeeding) found that interventions consisting of antepartum newborn care and breastfeeding education to mothers doubled rates of initiation of breastfeeding. A recent commentary by Jana et al (Jana 2009) on review findings for interventions for promoting the initiation of breastfeeding also suggested that educational strategies during the antenatal period (including breastfeeding education along with other components of essential newborn care) and maternal support are likely to have the greatest impact on early initiation of breastfeeding.

Notably, most of the reviewed studies, when implemented, neglected to document the complete description and characteristics of CHWs deployed, especially the level and amount of supervision provided to those workers, which could have helped us in identifying the importance of this factor and its association with other outcomes. This information would be of great relevance to policy and practice. Additional information on the initial level of education of CHWs, provision of refresher training, mode of training, balance of practical/theoretical sessions would have provided greater assistance in understanding the threshold effect, if any, of these factors on CHW performance in community settings. Importantly, community ownership and supervision of CHWs is a key characteristic which is insufficiently described and analysed in available literature. Finally, the diversity of studies, small number of studies in each subgroup and the limited intervention description precluded examination of the relations between the characteristics of the intervention and their effects. There is thus a clear need for additional research at an appropriate scale with detailed description of each component intervention.

Although cost-effectiveness analysis was not one of the main objectives of this review, it plays a crucial role in selecting and bundling intervention packages for scaling up and particularly in tailoring interventions to available health system resources. Only a few studies reported the actual costs incurred in providing interventions for saving one life or cost of one averted death (Manandhar DS et al., 2004, Bang AT et al., 2005a, Bang AT et al., 1999, Baqui et al., 2008). Therefore, cost-effectiveness is a priority area for research for the future and, where possible, researchers should facilitate cost-effectiveness meta-analysis by collecting and reporting cost-effectiveness data in a standardised format (e.g. costs per lives saved or disability-adjusted life years (DALYs) averted).

Given the rapid rise in health care costs, and the imperative of reaching hard-to-reach communities, it has become imperative to focus on developing cost-effective and

affordable ways to prevent disease and promote health in community settings (Morgan, 2001). The deployment of community support and advocacy groups with a mix of evidence-based promotive, preventive and therapeutic interventions can go a long way in reducing the inequity around maternal and newborn health. Our review underscores the importance of community mobilisation and empowerment strategies using the platform of community support groups and creation of an opportunity of incrementally adding on additional maternal and newborn interventions.

6. CONCLUSIONS

Our review offers encouraging evidence of the value of integrating maternal and newborn care in community settings through a range of strategies that work, many of which can be packaged effectively for delivery through a range of CHWs. While the importance of skilled delivery and facility based care for maternal care cannot be denied, our review provides encouraging evidence that the benefits of community-based strategies may extend across the continuum of maternal and newborn care. The most successful packages were those that emphasised clean practices by involving family members through community support and advocacy groups and community mobilisation and education strategies, provision of care through trained CHWs via home visitation, and strengthened proper referrals for sick mothers and newborns.

Notwithstanding these findings, this analysis largely derives from a limited number of effectiveness trials as most studies were conducted in efficacy settings. Also the bulk of the data were from studies conducted in Asia with very limited information from sub-Saharan and central African settings. There is thus a clear need for additional research at an appropriate scale and in the right settings. Given the rapid rise in healthcare costs, and the imperative of reaching hard-to-reach communities, it has become crucial to focus on developing cost-effective and affordable ways to prevent disease and promote health in community settings. Although this was not one of the main objectives of this review, it plays a fundamental role in selecting and bundling intervention packages for scaling up and particularly in tailoring interventions to available health system resources. Only few studies reported the actual costs incurred for providing interventions for saving one life or cost of one averted death. Therefore, cost-effectiveness is a priority area for research for the future and researchers should facilitate cost-effectiveness meta-analysis by collecting and reporting cost-effectiveness data in a standardised format (e.g. costs per lives saved or DALYs averted).

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[i] Abridged versions of this review are available in the Cochrane library (Lassi et al, 2010) and in the Journal of Development Effectiveness (Lassi et al, 2011).

[ii] See www.un.org/millenniumgoals

[iii] Prior systematic reviews have generated evidence on community-based maternal and neonatal intervention trials BHUTTA ZA, DARMSTADT GL, HASAN BS & HAWS RA (2005) Community-Based Interventions for Improving Perinatal and Neonatal Health Outcomes in Developing Countries: A Review of the Evidence. *Pediatrics,* 115**,** 519-617., though these were not subjected to meta-analysis. This review does not evaluate the impact of training TBAs alone (Simpley 2007), or effectiveness of a health education strategy designed for mothers and other family members on newborn survival THAVER D, ZAIDI AKM, OWAIS A, H. B. & BHUTTA ZA (2009) The effect of community health educational interventions on newborn survival in developing countries [Protocol]. *Cochrane Database of Systematic Reviews,* as these are being evaluated in other reviews.

[iv] In particular, this search extended to reviewing the grey literature in non-indexed and non-electronic sources, including project documents identified through key informants and agencies. The bibliographies of books with sections pertaining to community-based maternal and/or newborn care were also searched manually to identify relevant reports and publications. Over 20 experts in

the field were specifically approached at a conference on community approaches for newborn care (Baltimore, May 1-2, 2009) and the CHERG meeting in Geneva (June 9-11, 2009) for possible unpublished studies or reports for inclusion in this analysis.

[v] For dichotomous data, we presented results as a summary ratio with 95 percent confidence intervals. For continuous data, we used the mean difference if outcomes are measured in the same way between trials. We used standardised mean differences to combine trials that measure the same outcome, but use different scales. For analyzing and pooling data from cluster-randomised trials, the entire cluster was used as the unit of randomisation and the analysis adjusted for design. We assessed statistical heterogeneity in each meta-analysis using the T^2, I^2 and Chi^2 statistics. We regarded heterogeneity as substantial if T^2 was greater than zero and either I^2 was greater than 30% or there was a low P value (< 0.10) in the Chi^2 test for heterogeneity.

[vi] We included results from two intervention arms (two sub sets) of Baqui 2008 and reported them as Baqui-home care (a) 2008; Baqui-com care (b) 2008.

[vii] Results are presented in forest plots, where the point estimate of each study is represented by a blob, the size of the blob reflects the study's proportionate weighting in the pooled estimated effect size, and the width of the horizontal line indicates the 95 percent confidence interval (CI). The pooled estimated effect size and CI are given in the diamond shape centred on the average point estimate. The vertical line in the middle is where the decision is made. If the CI crosses the line then there is no statistically significant difference in the effect of the two interventions (ie the intervention is not effective); if the CI does not cross the vertical line then the analysis favours either the experimental arm or the control arm depending on the direction of improvement. For mortality and morbidity outcomes, an improvement is measured as a reduction in treatment over control group, and therefore a risk ratio or mean difference to the left of the vertical line. For all other outcomes, an improvement is measured as an increase in treatment over control group, and therefore a risk ratio or mean difference to the right of the vertical line.

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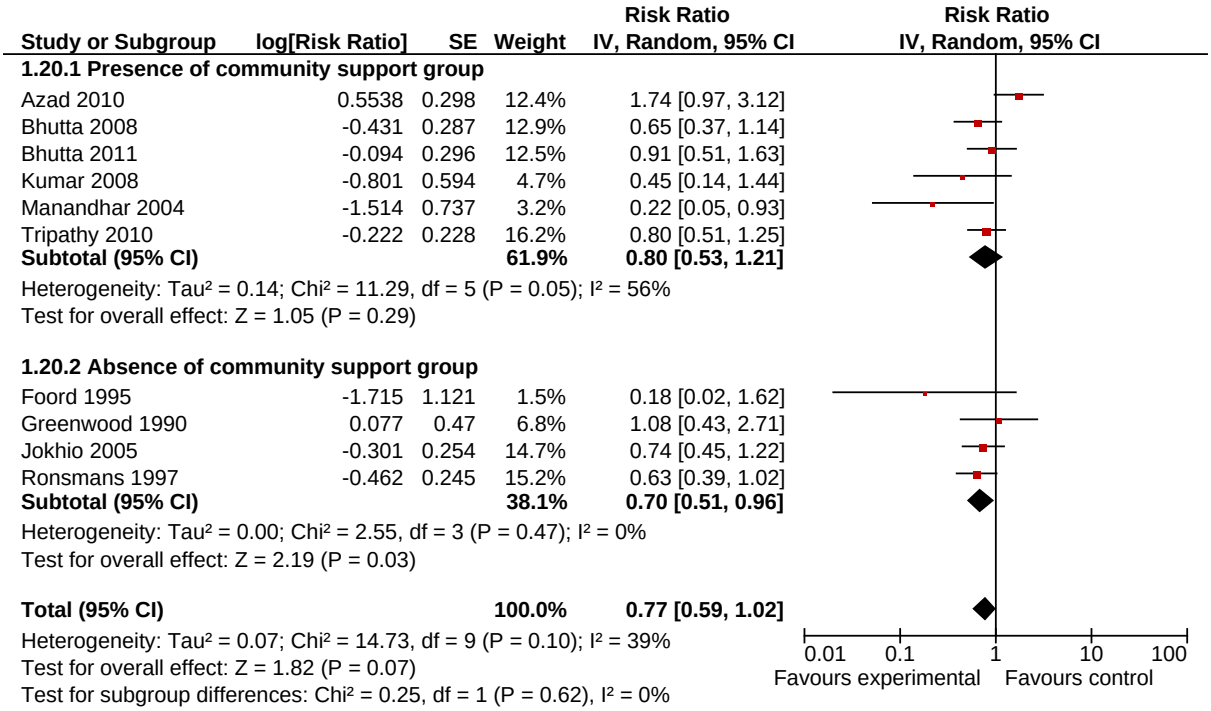
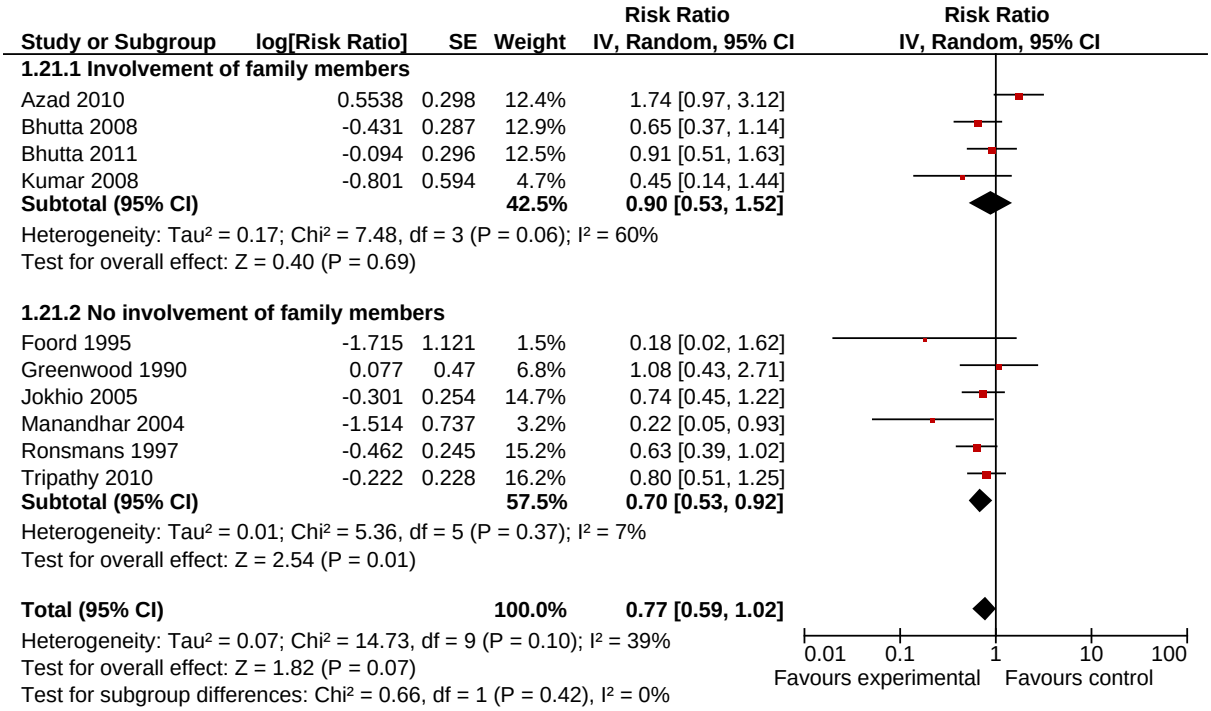
ANNEX 1: RESULTS OF META-ANALYSIS AND FOREST PLOTS

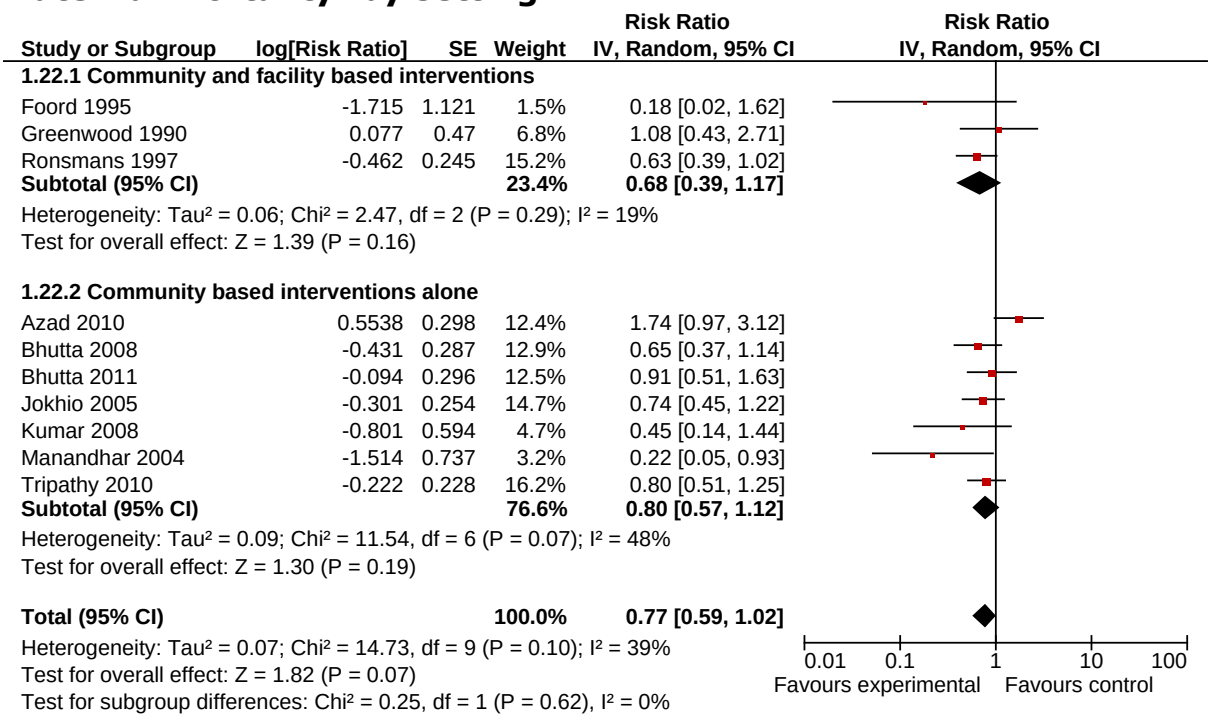
Maternal mortality: by community support groups



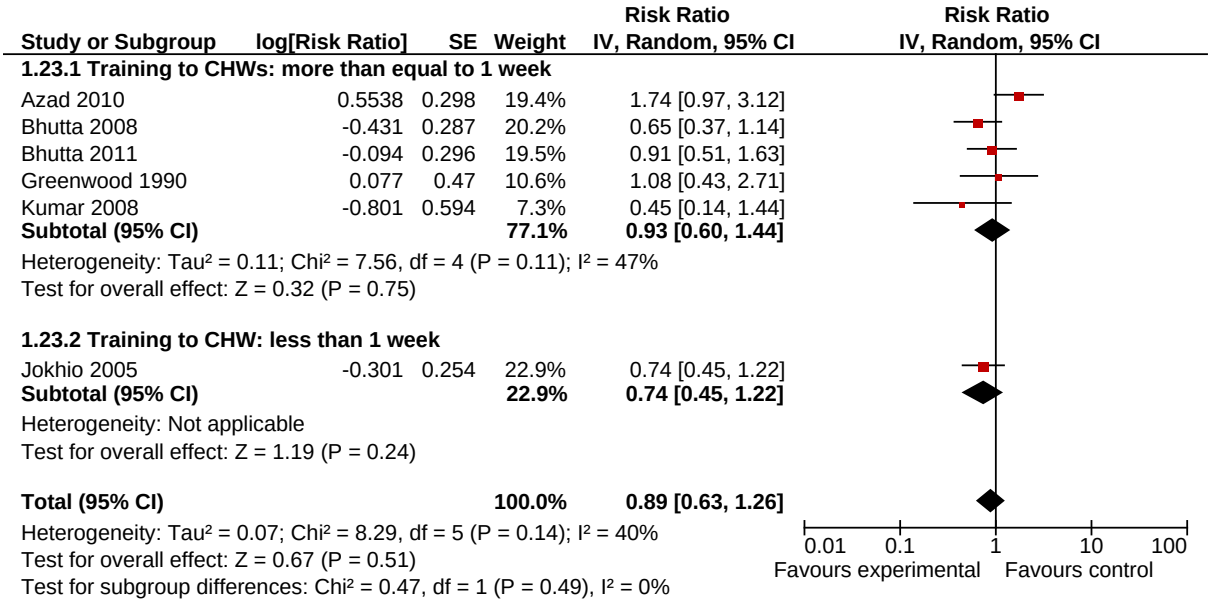
Maternal mortality: by involvement of family members



Maternal mortality: by setting

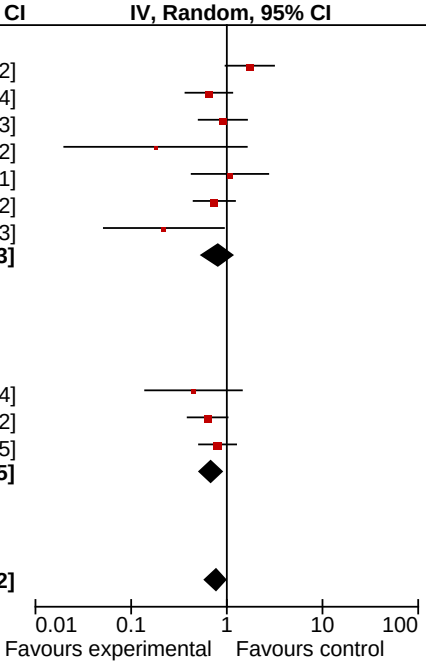


Maternal mortality: by extent of training to CHWs



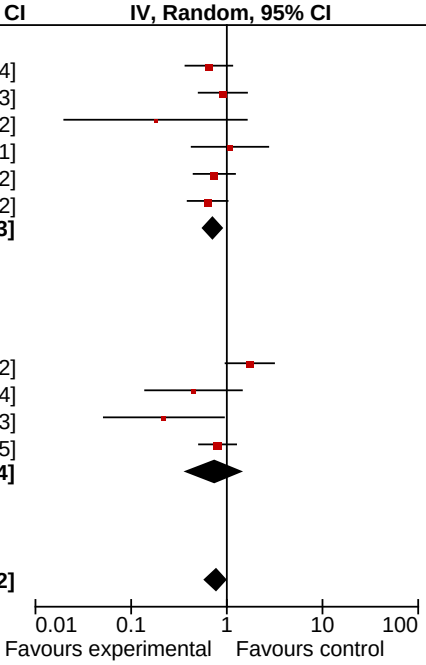
Maternal mortality: by trained TBAs

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.24.1 Trained TBAs				
Azad 2010	0.5538	0.298	12.4%	1.74 [0.97, 3.12]
Bhutta 2008	-0.431	0.287	12.9%	0.65 [0.37, 1.14]
Bhutta 2011	-0.094	0.296	12.5%	0.91 [0.51, 1.63]
Foord 1995	-1.715	1.121	1.5%	0.18 [0.02, 1.62]
Greenwood 1990	0.077	0.47	6.8%	1.08 [0.43, 2.71]
Jokhio 2005	-0.301	0.254	14.7%	0.74 [0.45, 1.22]
Manandhar 2004	-1.514	0.737	3.2%	0.22 [0.05, 0.93]
Subtotal (95% CI)			**64.0%**	**0.82 [0.54, 1.23]**
Heterogeneity: Tau² = 0.14; Chi² = 12.53, df = 6 (P = 0.05); I² = 52%				
Test for overall effect: Z = 0.96 (P = 0.34)				
1.24.2 No trained TBAs				
Kumar 2008	-0.801	0.594	4.7%	0.45 [0.14, 1.44]
Ronsmans 1997	-0.462	0.245	15.2%	0.63 [0.39, 1.02]
Tripathy 2010	-0.222	0.228	16.2%	0.80 [0.51, 1.25]
Subtotal (95% CI)			**36.0%**	**0.69 [0.51, 0.95]**
Heterogeneity: Tau² = 0.00; Chi² = 1.09, df = 2 (P = 0.58); I² = 0%				
Test for overall effect: Z = 2.29 (P = 0.02)				
Total (95% CI)			**100.0%**	**0.77 [0.59, 1.02]**
Heterogeneity: Tau² = 0.07; Chi² = 14.73, df = 9 (P = 0.10); I² = 39%				
Test for overall effect: Z = 1.82 (P = 0.07)				
Test for subgroup differences: Chi² = 0.40, df = 1 (P = 0.53), I² = 0%				



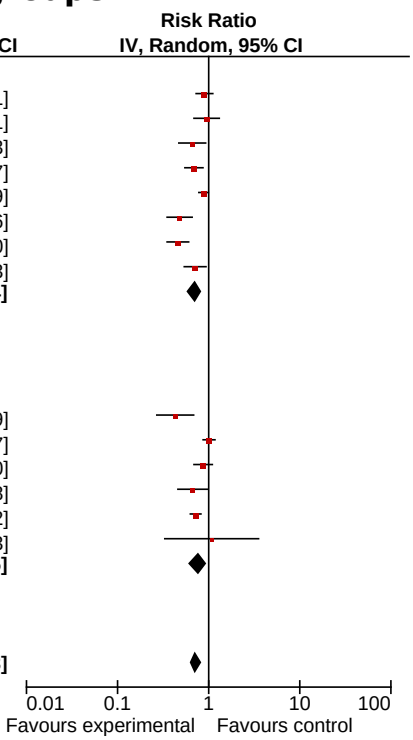
Maternal mortality: by clean delivery practices

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.25.1 clean delivery practices				
Bhutta 2008	-0.431	0.287	12.9%	0.65 [0.37, 1.14]
Bhutta 2011	-0.094	0.296	12.5%	0.91 [0.51, 1.63]
Foord 1995	-1.715	1.121	1.5%	0.18 [0.02, 1.62]
Greenwood 1990	0.077	0.47	6.8%	1.08 [0.43, 2.71]
Jokhio 2005	-0.301	0.254	14.7%	0.74 [0.45, 1.22]
Ronsmans 1997	-0.462	0.245	15.2%	0.63 [0.39, 1.02]
Subtotal (95% CI)			**63.5%**	**0.72 [0.56, 0.93]**
Heterogeneity: Tau² = 0.00; Chi² = 3.34, df = 5 (P = 0.65); I² = 0%				
Test for overall effect: Z = 2.52 (P = 0.01)				
1.25.2 No clean delivery practices				
Azad 2010	0.5538	0.298	12.4%	1.74 [0.97, 3.12]
Kumar 2008	-0.801	0.594	4.7%	0.45 [0.14, 1.44]
Manandhar 2004	-1.514	0.737	3.2%	0.22 [0.05, 0.93]
Tripathy 2010	-0.222	0.228	16.2%	0.80 [0.51, 1.25]
Subtotal (95% CI)			**36.5%**	**0.75 [0.36, 1.54]**
Heterogeneity: Tau² = 0.35; Chi² = 10.17, df = 3 (P = 0.02); I² = 70%				
Test for overall effect: Z = 0.79 (P = 0.43)				
Total (95% CI)			**100.0%**	**0.77 [0.59, 1.02]**
Heterogeneity: Tau² = 0.07; Chi² = 14.73, df = 9 (P = 0.10); I² = 39%				
Test for overall effect: Z = 1.82 (P = 0.07)				
Test for subgroup differences: Chi² = 0.01, df = 1 (P = 0.93), I² = 0%				



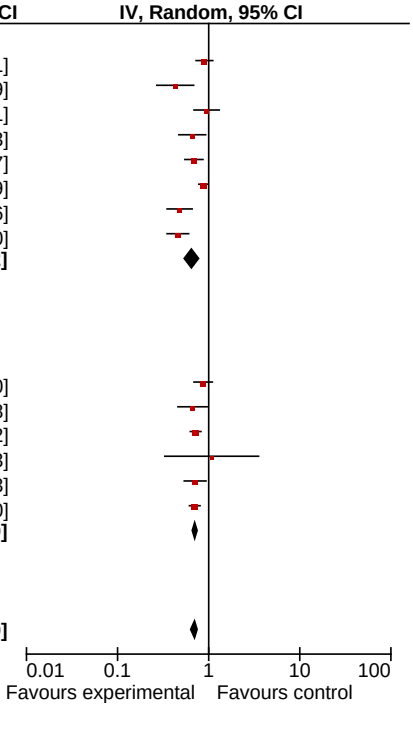
Neonatal mortality: by community support groups

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.26.1 Presence of community support groups				
Azad 2010	-0.105	0.107	8.5%	0.90 [0.73, 1.11]
Baqui cc 2008	-0.051	0.163	6.6%	0.95 [0.69, 1.31]
Baqui hc 2008	-0.415	0.173	6.3%	0.66 [0.47, 0.93]
Bhutta 2008	-0.371	0.116	8.2%	0.69 [0.55, 0.87]
Bhutta 2011	-0.128	0.061	10.0%	0.88 [0.78, 0.99]
Kumar ENC 2008	-0.734	0.161	6.7%	0.48 [0.35, 0.66]
Kumar ENC+thermospot 2008	-0.777	0.139	7.4%	0.46 [0.35, 0.60]
Tripathy 2010	-0.342	0.14	7.4%	0.71 [0.54, 0.93]
Subtotal (95% CI)			**61.1%**	**0.70 [0.59, 0.84]**
Heterogeneity: Tau² = 0.05; Chi² = 32.94, df = 7 (P < 0.0001); I² = 79%				
Test for overall effect: Z = 3.77 (P = 0.0002)				
1.26.2 Absence of community support groups				
Bang 1999	-0.844	0.238	4.6%	0.43 [0.27, 0.69]
Baqui 2008	0.0099	0.076	9.5%	1.01 [0.87, 1.17]
Darmstadt 2010	-0.139	0.118	8.1%	0.87 [0.69, 1.10]
Greenwood 1990	-0.4	0.192	5.7%	0.67 [0.46, 0.98]
Jokhio 2005	-0.329	0.068	9.8%	0.72 [0.63, 0.82]
Kafatos 1991	0.077	0.604	1.1%	1.08 [0.33, 3.53]
Subtotal (95% CI)			**38.9%**	**0.77 [0.62, 0.95]**
Heterogeneity: Tau² = 0.04; Chi² = 20.09, df = 5 (P = 0.001); I² = 75%				
Test for overall effect: Z = 2.44 (P = 0.01)				
Total (95% CI)			**100.0%**	**0.73 [0.64, 0.83]**
Heterogeneity: Tau² = 0.04; Chi² = 54.14, df = 13 (P < 0.00001); I² = 76%				
Test for overall effect: Z = 4.73 (P < 0.00001)				
Test for subgroup differences: Chi² = 0.35, df = 1 (P = 0.55), I² = 0%				



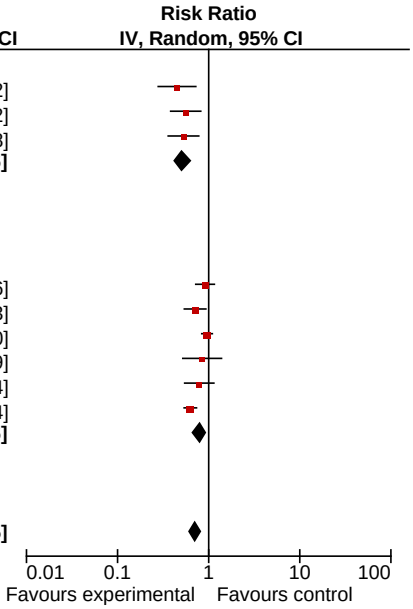
Neonatal mortality: by involvement of family members

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.27.1 Involvement of family members				
Azad 2010	-0.105	0.107	8.7%	0.90 [0.73, 1.11]
Bang 1999	-0.844	0.238	4.1%	0.43 [0.27, 0.69]
Baqui cc 2008	-0.051	0.163	6.3%	0.95 [0.69, 1.31]
Baqui hc 2008	-0.415	0.173	5.9%	0.66 [0.47, 0.93]
Bhutta 2008	-0.371	0.116	8.3%	0.69 [0.55, 0.87]
Bhutta 2011	-0.128	0.061	10.8%	0.88 [0.78, 0.99]
Kumar ENC 2008	-0.734	0.161	6.4%	0.48 [0.35, 0.66]
Kumar ENC+thermospot 2008	-0.777	0.139	7.2%	0.46 [0.35, 0.60]
Subtotal (95% CI)			**57.5%**	**0.67 [0.54, 0.82]**
Heterogeneity: Tau² = 0.07; Chi² = 38.43, df = 7 (P < 0.00001); I² = 82%				
Test for overall effect: Z = 3.78 (P = 0.0002)				
1.27.2 No involvement of family members				
Darmstadt 2010	-0.139	0.118	8.2%	0.87 [0.69, 1.10]
Greenwood 1990	-0.4	0.192	5.3%	0.67 [0.46, 0.98]
Jokhio 2005	-0.329	0.068	10.5%	0.72 [0.63, 0.82]
Kafatos 1991	0.077	0.604	0.9%	1.08 [0.33, 3.53]
Manandhar 2004	-0.342	0.14	7.2%	0.71 [0.54, 0.93]
Tripathy 2010	-0.352	0.068	10.5%	0.70 [0.62, 0.80]
Subtotal (95% CI)			**42.5%**	**0.73 [0.67, 0.79]**
Heterogeneity: Tau² = 0.00; Chi² = 3.22, df = 5 (P = 0.67); I² = 0%				
Test for overall effect: Z = 7.66 (P < 0.00001)				
Total (95% CI)			**100.0%**	**0.71 [0.63, 0.79]**
Heterogeneity: Tau² = 0.03; Chi² = 42.06, df = 13 (P < 0.0001); I² = 69%				
Test for overall effect: Z = 5.90 (P < 0.00001)				
Test for subgroup differences: Chi² = 0.54, df = 1 (P = 0.46), I² = 0%				



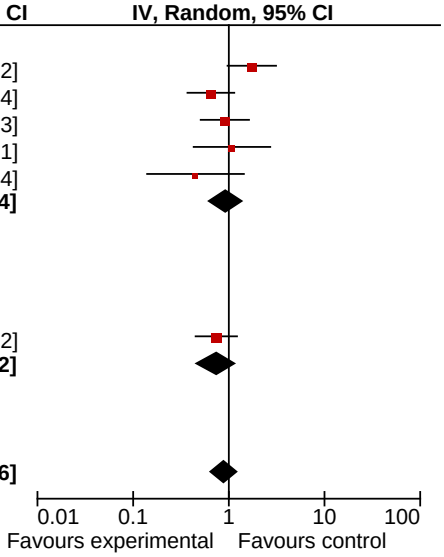
Neonatal mortality: by preventive and therapeutic interventions

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.34.1 Preventive and therapeutic package of care				
Bang 1999	-0.799	0.242	7.7%	0.45 [0.28, 0.72]
Kumar ENC 2008	-0.58	0.194	9.6%	0.56 [0.38, 0.82]
Kumar ENC+thermospot 2008	-0.635	0.197	9.4%	0.53 [0.36, 0.78]
Subtotal (95% CI)			**26.7%**	**0.52 [0.41, 0.66]**
Heterogeneity: Tau² = 0.00; Chi² = 0.51, df = 2 (P = 0.77); I² = 0%				
Test for overall effect: Z = 5.45 (P < 0.00001)				
1.34.2 Preventive package of care alone				
Azad 2010	-0.09	0.12	13.1%	0.91 [0.72, 1.16]
Bhutta 2008	-0.342	0.139	12.2%	0.71 [0.54, 0.93]
Bhutta 2011	-0.041	0.068	15.6%	0.96 [0.84, 1.10]
Greenwood 1990	-0.163	0.25	7.4%	0.85 [0.52, 1.39]
Manandhar 2004	-0.236	0.188	9.8%	0.79 [0.55, 1.14]
Tripathy 2010	-0.462	0.079	15.1%	0.63 [0.54, 0.74]
Subtotal (95% CI)			**73.3%**	**0.80 [0.66, 0.96]**
Heterogeneity: Tau² = 0.03; Chi² = 18.30, df = 5 (P = 0.003); I² = 73%				
Test for overall effect: Z = 2.42 (P = 0.02)				
Total (95% CI)			**100.0%**	**0.71 [0.60, 0.85]**
Heterogeneity: Tau² = 0.05; Chi² = 30.73, df = 8 (P = 0.0002); I² = 74%				
Test for overall effect: Z = 3.78 (P = 0.0002)				
Test for subgroup differences: Chi² = 7.97, df = 1 (P = 0.005), I² = 87.4%				



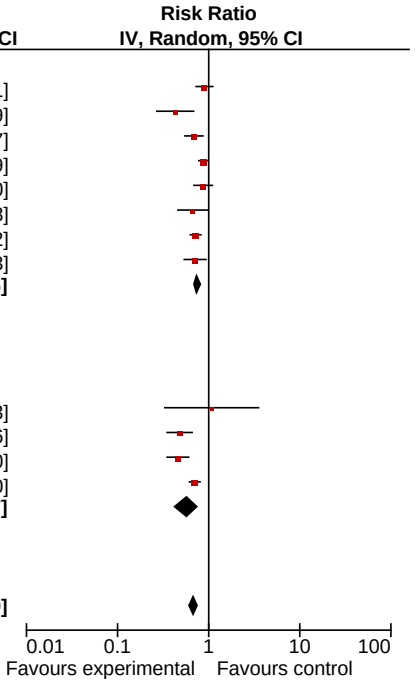
Neonatal mortality: by extent of training to CHWs

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.23.1 Training to CHWs: more than equal to 1 week				
Azad 2010	0.5538	0.298	19.4%	1.74 [0.97, 3.12]
Bhutta 2008	-0.431	0.287	20.2%	0.65 [0.37, 1.14]
Bhutta 2011	-0.094	0.296	19.5%	0.91 [0.51, 1.63]
Greenwood 1990	0.077	0.47	10.6%	1.08 [0.43, 2.71]
Kumar 2008	-0.801	0.594	7.3%	0.45 [0.14, 1.44]
Subtotal (95% CI)			**77.1%**	**0.93 [0.60, 1.44]**
Heterogeneity: Tau² = 0.11; Chi² = 7.56, df = 4 (P = 0.11); I² = 47%				
Test for overall effect: Z = 0.32 (P = 0.75)				
1.23.2 Training to CHW: less than 1 week				
Jokhio 2005	-0.301	0.254	22.9%	0.74 [0.45, 1.22]
Subtotal (95% CI)			**22.9%**	**0.74 [0.45, 1.22]**
Heterogeneity: Not applicable				
Test for overall effect: Z = 1.19 (P = 0.24)				
Total (95% CI)			**100.0%**	**0.89 [0.63, 1.26]**
Heterogeneity: Tau² = 0.07; Chi² = 8.29, df = 5 (P = 0.14); I² = 40%				
Test for overall effect: Z = 0.67 (P = 0.51)				
Test for subgroup differences: Chi² = 0.47, df = 1 (P = 0.49), I² = 0%				



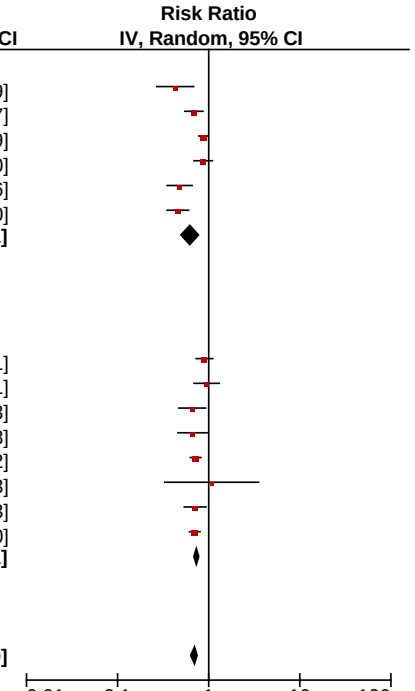
Neonatal mortality: by trained TBAs

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.30.1 Trained TBAs				
Azad 2010	-0.105	0.107	9.9%	0.90 [0.73, 1.11]
Bang 1999	-0.844	0.238	4.7%	0.43 [0.27, 0.69]
Bhutta 2008	-0.371	0.116	9.4%	0.69 [0.55, 0.87]
Bhutta 2011	-0.128	0.061	12.1%	0.88 [0.78, 0.99]
Darmstadt 2010	-0.139	0.118	9.3%	0.87 [0.69, 1.10]
Greenwood 1990	-0.4	0.192	6.1%	0.67 [0.46, 0.98]
Jokhio 2005	-0.329	0.068	11.8%	0.72 [0.63, 0.82]
Manandhar 2004	-0.342	0.14	8.2%	0.71 [0.54, 0.93]
Subtotal (95% CI)			**71.6%**	**0.76 [0.68, 0.86]**
Heterogeneity: Tau² = 0.01; Chi² = 16.35, df = 7 (P = 0.02); I² = 57%				
Test for overall effect: Z = 4.55 (P < 0.00001)				
1.30.2 No trained TBAs				
Kafatos 1991	0.077	0.604	1.0%	1.08 [0.33, 3.53]
Kumar ENC 2008	-0.734	0.161	7.3%	0.48 [0.35, 0.66]
Kumar ENC+thermospot 2008	-0.777	0.139	8.3%	0.46 [0.35, 0.60]
Tripathy 2010	-0.352	0.068	11.8%	0.70 [0.62, 0.80]
Subtotal (95% CI)			**28.4%**	**0.57 [0.42, 0.77]**
Heterogeneity: Tau² = 0.06; Chi² = 11.40, df = 3 (P = 0.010); I² = 74%				
Test for overall effect: Z = 3.69 (P = 0.0002)				
Total (95% CI)			**100.0%**	**0.70 [0.61, 0.79]**
Heterogeneity: Tau² = 0.03; Chi² = 39.29, df = 11 (P < 0.0001); I² = 72%				
Test for overall effect: Z = 5.71 (P < 0.00001)				
Test for subgroup differences: Chi² = 3.12, df = 1 (P = 0.08), I² = 67.9%				



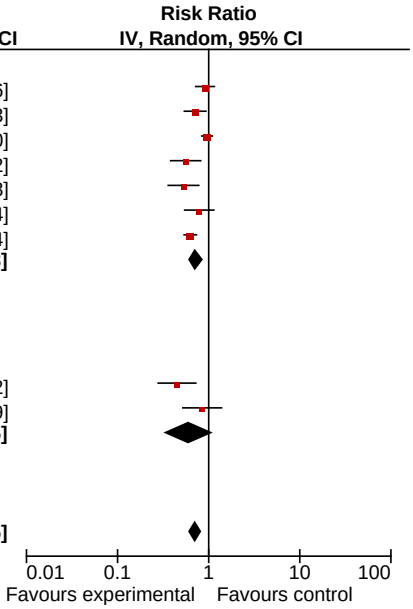
Neonatal mortality: by provision of referral

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.31.1 Referral to sick newborn				
Bang 1999	-0.844	0.238	4.1%	0.43 [0.27, 0.69]
Bhutta 2008	-0.371	0.116	8.3%	0.69 [0.55, 0.87]
Bhutta 2011	-0.128	0.061	10.8%	0.88 [0.78, 0.99]
Darmstadt 2010	-0.139	0.118	8.2%	0.87 [0.69, 1.10]
Kumar ENC 2008	-0.734	0.161	6.4%	0.48 [0.35, 0.66]
Kumar ENC+thermospot 2008	-0.777	0.139	7.2%	0.46 [0.35, 0.60]
Subtotal (95% CI)			**44.8%**	**0.63 [0.49, 0.81]**
Heterogeneity: Tau² = 0.08; Chi² = 34.45, df = 5 (P < 0.00001); I² = 85%				
Test for overall effect: Z = 3.56 (P = 0.0004)				
1.31.2 No referral to sick newborn				
Azad 2010	-0.105	0.107	8.7%	0.90 [0.73, 1.11]
Baqui cc 2008	-0.051	0.163	6.3%	0.95 [0.69, 1.31]
Baqui hc 2008	-0.415	0.173	5.9%	0.66 [0.47, 0.93]
Greenwood 1990	-0.4	0.192	5.3%	0.67 [0.46, 0.98]
Jokhio 2005	-0.329	0.068	10.5%	0.72 [0.63, 0.82]
Kafatos 1991	0.077	0.604	0.9%	1.08 [0.33, 3.53]
Manandhar 2004	-0.342	0.14	7.2%	0.71 [0.54, 0.93]
Tripathy 2010	-0.352	0.068	10.5%	0.70 [0.62, 0.80]
Subtotal (95% CI)			**55.2%**	**0.74 [0.69, 0.81]**
Heterogeneity: Tau² = 0.00; Chi² = 7.61, df = 7 (P = 0.37); I² = 8%				
Test for overall effect: Z = 7.02 (P < 0.00001)				
Total (95% CI)			**100.0%**	**0.71 [0.63, 0.79]**
Heterogeneity: Tau² = 0.03; Chi² = 42.06, df = 13 (P < 0.0001); I² = 69%				
Test for overall effect: Z = 5.90 (P < 0.00001)				
Test for subgroup differences: Chi² = 1.54, df = 1 (P = 0.21), I² = 35.2%				



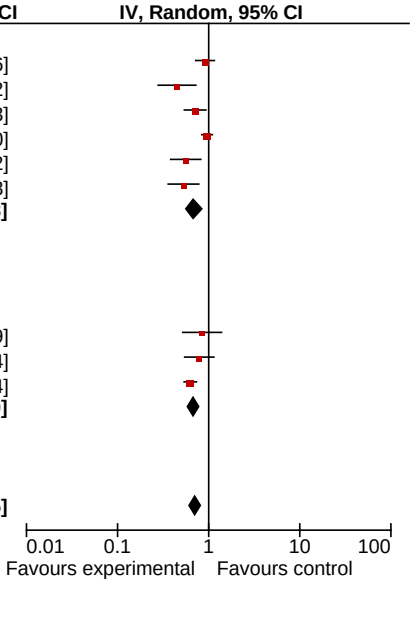
Early neonatal mortality: by community support groups

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.32.1 Presence of community support groups				
Azad 2010	-0.09	0.12	13.1%	0.91 [0.72, 1.16]
Bhutta 2008	-0.342	0.139	12.2%	0.71 [0.54, 0.93]
Bhutta 2011	-0.041	0.068	15.6%	0.96 [0.84, 1.10]
Kumar ENC 2008	-0.58	0.194	9.6%	0.56 [0.38, 0.82]
Kumar ENC+thermospot 2008	-0.635	0.197	9.4%	0.53 [0.36, 0.78]
Manandhar 2004	-0.236	0.188	9.8%	0.79 [0.55, 1.14]
Tripathy 2010	-0.462	0.079	15.1%	0.63 [0.54, 0.74]
Subtotal (95% CI)			**84.9%**	**0.73 [0.60, 0.88]**
Heterogeneity: Tau² = 0.04; Chi² = 25.58, df = 6 (P = 0.0003); I² = 77%				
Test for overall effect: Z = 3.29 (P = 0.001)				
1.32.2 Absence of community support group				
Bang 1999	-0.799	0.242	7.7%	0.45 [0.28, 0.72]
Greenwood 1990	-0.163	0.25	7.4%	0.85 [0.52, 1.39]
Subtotal (95% CI)			**15.1%**	**0.62 [0.33, 1.15]**
Heterogeneity: Tau² = 0.14; Chi² = 3.34, df = 1 (P = 0.07); I² = 70%				
Test for overall effect: Z = 1.52 (P = 0.13)				
Total (95% CI)			**100.0%**	**0.71 [0.60, 0.85]**
Heterogeneity: Tau² = 0.05; Chi² = 30.73, df = 8 (P = 0.0002); I² = 74%				
Test for overall effect: Z = 3.78 (P = 0.0002)				
Test for subgroup differences: Chi² = 0.26, df = 1 (P = 0.61), I² = 0%				



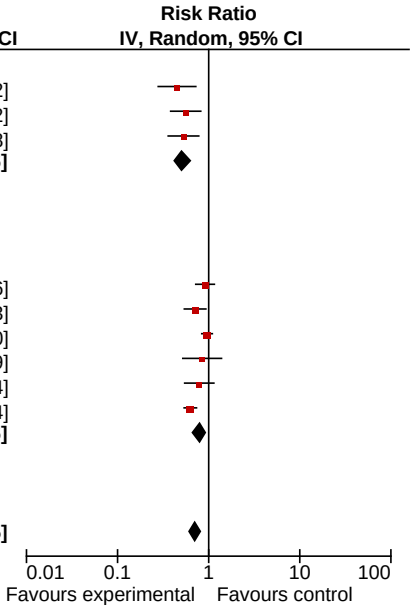
Early neonatal mortality: by involvement of family members

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.33.1 Involvement of family members				
Azad 2010	-0.09	0.12	13.1%	0.91 [0.72, 1.16]
Bang 1999	-0.799	0.242	7.7%	0.45 [0.28, 0.72]
Bhutta 2008	-0.342	0.139	12.2%	0.71 [0.54, 0.93]
Bhutta 2011	-0.041	0.068	15.6%	0.96 [0.84, 1.10]
Kumar ENC 2008	-0.58	0.194	9.6%	0.56 [0.38, 0.82]
Kumar ENC+thermospot 2008	-0.635	0.197	9.4%	0.53 [0.36, 0.78]
Subtotal (95% CI)			**67.6%**	**0.70 [0.55, 0.88]**
Heterogeneity: Tau² = 0.06; Chi² = 22.17, df = 5 (P = 0.0005); I² = 77%				
Test for overall effect: Z = 2.97 (P = 0.003)				
1.33.2 No involvement of family members				
Greenwood 1990	-0.163	0.25	7.4%	0.85 [0.52, 1.39]
Manandhar 2004	-0.236	0.188	9.8%	0.79 [0.55, 1.14]
Tripathy 2010	-0.462	0.079	15.1%	0.63 [0.54, 0.74]
Subtotal (95% CI)			**32.4%**	**0.68 [0.57, 0.80]**
Heterogeneity: Tau² = 0.00; Chi² = 2.26, df = 2 (P = 0.32); I² = 12%				
Test for overall effect: Z = 4.65 (P < 0.00001)				
Total (95% CI)			**100.0%**	**0.71 [0.60, 0.85]**
Heterogeneity: Tau² = 0.05; Chi² = 30.73, df = 8 (P = 0.0002); I² = 74%				
Test for overall effect: Z = 3.78 (P = 0.0002)				
Test for subgroup differences: Chi² = 0.04, df = 1 (P = 0.85), I² = 0%				



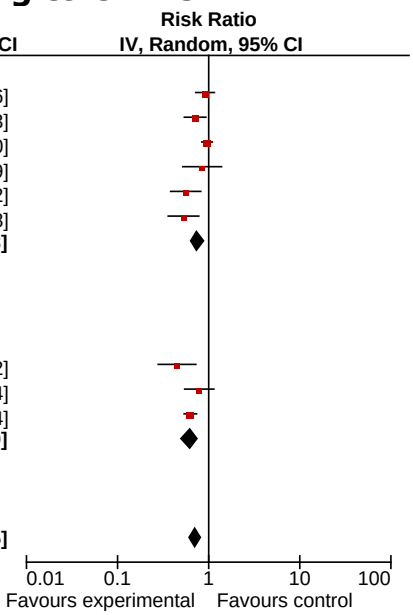
Early neonatal mortality: by preventive and therapeutic interventions

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.34.1 Preventive and therapeutic package of care				
Bang 1999	-0.799	0.242	7.7%	0.45 [0.28, 0.72]
Kumar ENC 2008	-0.58	0.194	9.6%	0.56 [0.38, 0.82]
Kumar ENC+thermospot 2008	-0.635	0.197	9.4%	0.53 [0.36, 0.78]
Subtotal (95% CI)			**26.7%**	**0.52 [0.41, 0.66]**
Heterogeneity: Tau² = 0.00; Chi² = 0.51, df = 2 (P = 0.77); I² = 0%				
Test for overall effect: Z = 5.45 (P < 0.00001)				
1.34.2 Preventive package of care alone				
Azad 2010	-0.09	0.12	13.1%	0.91 [0.72, 1.16]
Bhutta 2008	-0.342	0.139	12.2%	0.71 [0.54, 0.93]
Bhutta 2011	-0.041	0.068	15.6%	0.96 [0.84, 1.10]
Greenwood 1990	-0.163	0.25	7.4%	0.85 [0.52, 1.39]
Manandhar 2004	-0.236	0.188	9.8%	0.79 [0.55, 1.14]
Tripathy 2010	-0.462	0.079	15.1%	0.63 [0.54, 0.74]
Subtotal (95% CI)			**73.3%**	**0.80 [0.66, 0.96]**
Heterogeneity: Tau² = 0.03; Chi² = 18.30, df = 5 (P = 0.003); I² = 73%				
Test for overall effect: Z = 2.42 (P = 0.02)				
Total (95% CI)			**100.0%**	**0.71 [0.60, 0.85]**
Heterogeneity: Tau² = 0.05; Chi² = 30.73, df = 8 (P = 0.0002); I² = 74%				
Test for overall effect: Z = 3.78 (P = 0.0002)				
Test for subgroup differences: Chi² = 7.97, df = 1 (P = 0.005), I² = 87.4%				



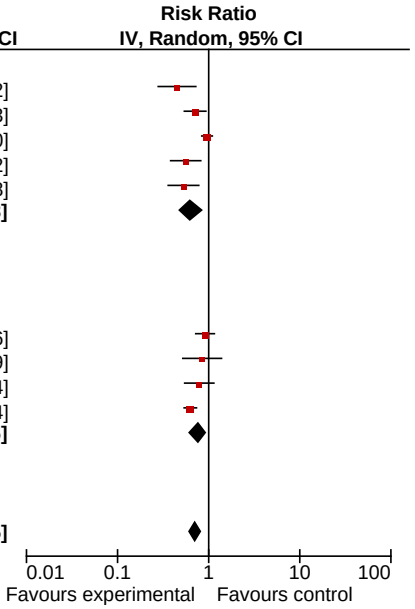
Early neonatal mortality: by extent of training to CHWs

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.35.1 Extent of CHW training: more than and equal to 1 week				
Azad 2010	-0.09	0.12	13.1%	0.91 [0.72, 1.16]
Bhutta 2008	-0.342	0.139	12.2%	0.71 [0.54, 0.93]
Bhutta 2011	-0.041	0.068	15.6%	0.96 [0.84, 1.10]
Greenwood 1990	-0.163	0.25	7.4%	0.85 [0.52, 1.39]
Kumar ENC 2008	-0.58	0.194	9.6%	0.56 [0.38, 0.82]
Kumar ENC+thermospot 2008	-0.635	0.197	9.4%	0.53 [0.36, 0.78]
Subtotal (95% CI)			**67.3%**	**0.76 [0.62, 0.93]**
Heterogeneity: Tau² = 0.04; Chi² = 15.61, df = 5 (P = 0.008); I² = 68%				
Test for overall effect: Z = 2.65 (P = 0.008)				
1.35.2 extent of training to CHW: less than 1 week				
Bang 1999	-0.799	0.242	7.7%	0.45 [0.28, 0.72]
Manandhar 2004	-0.236	0.188	9.8%	0.79 [0.55, 1.14]
Tripathy 2010	-0.462	0.079	15.1%	0.63 [0.54, 0.74]
Subtotal (95% CI)			**32.7%**	**0.63 [0.50, 0.79]**
Heterogeneity: Tau² = 0.02; Chi² = 3.38, df = 2 (P = 0.18); I² = 41%				
Test for overall effect: Z = 3.95 (P < 0.0001)				
Total (95% CI)			**100.0%**	**0.71 [0.60, 0.85]**
Heterogeneity: Tau² = 0.05; Chi² = 30.73, df = 8 (P = 0.0002); I² = 74%				
Test for overall effect: Z = 3.78 (P = 0.0002)				
Test for subgroup differences: Chi² = 1.49, df = 1 (P = 0.22), I² = 32.7%				



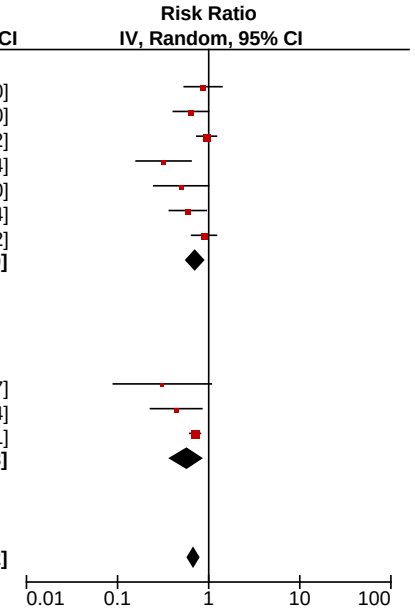
Early neonatal mortality: by provision of referral

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.36.1 referrals to sick newborns				
Bang 1999	-0.799	0.242	7.7%	0.45 [0.28, 0.72]
Bhutta 2008	-0.342	0.139	12.2%	0.71 [0.54, 0.93]
Bhutta 2011	-0.041	0.068	15.6%	0.96 [0.84, 1.10]
Kumar ENC 2008	-0.58	0.194	9.6%	0.56 [0.38, 0.82]
Kumar ENC+thermospot 2008	-0.635	0.197	9.4%	0.53 [0.36, 0.78]
Subtotal (95% CI)			**54.5%**	**0.64 [0.47, 0.88]**
Heterogeneity: Tau² = 0.09; Chi² = 21.29, df = 4 (P = 0.0003); I² = 81%				
Test for overall effect: Z = 2.81 (P = 0.005)				
1.36.2 No referrals to sick newborns				
Azad 2010	-0.09	0.12	13.1%	0.91 [0.72, 1.16]
Greenwood 1990	-0.163	0.25	7.4%	0.85 [0.52, 1.39]
Manandhar 2004	-0.236	0.188	9.8%	0.79 [0.55, 1.14]
Tripathy 2010	-0.462	0.079	15.1%	0.63 [0.54, 0.74]
Subtotal (95% CI)			**45.5%**	**0.77 [0.62, 0.96]**
Heterogeneity: Tau² = 0.03; Chi² = 7.49, df = 3 (P = 0.06); I² = 60%				
Test for overall effect: Z = 2.36 (P = 0.02)				
Total (95% CI)			**100.0%**	**0.71 [0.60, 0.85]**
Heterogeneity: Tau² = 0.05; Chi² = 30.73, df = 8 (P = 0.0002); I² = 74%				
Test for overall effect: Z = 3.78 (P = 0.0002)				
Test for subgroup differences: Chi² = 0.81, df = 1 (P = 0.37), I² = 0%				



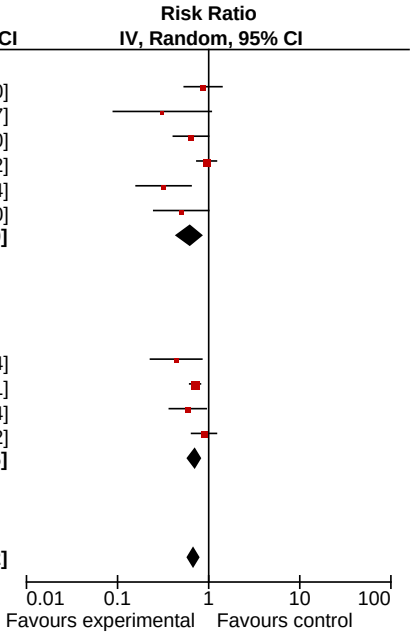
Late neonatal mortality: by community support groups

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.37.1 Presence of community support groups				
Azad 2010	-0.139	0.243	9.2%	0.87 [0.54, 1.40]
Bhutta 2008	-0.446	0.227	10.0%	0.64 [0.41, 1.00]
Bhutta 2011	-0.051	0.126	16.9%	0.95 [0.74, 1.22]
Kumar ENC 2008	-1.139	0.354	5.4%	0.32 [0.16, 0.64]
Kumar ENC+thermospot 2008	-0.693	0.354	5.4%	0.50 [0.25, 1.00]
Manandhar 2004	-0.527	0.238	9.4%	0.59 [0.37, 0.94]
Tripathy 2010	-0.117	0.16	14.2%	0.89 [0.65, 1.22]
Subtotal (95% CI)			**70.5%**	**0.71 [0.55, 0.90]**
Heterogeneity: Tau² = 0.06; Chi² = 13.37, df = 6 (P = 0.04); I² = 55%				
Test for overall effect: Z = 2.79 (P = 0.005)				
1.37.2 Absence of community support groups				
Bang 1999	-1.171	0.631	2.0%	0.31 [0.09, 1.07]
Greenwood 1990	-0.821	0.331	6.0%	0.44 [0.23, 0.84]
Jokhio 2005	-0.342	0.069	21.5%	0.71 [0.62, 0.81]
Subtotal (95% CI)			**29.5%**	**0.57 [0.37, 0.88]**
Heterogeneity: Tau² = 0.07; Chi² = 3.63, df = 2 (P = 0.16); I² = 45%				
Test for overall effect: Z = 2.51 (P = 0.01)				
Total (95% CI)			**100.0%**	**0.69 [0.57, 0.82]**
Heterogeneity: Tau² = 0.04; Chi² = 18.46, df = 9 (P = 0.03); I² = 51%				
Test for overall effect: Z = 4.05 (P < 0.0001)				
Test for subgroup differences: Chi² = 0.68, df = 1 (P = 0.41), I² = 0%				



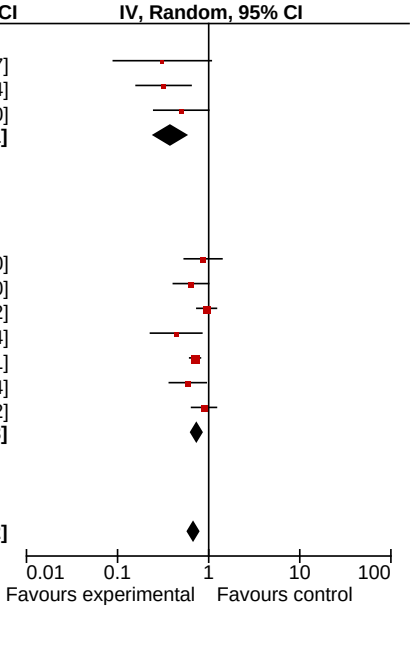
Late neonatal mortality: by involvement of family members

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.38.1 Involvement of family members				
Azad 2010	-0.139	0.243	9.2%	0.87 [0.54, 1.40]
Bang 1999	-1.171	0.631	2.0%	0.31 [0.09, 1.07]
Bhutta 2008	-0.446	0.227	10.0%	0.64 [0.41, 1.00]
Bhutta 2011	-0.051	0.126	16.9%	0.95 [0.74, 1.22]
Kumar ENC 2008	-1.139	0.354	5.4%	0.32 [0.16, 0.64]
Kumar ENC+thermospot 2008	-0.693	0.354	5.4%	0.50 [0.25, 1.00]
Subtotal (95% CI)			**48.9%**	**0.63 [0.44, 0.90]**
Heterogeneity: Tau² = 0.11; Chi² = 13.41, df = 5 (P = 0.02); I² = 63%				
Test for overall effect: Z = 2.55 (P = 0.01)				
1.38.2 No involvement of family members				
Greenwood 1990	-0.821	0.331	6.0%	0.44 [0.23, 0.84]
Jokhio 2005	-0.342	0.069	21.5%	0.71 [0.62, 0.81]
Manandhar 2004	-0.527	0.238	9.4%	0.59 [0.37, 0.94]
Tripathy 2010	-0.117	0.16	14.2%	0.89 [0.65, 1.22]
Subtotal (95% CI)			**51.1%**	**0.70 [0.58, 0.86]**
Heterogeneity: Tau² = 0.02; Chi² = 4.67, df = 3 (P = 0.20); I² = 36%				
Test for overall effect: Z = 3.45 (P = 0.0006)				
Total (95% CI)			**100.0%**	**0.69 [0.57, 0.82]**
Heterogeneity: Tau² = 0.04; Chi² = 18.46, df = 9 (P = 0.03); I² = 51%				
Test for overall effect: Z = 4.05 (P < 0.0001)				
Test for subgroup differences: Chi² = 0.28, df = 1 (P = 0.60), I² = 0%				



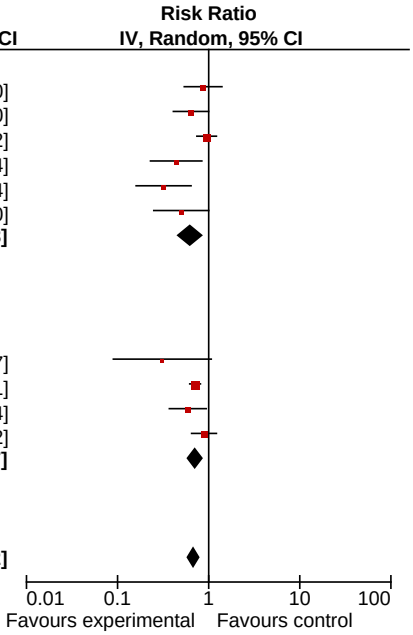
Late neonatal mortality: by preventive and therapeutic interventions

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.39.1 Preventive and therapeutic package of care				
Bang 1999	-1.171	0.631	2.0%	0.31 [0.09, 1.07]
Kumar ENC 2008	-1.139	0.354	5.4%	0.32 [0.16, 0.64]
Kumar ENC+thermospot 2008	-0.693	0.354	5.4%	0.50 [0.25, 1.00]
Subtotal (95% CI)			**12.8%**	**0.39 [0.24, 0.61]**
Heterogeneity: Tau² = 0.00; Chi² = 0.93, df = 2 (P = 0.63); I² = 0%				
Test for overall effect: Z = 4.09 (P < 0.0001)				
1.39.2 Preventive package of care alone				
Azad 2010	-0.139	0.243	9.2%	0.87 [0.54, 1.40]
Bhutta 2008	-0.446	0.227	10.0%	0.64 [0.41, 1.00]
Bhutta 2011	-0.051	0.126	16.9%	0.95 [0.74, 1.22]
Greenwood 1990	-0.821	0.331	6.0%	0.44 [0.23, 0.84]
Jokhio 2005	-0.342	0.069	21.5%	0.71 [0.62, 0.81]
Manandhar 2004	-0.527	0.238	9.4%	0.59 [0.37, 0.94]
Tripathy 2010	-0.117	0.16	14.2%	0.89 [0.65, 1.22]
Subtotal (95% CI)			**87.2%**	**0.76 [0.65, 0.88]**
Heterogeneity: Tau² = 0.02; Chi² = 9.75, df = 6 (P = 0.14); I² = 38%				
Test for overall effect: Z = 3.50 (P = 0.0005)				
Total (95% CI)			**100.0%**	**0.69 [0.57, 0.82]**
Heterogeneity: Tau² = 0.04; Chi² = 18.46, df = 9 (P = 0.03); I² = 51%				
Test for overall effect: Z = 4.05 (P < 0.0001)				
Test for subgroup differences: Chi² = 7.40, df = 1 (P = 0.007), I² = 86.5%				



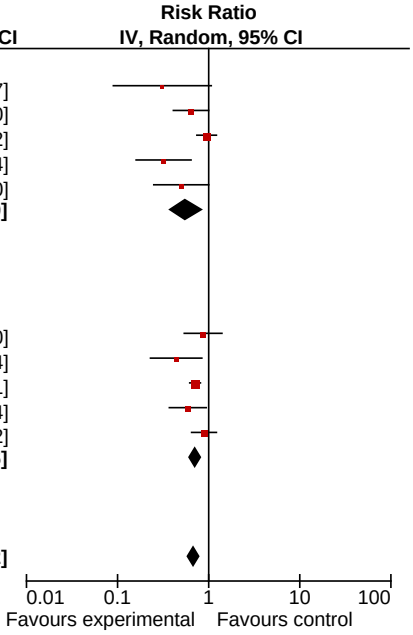
Late neonatal mortality: by extent of training to CHWs

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.40.1 extent of training to CHW: more than and equal to 1 week				
Azad 2010	-0.139	0.243	9.2%	0.87 [0.54, 1.40]
Bhutta 2008	-0.446	0.227	10.0%	0.64 [0.41, 1.00]
Bhutta 2011	-0.051	0.126	16.9%	0.95 [0.74, 1.22]
Greenwood 1990	-0.821	0.331	6.0%	0.44 [0.23, 0.84]
Kumar ENC 2008	-1.139	0.354	5.4%	0.32 [0.16, 0.64]
Kumar ENC+thermospot 2008	-0.693	0.354	5.4%	0.50 [0.25, 1.00]
Subtotal (95% CI)			**52.9%**	**0.63 [0.45, 0.88]**
Heterogeneity: Tau² = 0.11; Chi² = 14.08, df = 5 (P = 0.02); I² = 64%				
Test for overall effect: Z = 2.72 (P = 0.007)				
1.40.2 extent of training: less than 1 week				
Bang 1999	-1.171	0.631	2.0%	0.31 [0.09, 1.07]
Jokhio 2005	-0.342	0.069	21.5%	0.71 [0.62, 0.81]
Manandhar 2004	-0.527	0.238	9.4%	0.59 [0.37, 0.94]
Tripathy 2010	-0.117	0.16	14.2%	0.89 [0.65, 1.22]
Subtotal (95% CI)			**47.1%**	**0.72 [0.59, 0.87]**
Heterogeneity: Tau² = 0.01; Chi² = 4.26, df = 3 (P = 0.23); I² = 30%				
Test for overall effect: Z = 3.30 (P = 0.0010)				
Total (95% CI)			**100.0%**	**0.69 [0.57, 0.82]**
Heterogeneity: Tau² = 0.04; Chi² = 18.46, df = 9 (P = 0.03); I² = 51%				
Test for overall effect: Z = 4.05 (P < 0.0001)				
Test for subgroup differences: Chi² = 0.47, df = 1 (P = 0.49), I² = 0%				



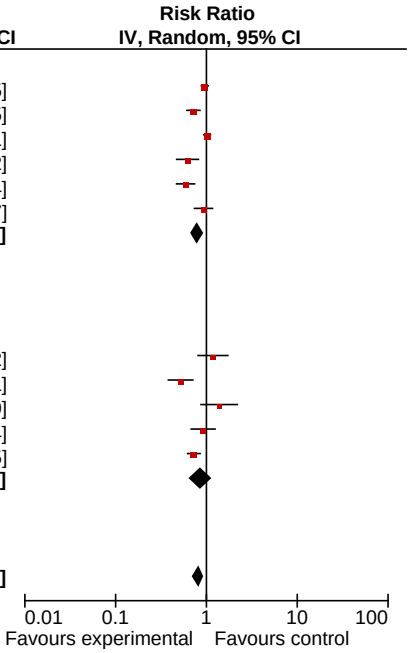
Late neonatal mortality: by provision of referral

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.41.1 Referrals to sick newborns				
Bang 1999	-1.171	0.631	2.0%	0.31 [0.09, 1.07]
Bhutta 2008	-0.446	0.227	10.0%	0.64 [0.41, 1.00]
Bhutta 2011	-0.051	0.126	16.9%	0.95 [0.74, 1.22]
Kumar ENC 2008	-1.139	0.354	5.4%	0.32 [0.16, 0.64]
Kumar ENC+thermospot 2008	-0.693	0.354	5.4%	0.50 [0.25, 1.00]
Subtotal (95% CI)			**39.7%**	**0.57 [0.36, 0.89]**
Heterogeneity: Tau² = 0.16; Chi² = 13.07, df = 4 (P = 0.01); I² = 69%				
Test for overall effect: Z = 2.49 (P = 0.01)				
1.41.2 No referrals to sick newborns				
Azad 2010	-0.139	0.243	9.2%	0.87 [0.54, 1.40]
Greenwood 1990	-0.821	0.331	6.0%	0.44 [0.23, 0.84]
Jokhio 2005	-0.342	0.069	21.5%	0.71 [0.62, 0.81]
Manandhar 2004	-0.527	0.238	9.4%	0.59 [0.37, 0.94]
Tripathy 2010	-0.117	0.16	14.2%	0.89 [0.65, 1.22]
Subtotal (95% CI)			**60.3%**	**0.72 [0.61, 0.86]**
Heterogeneity: Tau² = 0.01; Chi² = 5.30, df = 4 (P = 0.26); I² = 25%				
Test for overall effect: Z = 3.77 (P = 0.0002)				
Total (95% CI)			**100.0%**	**0.69 [0.57, 0.82]**
Heterogeneity: Tau² = 0.04; Chi² = 18.46, df = 9 (P = 0.03); I² = 51%				
Test for overall effect: Z = 4.05 (P < 0.0001)				
Test for subgroup differences: Chi² = 1.01, df = 1 (P = 0.32), I² = 0.9%				



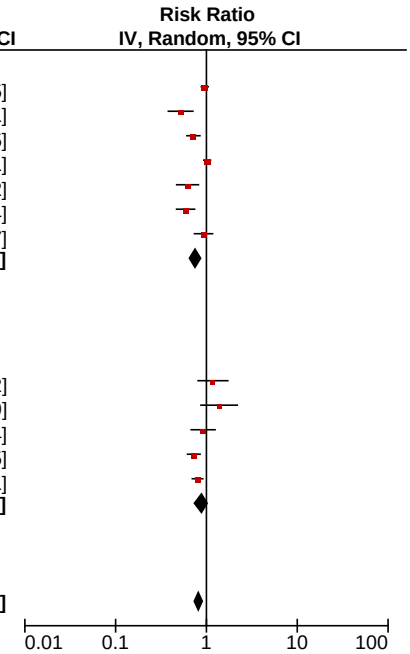
Perinatal mortality: by community support groups

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.42.1 Presence of community support groups				
Azad 2010	-0.041	0.044	12.0%	0.96 [0.88, 1.05]
Bhutta 2008	-0.329	0.084	10.7%	0.72 [0.61, 0.85]
Bhutta 2011	0.0198	0.042	12.0%	1.02 [0.94, 1.11]
Kumar ENC 2008	-0.478	0.141	8.4%	0.62 [0.47, 0.82]
Kumar ENC+thermospot 2008	-0.528	0.116	9.4%	0.59 [0.47, 0.74]
Tripathy 2010	-0.073	0.1164	9.4%	0.93 [0.74, 1.17]
Subtotal (95% CI)			**61.9%**	**0.81 [0.69, 0.95]**
Heterogeneity: Tau² = 0.03; Chi² = 38.01, df = 5 (P < 0.00001); I² = 87%				
Test for overall effect: Z = 2.55 (P = 0.01)				
1.42.2 Absence of community support groups				
Alisjahbana 1995	0.166	0.192	6.5%	1.18 [0.81, 1.72]
Bang 1999	-0.654	0.159	7.7%	0.52 [0.38, 0.71]
Foord 1995	0.322	0.235	5.3%	1.38 [0.87, 2.19]
Greenwood 1990	-0.083	0.154	7.9%	0.92 [0.68, 1.24]
Jokhio 2005	-0.3202	0.081	10.8%	0.73 [0.62, 0.85]
Subtotal (95% CI)			**38.1%**	**0.86 [0.65, 1.15]**
Heterogeneity: Tau² = 0.08; Chi² = 18.99, df = 4 (P = 0.0008); I² = 79%				
Test for overall effect: Z = 0.99 (P = 0.32)				
Total (95% CI)			**100.0%**	**0.82 [0.71, 0.94]**
Heterogeneity: Tau² = 0.04; Chi² = 62.60, df = 10 (P < 0.00001); I² = 84%				
Test for overall effect: Z = 2.80 (P = 0.005)				
Test for subgroup differences: Chi² = 0.15, df = 1 (P = 0.70), I² = 0%				



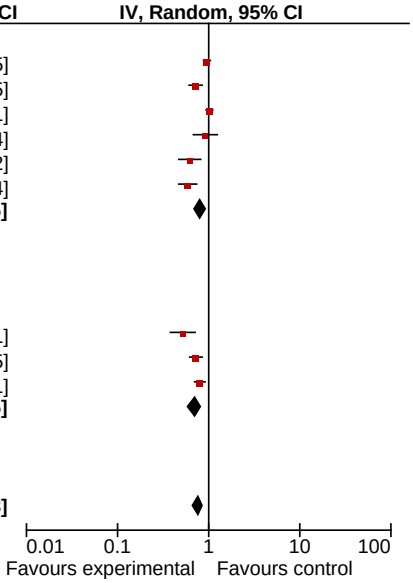
Perinatal mortality: by involvement of family members

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.43.1 Involvement of family members				
Azad 2010	-0.041	0.044	11.1%	0.96 [0.88, 1.05]
Bang 1999	-0.654	0.159	6.7%	0.52 [0.38, 0.71]
Bhutta 2008	-0.329	0.084	9.7%	0.72 [0.61, 0.85]
Bhutta 2011	0.0198	0.042	11.1%	1.02 [0.94, 1.11]
Kumar ENC 2008	-0.478	0.141	7.4%	0.62 [0.47, 0.82]
Kumar ENC+thermospot 2008	-0.528	0.116	8.4%	0.59 [0.47, 0.74]
Manandhar 2004	-0.073	0.1164	8.4%	0.93 [0.74, 1.17]
Subtotal (95% CI)			**62.8%**	**0.77 [0.65, 0.91]**
Heterogeneity: Tau² = 0.04; Chi² = 50.34, df = 6 (P < 0.00001); I² = 88%				
Test for overall effect: Z = 3.06 (P = 0.002)				
1.43.2 No involvement of family members				
Alisjahbana 1995	0.166	0.192	5.7%	1.18 [0.81, 1.72]
Foord 1995	0.322	0.235	4.5%	1.38 [0.87, 2.19]
Greenwood 1990	-0.083	0.154	6.9%	0.92 [0.68, 1.24]
Jokhio 2005	-0.3202	0.081	9.8%	0.73 [0.62, 0.85]
Tripathy 2010	-0.223	0.068	10.3%	0.80 [0.70, 0.91]
Subtotal (95% CI)			**37.2%**	**0.90 [0.75, 1.08]**
Heterogeneity: Tau² = 0.03; Chi² = 11.46, df = 4 (P = 0.02); I² = 65%				
Test for overall effect: Z = 1.18 (P = 0.24)				
Total (95% CI)			**100.0%**	**0.82 [0.72, 0.93]**
Heterogeneity: Tau² = 0.03; Chi² = 64.91, df = 11 (P < 0.00001); I² = 83%				
Test for overall effect: Z = 3.15 (P = 0.002)				
Test for subgroup differences: Chi² = 1.50, df = 1 (P = 0.22), I² = 33.2%				



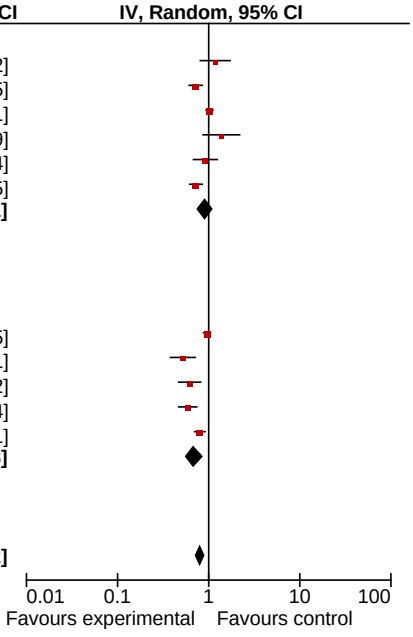
Perinatal mortality: by extent of training to CHWs

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.44.1 extent of training to CHW: more than and equal to 1 week				
Azad 2010	-0.041	0.044	13.5%	0.96 [0.88, 1.05]
Bhutta 2008	-0.329	0.084	11.9%	0.72 [0.61, 0.85]
Bhutta 2011	0.0198	0.042	13.6%	1.02 [0.94, 1.11]
Greenwood 1990	-0.083	0.154	8.6%	0.92 [0.68, 1.24]
Kumar ENC 2008	-0.478	0.141	9.1%	0.62 [0.47, 0.82]
Kumar ENC+thermospot 2008	-0.528	0.116	10.3%	0.59 [0.47, 0.74]
Subtotal (95% CI)			**67.0%**	**0.80 [0.68, 0.95]**
Heterogeneity: Tau² = 0.03; Chi² = 38.00, df = 5 (P < 0.00001); I² = 87%				
Test for overall effect: Z = 2.55 (P = 0.01)				
1.44.2 extent of training: less than 1 week				
Bang 1999	-0.654	0.159	8.3%	0.52 [0.38, 0.71]
Jokhio 2005	-0.3202	0.081	12.0%	0.73 [0.62, 0.85]
Tripathy 2010	-0.223	0.068	12.6%	0.80 [0.70, 0.91]
Subtotal (95% CI)			**33.0%**	**0.70 [0.58, 0.85]**
Heterogeneity: Tau² = 0.02; Chi² = 6.30, df = 2 (P = 0.04); I² = 68%				
Test for overall effect: Z = 3.63 (P = 0.0003)				
Total (95% CI)			**100.0%**	**0.76 [0.66, 0.88]**
Heterogeneity: Tau² = 0.04; Chi² = 58.54, df = 8 (P < 0.00001); I² = 86%				
Test for overall effect: Z = 3.77 (P = 0.0002)				
Test for subgroup differences: Chi² = 1.05, df = 1 (P = 0.31), I² = 4.6%				



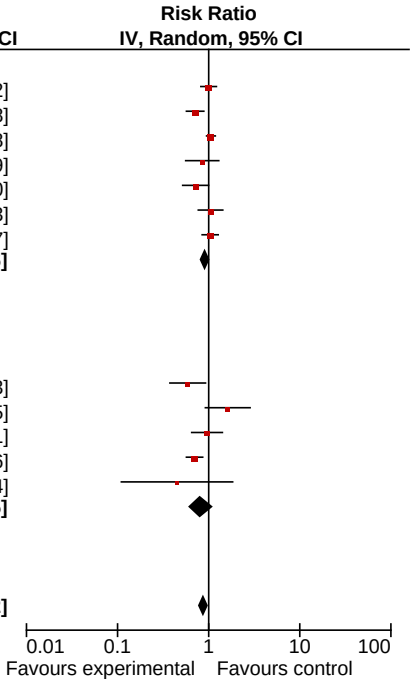
Perinatal mortality: referrals to high risk pregnancies

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.45.1 Referrals ho high risk pregnancies				
Alisjahbana 1995	0.166	0.192	6.3%	1.18 [0.81, 1.72]
Bhutta 2008	-0.329	0.084	10.5%	0.72 [0.61, 0.85]
Bhutta 2011	0.0198	0.042	12.0%	1.02 [0.94, 1.11]
Foord 1995	0.322	0.235	5.0%	1.38 [0.87, 2.19]
Greenwood 1990	-0.083	0.154	7.6%	0.92 [0.68, 1.24]
Jokhio 2005	-0.3202	0.081	10.7%	0.73 [0.62, 0.85]
Subtotal (95% CI)			**52.1%**	**0.92 [0.76, 1.11]**
Heterogeneity: Tau² = 0.04; Chi² = 27.79, df = 5 (P < 0.0001); I² = 82%				
Test for overall effect: Z = 0.88 (P = 0.38)				
1.45.2 No referrals to high risk pregnancies				
Azad 2010	-0.041	0.044	11.9%	0.96 [0.88, 1.05]
Bang 1999	-0.654	0.159	7.5%	0.52 [0.38, 0.71]
Kumar ENC 2008	-0.478	0.141	8.2%	0.62 [0.47, 0.82]
Kumar ENC+thermospot 2008	-0.528	0.116	9.2%	0.59 [0.47, 0.74]
Tripathy 2010	-0.223	0.068	11.1%	0.80 [0.70, 0.91]
Subtotal (95% CI)			**47.9%**	**0.70 [0.56, 0.88]**
Heterogeneity: Tau² = 0.05; Chi² = 32.72, df = 4 (P < 0.00001); I² = 88%				
Test for overall effect: Z = 3.12 (P = 0.002)				
Total (95% CI)			**100.0%**	**0.81 [0.71, 0.92]**
Heterogeneity: Tau² = 0.04; Chi² = 64.69, df = 10 (P < 0.00001); I² = 85%				
Test for overall effect: Z = 3.11 (P = 0.002)				
Test for subgroup differences: Chi² = 3.23, df = 1 (P = 0.07), I² = 69.1%				



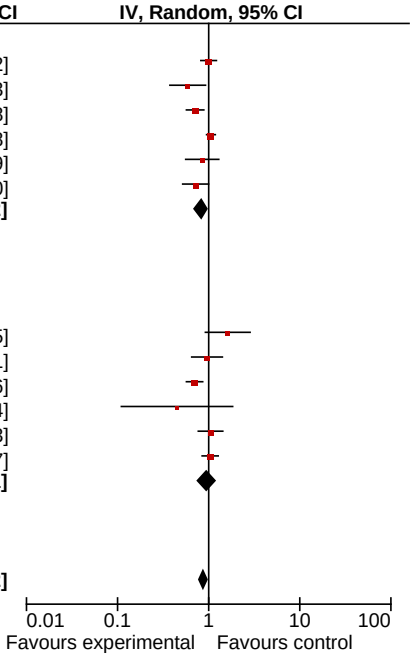
Stillbirths: by community support groups

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.46.1 Presence of community support group				
Azad 2010	0	0.101	11.6%	1.00 [0.82, 1.22]
Bhutta 2008	-0.342	0.112	11.0%	0.71 [0.57, 0.88]
Bhutta 2011	0.0583	0.056	14.0%	1.06 [0.95, 1.18]
Kumar ENC 2008	-0.162	0.213	6.3%	0.85 [0.56, 1.29]
Kumar ENC+thermospot 2008	-0.329	0.166	8.2%	0.72 [0.52, 1.00]
Manandhar 2004	0.048	0.158	8.6%	1.05 [0.77, 1.43]
Tripathy 2010	0.039	0.103	11.5%	1.04 [0.85, 1.27]
Subtotal (95% CI)			**71.0%**	**0.93 [0.81, 1.06]**
Heterogeneity: Tau² = 0.02; Chi² = 14.65, df = 6 (P = 0.02); I² = 59%				
Test for overall effect: Z = 1.09 (P = 0.28)				
1.46.2 Absence of community support group				
Bang 1999	-0.528	0.23	5.7%	0.59 [0.38, 0.93]
Foord 1995	0.482	0.288	4.2%	1.62 [0.92, 2.85]
Greenwood 1990	-0.041	0.198	6.8%	0.96 [0.65, 1.41]
Jokhio 2005	-0.3567	0.105	11.4%	0.70 [0.57, 0.86]
Kafatos 1991	-0.799	0.718	0.9%	0.45 [0.11, 1.84]
Subtotal (95% CI)			**29.0%**	**0.83 [0.59, 1.15]**
Heterogeneity: Tau² = 0.08; Chi² = 10.63, df = 4 (P = 0.03); I² = 62%				
Test for overall effect: Z = 1.14 (P = 0.25)				
Total (95% CI)			**100.0%**	**0.89 [0.78, 1.02]**
Heterogeneity: Tau² = 0.03; Chi² = 32.07, df = 11 (P = 0.0007); I² = 66%				
Test for overall effect: Z = 1.70 (P = 0.09)				
Test for subgroup differences: Chi² = 0.42, df = 1 (P = 0.52), I² = 0%				



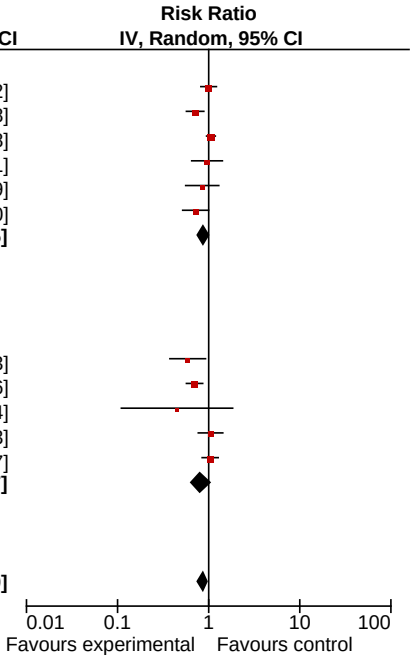
Stillbirths: by involvement of family members

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.47.1 Involvement of family members				
Azad 2010	0	0.101	11.6%	1.00 [0.82, 1.22]
Bang 1999	-0.528	0.23	5.7%	0.59 [0.38, 0.93]
Bhutta 2008	-0.342	0.112	11.0%	0.71 [0.57, 0.88]
Bhutta 2011	0.0583	0.056	14.0%	1.06 [0.95, 1.18]
Kumar ENC 2008	-0.162	0.213	6.3%	0.85 [0.56, 1.29]
Kumar ENC+thermospot 2008	-0.329	0.166	8.2%	0.72 [0.52, 1.00]
Subtotal (95% CI)			**56.7%**	**0.84 [0.70, 1.02]**
Heterogeneity: Tau² = 0.04; Chi² = 18.15, df = 5 (P = 0.003); I² = 72%				
Test for overall effect: Z = 1.80 (P = 0.07)				
1.47.2 No involvement of family members				
Foord 1995	0.482	0.288	4.2%	1.62 [0.92, 2.85]
Greenwood 1990	-0.041	0.198	6.8%	0.96 [0.65, 1.41]
Jokhio 2005	-0.3567	0.105	11.4%	0.70 [0.57, 0.86]
Kafatos 1991	-0.799	0.718	0.9%	0.45 [0.11, 1.84]
Manandhar 2004	0.048	0.158	8.6%	1.05 [0.77, 1.43]
Tripathy 2010	0.039	0.103	11.5%	1.04 [0.85, 1.27]
Subtotal (95% CI)			**43.3%**	**0.96 [0.76, 1.21]**
Heterogeneity: Tau² = 0.05; Chi² = 13.76, df = 5 (P = 0.02); I² = 64%				
Test for overall effect: Z = 0.36 (P = 0.72)				
Total (95% CI)			**100.0%**	**0.89 [0.78, 1.02]**
Heterogeneity: Tau² = 0.03; Chi² = 32.07, df = 11 (P = 0.0007); I² = 66%				
Test for overall effect: Z = 1.70 (P = 0.09)				
Test for subgroup differences: Chi² = 0.73, df = 1 (P = 0.39), I² = 0%				



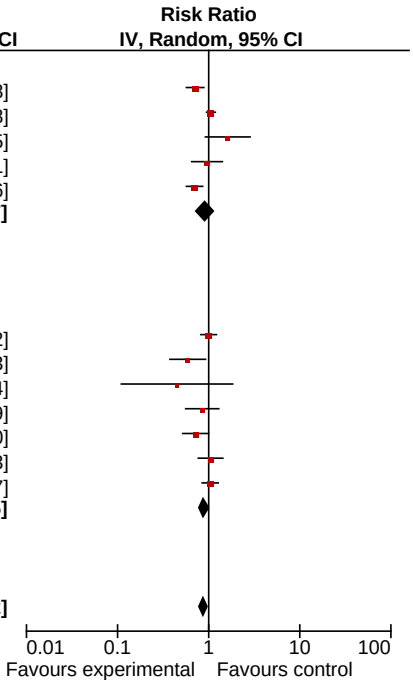
Stillbirths: by extent of training to CHWs

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.48.1 extent of training to CHW: more than and equal to 1 week				
Azad 2010	0	0.101	12.2%	1.00 [0.82, 1.22]
Bhutta 2008	-0.342	0.112	11.5%	0.71 [0.57, 0.88]
Bhutta 2011	0.0583	0.056	15.0%	1.06 [0.95, 1.18]
Greenwood 1990	-0.041	0.198	6.9%	0.96 [0.65, 1.41]
Kumar ENC 2008	-0.162	0.213	6.4%	0.85 [0.56, 1.29]
Kumar ENC+thermospot 2008	-0.329	0.166	8.4%	0.72 [0.52, 1.00]
Subtotal (95% CI)			**60.5%**	**0.89 [0.76, 1.05]**
Heterogeneity: Tau² = 0.02; Chi² = 13.86, df = 5 (P = 0.02); I² = 64%				
Test for overall effect: Z = 1.39 (P = 0.16)				
1.48.2 extent of training: less than 1 week				
Bang 1999	-0.528	0.23	5.8%	0.59 [0.38, 0.93]
Jokhio 2005	-0.3567	0.105	12.0%	0.70 [0.57, 0.86]
Kafatos 1991	-0.799	0.718	0.9%	0.45 [0.11, 1.84]
Manandhar 2004	0.048	0.158	8.8%	1.05 [0.77, 1.43]
Tripathy 2010	0.039	0.103	12.1%	1.04 [0.85, 1.27]
Subtotal (95% CI)			**39.5%**	**0.83 [0.64, 1.07]**
Heterogeneity: Tau² = 0.05; Chi² = 12.32, df = 4 (P = 0.02); I² = 68%				
Test for overall effect: Z = 1.47 (P = 0.14)				
Total (95% CI)			**100.0%**	**0.87 [0.76, 0.99]**
Heterogeneity: Tau² = 0.03; Chi² = 28.36, df = 10 (P = 0.002); I² = 65%				
Test for overall effect: Z = 2.09 (P = 0.04)				
Test for subgroup differences: Chi² = 0.24, df = 1 (P = 0.62), I² = 0%				



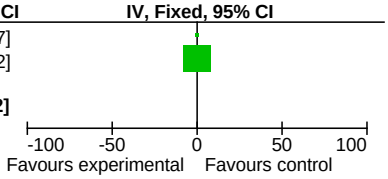
Stillbirths: referrals to high risk pregnancies

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
1.49.1 Referrals to high risk pregnancies				
Bhutta 2008	-0.342	0.112	11.0%	0.71 [0.57, 0.88]
Bhutta 2011	0.0583	0.056	14.0%	1.06 [0.95, 1.18]
Foord 1995	0.482	0.288	4.2%	1.62 [0.92, 2.85]
Greenwood 1990	-0.041	0.198	6.8%	0.96 [0.65, 1.41]
Jokhio 2005	-0.3567	0.105	11.4%	0.70 [0.57, 0.86]
Subtotal (95% CI)			**47.3%**	**0.91 [0.71, 1.17]**
Heterogeneity: Tau² = 0.06; Chi² = 22.30, df = 4 (P = 0.0002); I² = 82%				
Test for overall effect: Z = 0.75 (P = 0.45)				
1.49.2 No referrals to high risk pregnancies				
Azad 2010	0	0.101	11.6%	1.00 [0.82, 1.22]
Bang 1999	-0.528	0.23	5.7%	0.59 [0.38, 0.93]
Kafatos 1991	-0.799	0.718	0.9%	0.45 [0.11, 1.84]
Kumar ENC 2008	-0.162	0.213	6.3%	0.85 [0.56, 1.29]
Kumar ENC+thermospot 2008	-0.329	0.166	8.2%	0.72 [0.52, 1.00]
Manandhar 2004	0.048	0.158	8.6%	1.05 [0.77, 1.43]
Tripathy 2010	0.039	0.103	11.5%	1.04 [0.85, 1.27]
Subtotal (95% CI)			**52.7%**	**0.90 [0.77, 1.05]**
Heterogeneity: Tau² = 0.02; Chi² = 9.77, df = 6 (P = 0.13); I² = 39%				
Test for overall effect: Z = 1.34 (P = 0.18)				
Total (95% CI)			**100.0%**	**0.89 [0.78, 1.02]**
Heterogeneity: Tau² = 0.03; Chi² = 32.07, df = 11 (P = 0.0007); I² = 66%				
Test for overall effect: Z = 1.70 (P = 0.09)				
Test for subgroup differences: Chi² = 0.00, df = 1 (P = 0.94), I² = 0%				



Mean birth weight

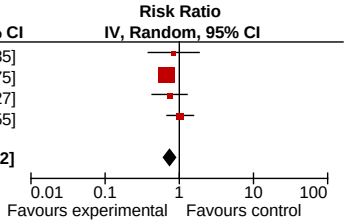
Study or Subgroup	Intervention Package Mean	SD	Total	Standard Care Mean	SD	Total	Weight	Mean Difference IV, Fixed, 95% CI
Kafatos 1991	3.391	0.2634	172	3.376	0.3186	245	1.4%	0.02 [-0.04, 0.07]
Srinivasan 1995	2.753	0.028	298	2.744	0.055	335	98.6%	0.01 [0.00, 0.02]
Total (95% CI)			**470**			**580**	**100.0%**	**0.01 [0.00, 0.02]**
Heterogeneity: Chi² = 0.04, df = 1 (P = 0.83); I² = 0%								
Test for overall effect: Z = 2.68 (P = 0.007)								



Maternal morbidity

Study or Subgroup	log[Risk Ratio]	SE	Intervention Package Total	Standard Care Total	Weight	Risk Ratio IV, Random, 95% CI
Bhutta 2008	-0.1743	0.403	1478	1401	6.5%	0.84 [0.38, 1.85]
Jokhio 2005	-0.4	0.057	100930	9432	61.7%	0.67 [0.60, 0.75]
Manandhar 2004	-0.301	0.277	3190	3524	12.5%	0.74 [0.43, 1.27]
Tripathy 2010	0.0295	0.21	9468	8867	19.4%	1.03 [0.68, 1.55]
Total (95% CI)			**115066**	**23224**	**100.0%**	**0.75 [0.61, 0.92]**

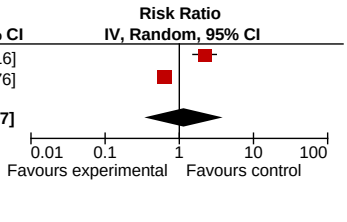
Heterogeneity: Tau² = 0.02; Chi² = 4.18, df = 3 (P = 0.24); I² = 28%
Test for overall effect: Z = 2.70 (P = 0.007)



Complications of pregnancy: Haemorrhage

Study or Subgroup	log[Risk Ratio]	SE	Intervention Package Total	Standard Care Total	Weight	Risk Ratio IV, Random, 95% CI
Alisjahbana 1995	0.788	0.185	2275	1000	49.2%	2.20 [1.53, 3.16]
Jokhio 2005	-0.462	0.098	10093	9432	50.8%	0.63 [0.52, 0.76]
Total (95% CI)			**12368**	**10432**	**100.0%**	**1.17 [0.34, 3.97]**

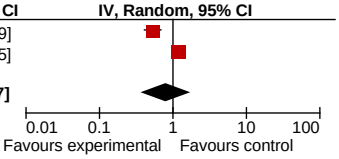
Heterogeneity: Tau² = 0.76; Chi² = 35.65, df = 1 (P < 0.00001); I² = 97%
Test for overall effect: Z = 0.25 (P = 0.81)



Obstructed labour

Study or Subgroup	log[Risk Ratio]	SE	Intervention Package Total	Standard Care Total	Weight	Risk Ratio IV, Random, 95% CI
Alisjahbana 1995	-0.635	0.131	2275	1000	49.0%	0.53 [0.41, 0.69]
Jokhio 2005	0.1739	0.0638	10093	9432	51.0%	1.19 [1.05, 1.35]
Total (95% CI)			**12368**	**10432**	**100.0%**	**0.80 [0.36, 1.77]**

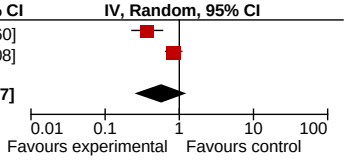
Heterogeneity: Tau² = 0.32; Chi² = 30.82, df = 1 (P < 0.00001); I² = 97%
Test for overall effect: Z = 0.55 (P = 0.58)



Puerperal sepsis

Study or Subgroup	log[Risk Ratio]	SE	Intervention Package Total	Standard Care Total	Weight	Risk Ratio IV, Random, 95% CI
Alisjahbana 1995	-0.994	0.243	2275	1000	46.8%	0.37 [0.23, 0.60]
Jokhio 2005	-0.1748	0.128	10093	9432	53.2%	0.84 [0.65, 1.08]
Total (95% CI)			**12368**	**10432**	**100.0%**	**0.57 [0.26, 1.27]**

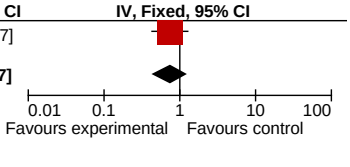
Heterogeneity: Tau² = 0.30; Chi² = 8.90, df = 1 (P = 0.003); I² = 89%
Test for overall effect: Z = 1.37 (P = 0.17)



Eclampsia

Study or Subgroup	log[Risk Ratio]	SE	Intervention Package Total	Standard Care Total	Weight	Risk Ratio IV, Fixed, 95% CI
Jokhio 2005	-0.301	0.277	10093	9432	100.0%	0.74 [0.43, 1.27]
Total (95% CI)			**10093**	**9432**	**100.0%**	**0.74 [0.43, 1.27]**

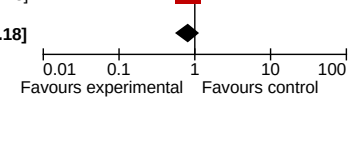
Heterogeneity: Not applicable
Test for overall effect: Z = 1.09 (P = 0.28)



Spontaneous abortion

Study or Subgroup	log[Risk Ratio]	SE	Intervention Package Total	Standard Care Total	Weight	Risk Ratio IV, Fixed, 95% CI
Jokhio 2005	-0.2107	0.194	10093	9432	100.0%	0.81 [0.55, 1.18]
Total (95% CI)			**10093**	**9432**	**100.0%**	**0.81 [0.55, 1.18]**

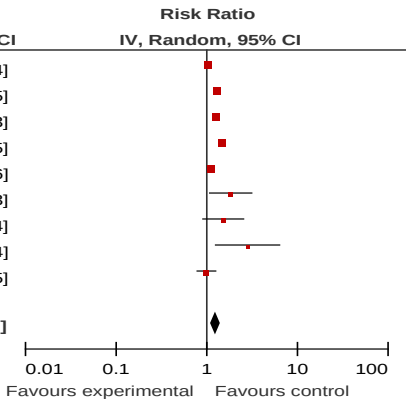
Heterogeneity: Not applicable
Test for overall effect: Z = 1.09 (P = 0.28)



Any Antenatal care

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Alisjahbana 1995	0.019	0.009	16.3%	1.02 [1.00, 1.04]
Baqui 2008	0.255	0.024	16.0%	1.29 [1.23, 1.35]
Baqui cc 2008	0.231	0.029	15.8%	1.26 [1.19, 1.33]
Baqui hc 2008	0.385	0.028	15.8%	1.47 [1.39, 1.55]
Bhutta 2011	0.1133	0.0185	16.1%	1.12 [1.08, 1.16]
Kumar ENC 2008	0.609	0.271	3.8%	1.84 [1.08, 3.13]
Kumar ENC+thermospot 2008	0.419	0.262	4.0%	1.52 [0.91, 2.54]
Manandhar 2004	1.037	0.413	1.9%	2.82 [1.26, 6.34]
Tripathy 2010	-0.008	0.118	10.1%	0.99 [0.79, 1.25]
Total (95% CI)			**100.0%**	**1.24 [1.11, 1.40]**

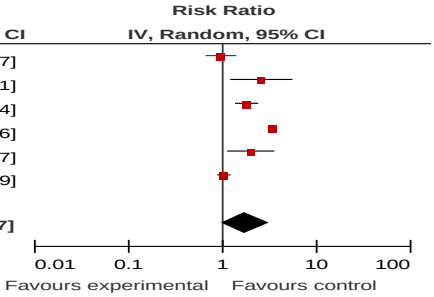
Heterogeneity: Tau² = 0.02; Chi² = 256.87, df = 8 (P < 0.00001); I² = 97%
Test for overall effect: Z = 3.60 (P = 0.0003)



Iron/folate supplementation

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Azad 2010	-0.041	0.18	17.0%	0.96 [0.67, 1.37]
Baqui 2008	0.948	0.378	14.1%	2.58 [1.23, 5.41]
Baqui cc 2008	0.588	0.134	17.4%	1.80 [1.38, 2.34]
Baqui hc 2008	1.212	0.043	18.0%	3.36 [3.09, 3.66]
Manandhar 2004	0.688	0.284	15.6%	1.99 [1.14, 3.47]
Tripathy 2010	0.029	0.072	17.9%	1.03 [0.89, 1.19]
Total (95% CI)			**100.0%**	**1.75 [0.97, 3.17]**

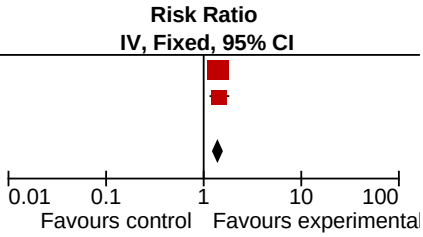
Heterogeneity: Tau² = 0.51; Chi² = 229.57, df = 5 (P < 0.00001); I² = 98%
Test for overall effect: Z = 1.85 (P = 0.06)



Referral to health facility for any complication during pregnancy

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Fixed, 95% CI
Alisjahbana 1995	0.329	0.088	59.9%	1.39 [1.17, 1.65]
Jokhio 2005	0.372	0.1075	40.1%	1.45 [1.18, 1.79]
Total (95% CI)			**100.0%**	**1.41 [1.24, 1.62]**

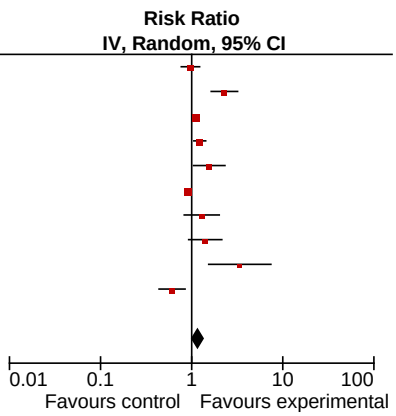
Heterogeneity: Chi² = 0.10, df = 1 (P = 0.76); I² = 0%
Test for overall effect: Z = 5.08 (P < 0.00001)



Institutional deliveries

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Azad 2010	-0.0304	0.118	11.7%	0.97 [0.77, 1.22]
Bhutta 2008	0.828	0.17	9.0%	2.29 [1.64, 3.19]
Bhutta 2011	0.104	0.023	15.9%	1.11 [1.06, 1.16]
Darmstadt 2010	0.207	0.076	13.9%	1.23 [1.06, 1.43]
Greenwood 1990	0.445	0.202	7.7%	1.56 [1.05, 2.32]
Jokhio 2005	-0.094	0.033	15.6%	0.91 [0.85, 0.97]
Kumar ENC 2008	0.255	0.225	6.8%	1.29 [0.83, 2.01]
Kumar ENC+thermospot 2008	0.344	0.213	7.2%	1.41 [0.93, 2.14]
Manandhar 2004	1.217	0.4	3.0%	3.38 [1.54, 7.40]
Tripathy 2010	-0.494	0.167	9.2%	0.61 [0.44, 0.85]
Total (95% CI)			**100.0%**	**1.18 [1.02, 1.38]**

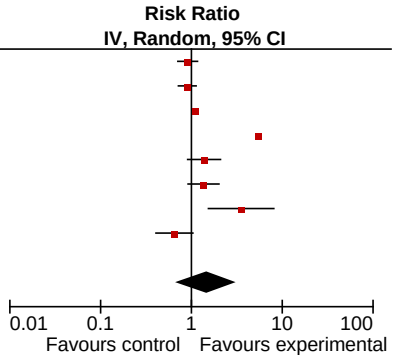
Heterogeneity: Tau² = 0.04; Chi² = 75.70, df = 9 (P < 0.00001); I² = 88%
Test for overall effect: Z = 2.20 (P = 0.03)



Birth attended by Health Care Provider

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Alisjahbana 1995	-0.094	0.127	12.8%	0.91 [0.71, 1.17]
Azad 2010	-0.105	0.114	12.8%	0.90 [0.72, 1.13]
Bhutta 2011	0.0953	0.0237	12.9%	1.10 [1.05, 1.15]
Jokhio 2005	1.699	0.024	12.9%	5.47 [5.22, 5.73]
Kumar ENC 2008	0.322	0.212	12.5%	1.38 [0.91, 2.09]
Kumar ENC+thermospot 2008	0.307	0.199	12.5%	1.36 [0.92, 2.01]
Manandhar 2004	1.261	0.423	11.2%	3.53 [1.54, 8.09]
Tripathy 2010	-0.431	0.238	12.3%	0.65 [0.41, 1.04]
Total (95% CI)			**100.0%**	**1.45 [0.68, 3.12]**

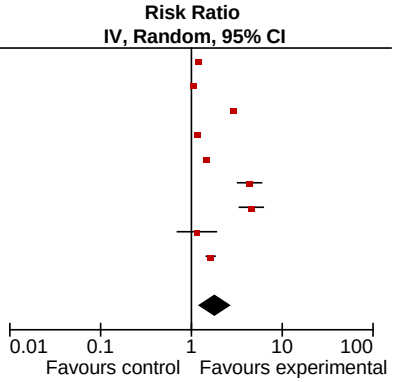
Heterogeneity: Tau² = 1.18; Chi² = 2433.81, df = 7 (P < 0.00001); I² = 100%
Test for overall effect: Z = 0.96 (P = 0.34)



Initiation of breastfeeding within one hour of birth

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Baqui cc 2008	0.182	0.022	11.4%	1.20 [1.15, 1.25]
Baqui hc 2008	0.049	0.025	11.4%	1.05 [1.00, 1.10]
Bhutta 2008	1.078	0.0013	11.4%	2.94 [2.93, 2.95]
Bhutta 2011	0.148	0.0269	11.4%	1.16 [1.10, 1.22]
Darmstadt 2010	0.378	0.029	11.4%	1.46 [1.38, 1.54]
Kumar ENC 2008	1.475	0.154	10.8%	4.37 [3.23, 5.91]
Kumar ENC+thermospot 2008	1.52	0.154	10.8%	4.57 [3.38, 6.18]
Manandhar 2004	0.139	0.251	9.9%	1.15 [0.70, 1.88]
Syed 2006	0.489	0.056	11.4%	1.63 [1.46, 1.82]
Total (95% CI)			**100.0%**	**1.83 [1.20, 2.77]**

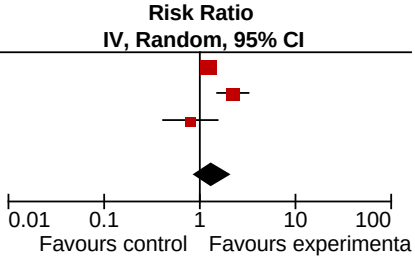
Heterogeneity: Tau² = 0.39; Chi² = 5214.38, df = 8 (P < 0.00001); I² = 100%
Test for overall effect: Z = 2.84 (P = 0.005)



Health care seeking for maternal morbidities

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Alisjahbana 1995	0.2	0.026	43.1%	1.22 [1.16, 1.29]
Manandhar 2004	0.795	0.192	33.7%	2.21 [1.52, 3.23]
Tripathy 2010	-0.226	0.334	23.2%	0.80 [0.41, 1.54]
Total (95% CI)			**100.0%**	**1.35 [0.85, 2.15]**

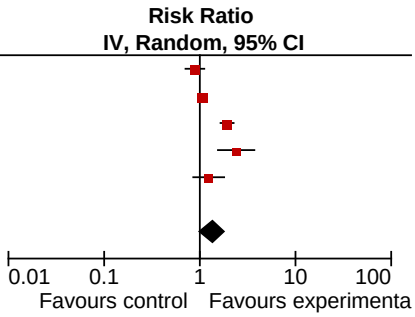
Heterogeneity: Tau² = 0.13; Chi² = 11.13, df = 2 (P = 0.004); I² = 82%
Test for overall effect: Z = 1.28 (P = 0.20)



Health care seeking for neonatal morbidities

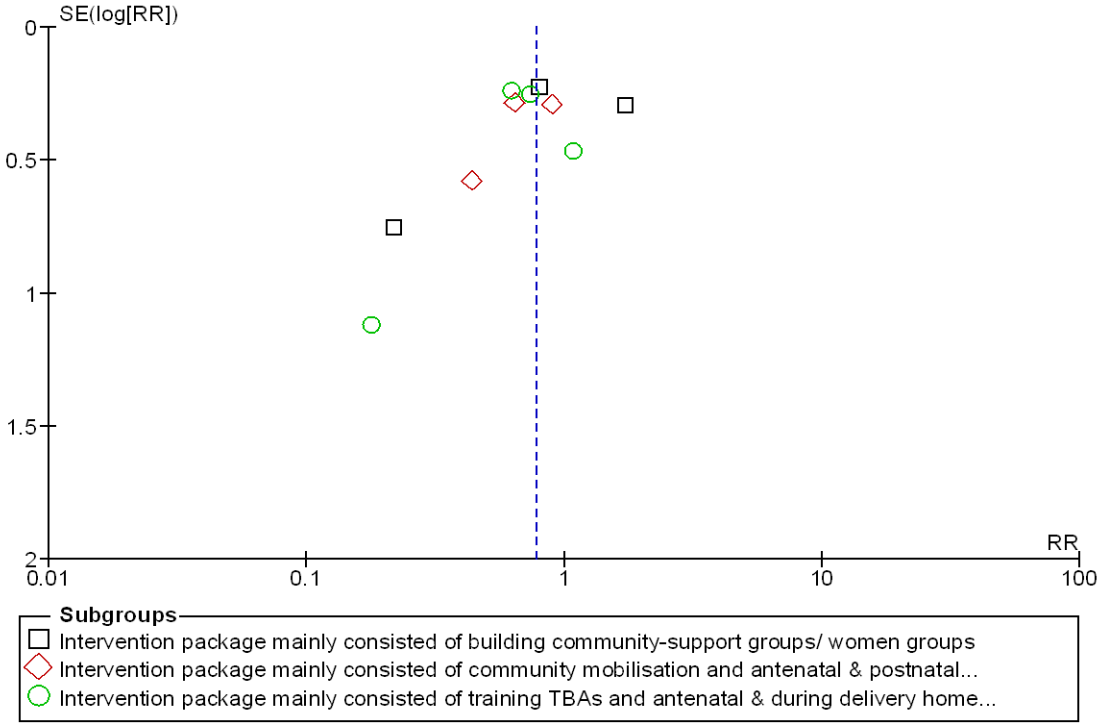
Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Random, 95% CI
Azad 2010	-0.117	0.115	20.8%	0.89 [0.71, 1.11]
Bari 2006	0.068	0.03	22.9%	1.07 [1.01, 1.14]
Kumar ENC 2008	0.657	0.08	21.9%	1.93 [1.65, 2.26]
Manandhar 2004	0.875	0.223	16.5%	2.40 [1.55, 3.71]
Tripathy 2010	0.216	0.189	17.9%	1.24 [0.86, 1.80]
Total (95% CI)			**100.0%**	**1.37 [0.99, 1.91]**

Heterogeneity: Tau² = 0.12; Chi² = 63.54, df = 4 (P < 0.00001); I² = 94%
Test for overall effect: Z = 1.88 (P = 0.06)



ANNEX 2: FUNNEL PLOTS FOR ASSESSMENT OF RISK OF REPORTING BIAS

a) Funnel plot: Maternal mortality



b)