Publication: Bulletin of the World Health Organization; Type: Research
Article DOI: 10.2471/BLT.09.069369

Home visits by community health workers to prevent neonatal deaths in developing countries: a systematic review

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(Submitted: 2 July 2009 – Revised version received: 16 January 2010 – Accepted: 17 January 2010 – Published online: 10 May 2010)

Abstract

Objective To determine whether home visits for neonatal care by community health workers can reduce infant and neonatal deaths and stillbirths in resource-limited settings.

Methods We conducted a systematic review up to 2008 of controlled trials comparing various intervention packages, one of them being home visits for neonatal care by community health workers. We performed meta-analysis to calculate the pooled risk of outcomes.

Findings Five trials, all from south Asia, satisfied the inclusion criteria. The intervention packages included in them comprised antenatal home visits (all trials), home visits during the neonatal period (all trials), home-based treatment for illness (3 trials) and community mobilization efforts (4 trials). Meta-analysis showed a reduced risk of neonatal death (relative risk, RR: 0.62; 95% confidence interval, CI: 0.44–0.87) and stillbirth (RR: 0.76; 95% CI: 0.65–0.89), and a significant improvement in antenatal and neonatal practice indicators (> 1 antenatal check-up, 2 doses of maternal tetanus toxoid, clean umbilical cord care, early breastfeeding and delayed bathing). Only one trial recorded infant deaths (RR: 0.41; 0.30–0.57). Subgroup analyses suggested a greater survival benefit when home visit coverage was ≥ 50% ($P < 0.001$) and when both preventive and curative interventions (injectable antibiotics) were conducted ($P = 0.088$).

Conclusion Home visits for antenatal and neonatal care, together with community mobilization activities, are associated with reduced neonatal mortality and stillbirths in southern Asian settings with high neonatal mortality and poor access to facility-based health care.

Introduction

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The last three decades have witnessed a significant fall in mortality rates among children under 5 years of age in developing countries, whereas neonatal mortality rates have decreased at a slower pace.[1,2] Estimates published in 2001 suggest that about 38% of all under-5 mortality occurs in the neonatal period and accounts for 4 million deaths worldwide each year.[3] Ninety-nine per cent of global neonatal mortality occurs in developing countries.[4] It is widely recognized that lowering neonatal mortality is vital for achieving further reductions in infant and child mortality.[1,5–8]

Among neonatal deaths, three fourths occur during the first week of life, while 25–45% occur within the first 24 hours after birth. The majority occur at home.[1,5,9,10] A strategy that promotes universal access to antenatal care, skilled birth attendance and early postnatal care has the potential to contribute to sustained reductions in neonatal mortality. To complement facility-based care, home-based strategies to promote optimal neonatal care practices have been proposed. Two related modalities for this purpose have been attempted in programmes and research trials in the last decade. The first involves home visits for the promotion of optimal neonatal care; the second includes home-based management of neonatal infections and other neonatal problems arising during birth, including neonatal resuscitation if required, plus the promotion of preventive interventions.

Information on the effectiveness of these complementary community-based approaches for reducing neonatal mortality is needed to frame policy for their inclusion in public health programmes. Further, the relative value of preventive or promotive and treatment interventions is unclear. We have therefore performed a systematic review for the purpose of determining whether home visits for neonatal care by community health workers can reduce infant and neonatal deaths and stillbirths in resource-limited settings with poor access to health facility-based care.

Methods

Inclusion criteria

Types of trials

We only looked for trials comparing groups that received different experimental interventions, including home visits for neonatal care by community health workers, with a control group that did not receive any home-based intervention by community health workers during the neonatal period. Trials having a random, quasi-random or non-random design, with individual or cluster allocation, were eligible for inclusion. However, trials evaluating interventions for the home-based follow up of infants born and initially cared for in a hospital were excluded, as were single-intervention trials.

Participants

The trial population had to be composed of neonates (i.e., infants ≤ 28 days old or in the first month of life if age not specified in days) born in resource-limited settings with poor access to health-facility-based care.

Interventions

Trials were required to include home-based experimental interventions by community health workers in the neonatal period. However, they could also include additional home-based interventions by community health workers during pregnancy or delivery.

Interventions during the neonatal period could include one or more of the following: (i) the promotion of optimal neonatal care practices, such as exclusive breastfeeding, keeping the baby warm and clean umbilical cord care; (ii) caregiver education to improve caregiver recognition of life-threatening neonatal problems and appropriate health care seeking behaviour; (iii) the identification of signs of severe neonatal illness and referral to a health facility; or (iv) home-based management of neonatal conditions.

. Interventions during pregnancy could comprise one or more of the following: (i) promotion of antenatal care; (ii) health education and/or counselling of the mother regarding desirable practices during pregnancy; (iii) promotion of delivery in a hospital or at home by a skilled birth attendant; and (iv) education about safe and/or clean delivery practices.

Interventions during delivery could include the implementation by community health workers of safe delivery practices at home and proper care of the neonate immediately after birth, such as keeping the baby warm, providing neonatal resuscitation (if required) and initiating breastfeeding early.

A community health worker was defined as any paid village health worker or unpaid volunteer, or any auxiliary health professional working in the community.

Outcome measures

Primary

The primary outcome was the all-cause neonatal mortality rate, defined as the number of deaths from any cause in infants up to the age of 28 completed days (or 1 month) divided by the number of live births in the study population.

Secondary

Secondary outcomes included: (i) all-cause infant mortality rate, defined as the number of deaths from any cause during the first year of life divided by the number of live births in the study population; (ii) cause-specific neonatal mortality: deaths due to sepsis, tetanus, asphyxia or prematurity (as defined by authors, irrespective of single- or multiple-cause assignment); (iii) stillbirth rate; and (iv) care practices during pregnancy and delivery and in the postnatal period in trials providing data on neonatal mortality. Such practices included the following: > 1 antenatal care visit; 2 doses of maternal tetanus toxoid injection; money saving for childbirth; skilled care at birth; clean umbilical cord care; breastfeeding initiation within 1 hour of birth; bathing of the neonate no less than 24 hours after birth; and skin-to-skin care after birth.

Search methods for identification of trials

We searched PubMed, the Cochrane Controlled Trials Register in the Cochrane Library, Excerpta Medica Database (EMBASE), Health Services Technology, Administration, and Research (HealthSTAR)), the ISI Web of Science, the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and clinical trials web sites. Included were articles in any language published from the beginning of each database up to 5 October 2008. For all included articles, we performed a lateral search in PubMed by using the “related

articles" link. We also hand searched for reviews and for conference proceedings/abstracts.

Since neonatal care practice indicators were not a primary outcome and were examined only as explanatory variables for any effect on mortality, we did not search for them independently. We did not employ any filter to limit the search to developing country (resource-limited) settings. However, we included only trials that had been conducted in countries with a low or middle level of human development.[11]

Quality assessment

The quality of the identified trials was assessed on the basis of the methods used for sampling and for allocation into intervention and control groups.[12] Randomization was classified as (a) adequate, (b) unclear, (c) inadequate and (d) not used; allocation concealment as (a) adequate, (b) unclear, (c) inadequate and (d) not used.

Data abstraction

Both authors extracted data separately. The data were then compared and any differences were resolved through mutual agreement. When necessary, the original investigators were asked for additional data or clarifications. Data entry and initial analysis were performed on SPSS version 14.0 software (SPSS Inc., Chicago, United States of America).

Analysis

We performed meta-analysis using Stata® software version 9.2 (StataCorp LP, College Station, USA). The presence of bias in the extracted data was evaluated quasi-statistically using the funnel plot[13] and formally with the "metabias" command.[14,15] To be able to appropriately combine individual and cluster randomized trials, we made pooled estimates (relative risk [RR] with 95% confidence intervals [CIs]) and calculated the heterogeneity of the evaluated outcome measures by the generic inverse variance method using the "metan" command[14,16,17]. The effect size of the intervention (summary RR) was calculated by comparing mortality rates at the end of each intervention or observation period, since baseline and/or change data were not available for all included trials. For completeness, we analysed both random effects and fixed effects model estimates;

however, a random effects model was preferred if substantial heterogeneity was present ($I^2 > 50\%$).

The following pre-specified subgroup analyses were performed for all-cause neonatal mortality as a hypothesis generating exercise: (i) random (individual or cluster) versus non-random or quasi-random allocation to examine the effect of trial quality on the RR of death; (ii) preventive interventions versus preventive and curative interventions (e.g. injectable antibiotics for neonatal sepsis) to examine the potential effect of adding curative treatment; (iii) high (> 45 deaths per 1000 live births) versus low (≤ 45 deaths per 1000 live births) baseline neonatal mortality to examine the possibility of a greater benefit in populations with higher baseline mortality; and (iv) proportion of neonates receiving a postnatal visit (< 50% versus ≥ 50%) to assess the effect of intervention coverage.

Results

Trial flow

We identified 60 potentially eligible references, 47 of which were excluded (Fig. 1) for reasons detailed in Table 1. The remaining 13 references, which pertained to 5 trials, were included in the review.[18–30]

Trial characteristics

Table 2 summarizes the characteristics of included trials, all of which were conducted in southern Asian countries with high baseline neonatal mortality rates (> 45 deaths per 1000 live births). Sylhet[18] and Shivgarh[20] trials were cluster-randomized and provided cluster-adjusted mortality data. The other three trials, from Hala,[19] Gadchiroli[21] and Barabanki,[30] were non-randomized or quasi-randomized and had a concurrent control group. End-line evaluation provided data on 17 675 and 14 251 live births, and on 746 and 779 neonatal deaths in the intervention and control arms, respectively.

Intervention Package

Table 2 describes the training received by the health-care workers who delivered each intervention package. Table 3 summarizes the intervention packages used in the trials.

Quantitative data synthesis

Five trials provided neonatal mortality data[18–21,30] and three provided data on stillbirths.[19–21] One trial provided infant mortality data and cause-specific mortality data.[21]

Neonatal mortality

All five trials provided neonatal mortality data.[18–21,30] The funnel plot appeared symmetrical, which suggests the absence of publication bias. This was confirmed using Egger's method ($P = 0.974$). There was evidence of a reduced risk of death during the neonatal period in association with home-based neonatal care; the pooled relative risk was 0.62 (95% CI: 0.44–0.87; $I^2 = 86.4\%$; $P < 0.001$) in the random effects model (Fig. 2).

On performing pre-specified subgroup analyses we found evidence of significant heterogeneity among subgroups with respect to randomization and coverage (Table 4). Subgroup analyses for baseline neonatal mortality were not feasible because all trials were classified as having high mortality. Trials with adequate randomization (RR: 0.54; 95% CI: 0.39–0.75), showed a greater reduction in neonatal mortality than non-randomized or quasi-randomized trials (RR: 0.67; 95% CI: 0.40–1.13; heterogeneity $P = 0.006$). A statistically non-significant trend towards a greater effect on mortality was observed with both curative (injectable antibiotics) and preventive interventions (RR: 0.51; 95% CI: 0.30–0.85), as compared to only preventive intervention (RR: 0.70; 95% CI: 0.44–1.12; heterogeneity $P = 0.088$). Higher ($\geq 50\%$) coverage with home-based neonatal care was associated with better survival (RR: 0.54; 95% CI: 0.42–0.70) than lower ($< 50\%$) coverage (RR: 1.06; 95% CI: 0.81–to 1.38; heterogeneity $P < 0.001$).

On performing univariate meta-regression analyses, none of these variables emerged as a significant predictor of heterogeneity (results not shown).

Infant mortality

Data on infant mortality were available from only one trial,[21] and it showed a significant decline (RR: 0.41; 95% CI: 0.3–0.57).

Cause-specific mortality

Only one trial[21] prsesented cause-specific mortality data for neonates. The reported reduction in neonatal cause-specific mortality due to sepsis, asphyxia, prematurity and hypothermia was 89.8% (95% CI: 78.6%–101.0%), 53.3% (23.8%–82.8%), 38% (4.3%–71.6%) and 100% (one-sided 95% CI not stated), respectively.

Stillbirth rate

Data was pooled from 3 trials.[19–21] There was evidence of a reduced risk of stillbirth; the pooled RR was 0.76 (95% CI: 0.65–0.89; $I^2 = 0\%$; $P = 0.766$) in random and fixed effects models.

Antenatal and neonatal care practice indicators

Antenatal and neonatal practice indicators improved significantly (> 1 antenatal checkup, 2 maternal doses of tetanus toxoid, clean umbilical cord care, early breastfeeding and delayed bathing) (Table 5).

Discussion

This systematic review of controlled trials, of which 5 satisfied the inclusion criteria, indicates that home visits for neonatal care by community health workers are associated with reduced neonatal mortality in resource-limited settings with poorly accessible health-facility-based care when conducted along with community mobilization activities.. Data from three trials showed a reduction in the stillbirth rate. Only one trial showed evidence of reduced infant mortality and neonatal cause-specific mortality (from sepsis, asphyxia, prematurity and hypothermia). While on meta-regression no variable emerged as a significant predictor of an effect on neonatal mortality; subgroup analyses suggested that the survival benefit is higher as intervention coverage increases and possibly when curative care (injectable antibiotics for neonatal sepsis) is provided in addition to preventive or promotive interventions.

Strengths and limitations of analyses

In this up-to-date systematic review that incorporated relevant subgroup and meta-regression analyses, no evidence of publication bias was found. With the sole exception of the Gadchiroli trial,[21–29] in which the intervention and control groups had only one

cluster each, all cluster- and individual-randomized trials were appropriately combined by correcting for a design effect on mortality outcomes. Both random and fixed effects models were used for pooling the data, and the results were invariably synchronous.

The review also had several limitations. First, data on stillbirths were limited to three trials, while only one trial had investigated infant mortality and cause-specific mortality. Second, all trials were conducted in parts of southern Asia with high baseline neonatal mortality rates (> 45 deaths per 1000 live births),[31] which impedes generalization to other regions, particularly to sub-Saharan Africa or to areas with lower neonatal mortality. Finally, the subgroup and meta-regression analyses showed discordance, perhaps because some subgroup results could have been falsely positive or because the number of trials may have been too small. Any significant predictor identified should therefore only be considered as exploratory.

We excluded trials that exclusively evaluated the effect of home-based follow-up of infants born in and recruited from hospitals because they were not central to framing policy on home-based neonatal care in settings with poor access to health facilities. Nevertheless, the conclusion regarding reduced mortality remained stable even after we included two such trials[32,33] from developing countries (Zambia[32] and the Syrian Arab Republic[33]). Upon assuming that all deaths in these two trials occurred in the neonatal period, the pooled RR of neonatal death in 7 trials was 0.64 (95% CI: 0.46–0.90; $I^2 = 81.8\%$; $P < 0.001$) in a random effects model.

We depicted both random-effects and fixed-effects model estimates for completeness; however, we preferred a random-effects model because substantial heterogeneity ($I^2 > 50\%$) was observed for neonatal mortality. Nevertheless, inferences regarding neonatal mortality and stillbirths remained stable irrespective of the model chosen, and this finding in better quality trials is reassuring. However, it may also indicate that effects in programme rather than research settings may be smaller. Subgroup analyses also suggested a greater neonatal survival benefit with higher (≥ 50%) intervention coverage levels, as expected. In the only trial (Barabanki[30]) with low postnatal intervention coverage (39%), intention to treat analysis did not reveal any reduction in neonatal mortality (RR: 1.06; 95% CI: 0.81 to 1.38). However, neonates who

received a postnatal home visit within 28 days of birth had 34% lower neonatal mortality (design effect, unadjusted: 35.7 deaths per 1000 live births; 95% CI: 29.2–42.1) than those who received no postnatal visit (53.8 deaths per 1000 live births; 95% CI: 48.9–58.8).[30] From a programmatic perspective it would have been useful to get some insight into the optimal number and timing of neonatal visits, but unfortunately this was not possible from the available data.

In the 5 trials under review, the intervention was delivered as a package comprising three components: home visits during pregnancy (all trials), home visits for neonatal care (all trials) and community mobilization efforts (4 trials). Thus, we were unable to differentiate the independent effects of the three intervention components on neonatal mortality. Other trials from similar settings, some of which are listed in Table 1, suggest that community mobilization alone, without home-based neonatal care, improves neonatal health outcomes, including survival.[34–40] However, in the only direct comparison of the two approaches,[18] neonatal mortality was reduced in the home-based care arm (RR: 0.66; 95% CI: 0.47–0.93) but not in the community-mobilization arm (RR: 0.95; 95% CI: 0.69–1.31). It was also impossible to differentiate the independent effects of antenatal and postnatal home visits. However, programmatically this is not crucial because in practice antenatal visits are required to establish contact with pregnant women prior to postnatal visits and health workers can also provide community mobilization services.

The effects on mortality observed in these trials is supported by significant improvements in antenatal and neonatal care practices whose association with reduced mortality has been demonstrated in previous reviews.[7]

Implications for policy

Home visits for neonatal care by community health workers, when accompanied by community mobilization efforts, are associated with reduced neonatal deaths and stillbirths in settings with high neonatal mortality rates (> 45 deaths per 1000 live births) and poor access to health-facility-based care. This provides evidence in support of adopting a policy of home-based neonatal care provided by community health workers in such settings. High intervention coverage (≥ 50%) is essential for achieving meaningful reductions in neonatal mortality. No concrete recommendations can be formulated from

the available evidence regarding the optimal timing of home visits and specific responsibilities of community health workers. It would be prudent to remember that all the evidence pertains to southern Asia; however, there are no obvious reasons to suspect different results in other regions with similar neonatal mortality rates and access to health care.

Implications for future research

The following gaps in the evidence base need to be urgently addressed to guide policy: (i) the effectiveness of the intervention package in high-mortality settings in other regions, particularly sub-Saharan Africa; (ii) the effectiveness of the intervention package in settings with lower neonatal mortality rates (15–29 and 30–45 deaths per 1000 live births[31]); (iii) the benefit of adding a curative component (especially the treatment of neonatal sepsis) to preventive or promotive neonatal care; (iv) the relative efficacy of home visits of a certain number and timing (e.g. 1 versus 2–3 in the first week of life); and (v) ways to achieve high coverage and an intervention of high quality in programme settings.

Acknowledgements

We are grateful to Prof. Clive Osmond, MRC Epidemiology Resource Centre, Southampton, the United Kingdom, for helping with the statistical analysis in relation to the calculation of cluster-adjusted relative risks.

Funding:

External: Department of Child and Adolescent Health and Development, World Health Organization, Geneva. Internal: Sitaram Bhartia Institute of Science and Research, New Delhi, India. The funding sources had no involvement in the study or the decision to publish the manuscript. There was no agreement with the funders that could have limited our ability to complete the research as planned, and we had full control of all primary data.

Competing interests:

None declared.

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Table 1. **Reasons for excluding references from systematic review of controlled trials of home-based interventions to reduce neonatal and infant deaths and stillbirths**

Reference	Reasons for exclusion
Alisjahbana A et al. An integrated village maternity service to improve referral patterns in a rural area in West-Java. *Int J Gynaecol Obstet* 1995;48 Suppl;S83-94	Intervention much broader in scope than defined for this review
Bilenko N et al. Utilization of antenatal care services by a semi-nomadic Bedouin Arab population: Evaluation of the impact of a local Maternal and Child Health Clinic. *Matern Child Health J* 2007;11:425-30	Not a controlled trial
Bolam A et al. The effects of postnatal health education for mothers on infant care and family planning practices in Nepal: a randomised controlled trial. *BMJ* 1998;316:805-11	Mortality data not available
Daga SR et al. Rural neonatal care: Dahanu experience. *Indian Pediatr* 1992;29:189-93	Not a controlled trial
Daga SR, Daga AS, Dighole RV, Patil RP. Anganwadi worker's participation in rural newborn care. *Indian J Pediatr* 1993;60:627-30	Not a controlled trial
de Francisco A, Schellenberg JA, Hall AJ, Greenwood AM, Cham K, Greenwood BM. Comparison of mortality between villages with and without Primary Health Care workers in Upper River Division, The Gambia. *J Trop Med Hyg* 1994;97:69-74	Not a controlled trial
Haider R et al. Effect of community-based peer counsellors on exclusive breastfeeding practices in Dhaka, Bangladesh: a randomised controlled trial. *Lancet* 2000;356:1643-7	Mortality data not available
Haider R et al. Training peer counselors to promote and support exclusive breastfeeding in Bangladesh. *J Hum Lact* 2002;18:7-12	Mortality data not available
Edgerley LP et al. Use of a community mobile health van to increase early access to prenatal care. *Matern Child Health J* 2007;11:235-9	No home visitation by CHWs
Fauveau V et al. Effect on mortality of community-based maternity-care programme in rural Bangladesh. *Lancet* 1991;338:1183-6	Mortality data not available
Foord F. Gambia: evaluation of the mobile health care service in West Kiang district. *World Health Stat Q* 1995;48:18-22	No home visitation by CHWs
Fox-Rushby JA. The Gambia: cost and effectiveness of a mobile maternal health care service, West Kiang. *World Health Stat Q* 1995;48:23-7	No home visitation by CHWs
Fullerton JT et al. Outcomes of a community- and home-	Not a controlled trial

based intervention for safe motherhood and newborn care. *Health Care Women Int* 2005;26:561-76	
Bang AT et al. Reduction in pneumonia mortality and total childhood mortality by means of community-based intervention trial in Gadchiroli, India. *Lancet* 1990;336:201-6	Home visitation only for a specific intervention, pneumonia
Bang AT et al. Pneumonia in neonates: can it be managed in the community? *Arch Dis Child* 1993;68:550-6	Home visitation only for a specific intervention, pneumonia
Bang AT et al. Management of childhood pneumonia by traditional birth attendants. The SEARCH Team. *Bull World Health Organ* 1994;72:897-905	Home visitation only for a specific intervention, pneumonia
Greenwood A et al. Evaluation of a primary health care programme in The Gambia. I. The impact of trained traditional birth attendants on the outcome of pregnancy. *J Trop Med Hyg* 1990;93:58-66	TBA training, no home visitation
Hill AG et al. Decline of mortality in children in rural Gambia: the influence of village-level primary health care. *Trop Med Int Health* 2000;5:107-18	Intervention much broader in scope than defined for this review
Jakobsen MS et al. Promotion of exclusive breastfeeding is not likely to be cost effective in West Africa. A randomized intervention study from Guinea-Bissau. *Acta Paediatr* 2008;97:68-75	Mortality data not available
Jokhio AH et al. An intervention involving traditional birth attendants and perinatal and maternal mortality in Pakistan. *N Engl J Med* 2005;352:2091-9	TBA training, no planned post-natal home visitation
Kielmann AA et al. The Narangwal Nutrition Study: a summary review. *Am J Clin Nutr* 1978;31:2040-57	No home visitation by CHWs
Kwast BE. Building a community-based maternity program. *Int J Gynaecol Obstet* 1995;48 Suppl;S67-82	Not a controlled trial
Leite AJ et al. Effectiveness of home-based peer counselling to promote breastfeeding in the northeast of Brazil: a randomized clinical trial. *Acta Paediatr* 2005;94:741-6	Mortality data not available
Mbonye AK et al. Intermittent preventive treatment of malaria in pregnancy: a community-based delivery system and its effect on parasitemia, anemia and low birth weight in Uganda. *Int J Infect Dis* 2008;12:22-9	Home visitation only for a specific intervention, malaria
McPherson RA et al. Are birth-preparedness programmes effective? Results from a field trial in Siraha district, Nepal. *J Health Popul Nutr* 2006;24:479-88	Not a controlled trial
Meegan ME et al. Effect on neonatal tetanus mortality after a culturally-based health promotion programme. *Lancet* 2001;358:640-1	Home visitation for only a specific intervention, cord care

Mehnaz A et al. Detection and management of pneumonia by community health workers — a community intervention study in Rehri village, Pakistan. *J Pak Med Assoc* 1997;47:42-5	Home visitation for only a specific intervention, cord care
Mercer A et al. Effectiveness of an NGO primary health care programme in rural Bangladesh: evidence from the management information system. *Health Policy Plan* 2004;19:187-98	Not a controlled trial
Morrow AL et al. Efficacy of home-based peer counselling to promote exclusive breastfeeding: a randomised controlled trial. *Lancet* 1999;353:1226-31	Mortality data not available
Mullany LC et al. Topical applications of chlorhexidine to the umbilical cord for prevention of omphalitis and neonatal mortality in southern Nepal: a community-based, cluster-randomised trial. *Lancet* 2006;367:910-8	Home visitation for only a specific intervention, cord care
Nankunda J et al. Community based peer counsellors for support of exclusive breastfeeding: experiences from rural Uganda. *Int Breastfeed J* 2006;1:19	Not a controlled trial
Pence BW et al. The effect of community nurses and health volunteers on child mortality: the Navrongo Community Health and Family Planning Project. *Scand J Public Health* 2007;35:599-608	Community mobilization only, no home-based care
Phillips JF et al. Accelerating reproductive and child health programme impact with community-based services: the Navrongo experiment in Ghana. *Bull World Health Organ* 2006;84:949-5557	Community mobilization only, no home-based care
Osrin D et al. Implementing a community-based participatory intervention to improve essential newborn care in rural Nepal. *Trans R Soc Trop Med Hyg* 2003;97:18-2119	Community mobilization only, no home-based care
Manandhar DS et al. Effect of a participatory intervention with women's groups on birth outcomes in Nepal: cluster-randomised controlled trial. *Lancet* 2004;364:970-9	Community mobilization only, no home-based care
Morrison J et al. Women's health groups to improve perinatal care in rural Nepal. *BMC Pregnancy Childbirth* 2005;5:6	Community mobilization only, no home-based care
O'Rourke K et al. Impact of community organization of women on perinatal outcomes in rural Bolivia. *Rev Panam Salud Publica* 1998;3:9-14	Community mobilization only, no home-based care
Perry HB et al. Impact of a community-based comprehensive primary healthcare programme on infant and child mortality in Bolivia. *J Health Popul Nutr* 2003;21:383-95	Community mobilization only, no home-based care
Pratinidhi A et al. Risk approach strategy in neonatal care. *Bull World Health Organ* 1986;64:291-7	Not a controlled trial

Shah U et al. Perinatal mortality in rural India: intervention through primary health care. II Neonatal mortality. *J Epidemiol Community Health* 1984;38:138-42	Not a controlled trial
Saleem S et al. Chlorhexidine vaginal and neonatal wipes in home births in Pakistan: a randomized controlled trial. *Obstet Gynecol* 2007;110:977-85	Home visitation only for a specific intervention, cord care
Sibley L et al. Home based life saving skills: promoting safe motherhood through innovative community-based interventions. *J Midwifery Womens Health* 2001;46:258-66	Not a controlled trial
Sibley L et al. The American College of Nurse-Midwives' home-based lifesaving skills program: a review of the Ethiopia field test. J Midwifery Womens Health 2004;49:320-8	Not a controlled trial
Sibley L et al. Home-based Life Saving Skills in Ethiopia: an update on the second phase of field testing. *J Midwifery Womens Health* 2006;51:284-91	Not a controlled trial
Sloan NL et al. Community-based kangaroo mother care to prevent neonatal and infant mortality: a randomized, controlled cluster trial. *Pediatrics* 2008;121:e1047-59	Home visitation only for a specific intervention, Kangaroo Mother Care
Taha TE et al. Effect of cleansing the birth canal with antiseptic solution on maternal and newborn morbidity and mortality in Malawi: clinical trial. *BMJ* 1997;315:216-9	Home visitation only for a specific intervention, cord care
Tielsch JM et al. Impact of newborn skin-cleansing with chlorhexidine on neonatal mortality in southern Nepal: a community-based, cluster-randomized trial. *Pediatrics* 2007;119:e330-40	Home visitation only for a specific intervention, cord care

CHW, community health worker.

Publication: Bulletin of the World Health Organization; Type: Research
Article DOI: 10.2471/BLT.09.069369

Table 2. **Characteristics of studies found through systematic review of trials of home-based interventions to reduce neonatal and infant deaths and stillbirths**

Author and year	**Sylhet 2008**[18]	**Hala 2008**[19]	**Shivgarh 2008**[20]	**Barabanki 2008**[30]	**Gadhchiroli 2005**[21–29]
Country	Bangladesh	Pakistan	India	India	India
Trial duration	2.5 years	2 years	16 months	2 years	10 years
Randomization	Adequate	No	Adequate	Quasi-randomized	No
Allocation concealment	No	No	No	No	No
Adjustment for cluster analysis	Yes	NA	Yes	No	NA
Intention to treat analysis	Yes	Unknown	Yes	Yes	Yes
Health worker type	Female community health workers	Lady health workers	Community-based health workers (*saksham sahayak*)	*Anganwadi* workers, auxiliary nurse–midwives and "change agents"	Village health workers
Training	• 6 weeks training • BCM, ENC and management of sick neonates	• 6 months training • BCM, ENC • 3-day voluntary training programme for traditional birth attendants (*dais*) in basic newborn care	• 7 days training • BCM, ENC • Community volunteers (*saksham karta*) helped community health workers (*saksham sahayaks*)	• 6 days training • ENC	• 6 days training • ENC
Intervention					
Maternal	Promotion of birth and neonatal care preparedness	Promotion of birth and neonatal care preparedness	Promotion of birth and neonatal care preparedness	Promotion of birth and neonatal care preparedness	Promotion of birth and neonatal care preparedness
Neonatal	• ENC promotion • Breastfeeding counselling • Assessment and referral of sick neonates • Domiciliary treatment with injectable	• ENC promotion • Breastfeeding counselling • Assessment and referral of sick neonates • Domiciliary treatment of neonatal	• ENC promotion • Breastfeeding counselling • Assessment and referral of sick neonates	• ENC promotion • Breastfeeding counselling • Assessment and referral of sick neonates	• ENC promotion • Breastfeeding counselling • Care at birth including neonatal resuscitation • Assessment and referral of sick neonates

	antibiotics, if referral failed	pneumonia with oral cotrimoxazole			• Domiciliary treatment of neonatal sepsis with co-trimoxazole and gentamicin
Other (in experimental group)	2-day training for TBAs	• Community health committees for maternal and neonatal care • Establishment of an emergency transport fund for mothers and neonates			
No. of home visits	5 (2 during pregnancy, 1 within 24 hours of birth, and 1 on days 3 and 7 after delivery)	7 (2 during pregnancy, 1 within 24 hours of birth, and 1 on days 3, 7, 14 and 28 after delivery)	4 (2 during pregnancy, 1 within 24 hours of birth and 1 on day 3 after delivery)	2 (1 during pregnancy and 1 within 28 days of delivery)	13 (2 during pregnancy, 1 during delivery and 8–12 during neonatal period)
Vital events at end-line survey (intervention/control group)					
No. of live births	2812/2872	2932/2610	2609/1079	7812/6014	1510/1676
No. of neonatal deaths	82/125	121/156	112/91	393/299	38/108
No. of infant deaths	NA/NA	NA/NA	NA/NA	NA/NA	47/127
No. of stillbirths	NA/NA	132/168	107/64	NA/NA	53/72
Baseline neonatal mortality (deaths per 1000 live births)	48.0	52.1	84.2	45.8	65.2

BCM, behaviour change management; ENC, essential neonatal care; NA, not available; TBA, traditional birth attendant.

Publication: Bulletin of the World Health Organization; Type: Research
Article DOI: 10.2471/BLT.09.069369

Table 3. **Intervention packages in different trials of home-based interventions to reduce neonatal and infant deaths and stillbirths, as found in a systematic review**

Trial	Home visits to promote optimal neonatal care practices	Community activities to promote optimal neonatal care practices	Treatment of neonatal illness at home
Gadhchiroli[21] (India)	• Surveillance to identify pregnant women • Home visits during pregnancy (2) for birth preparedness • Home visits after birth (8 –11 visits in 28 days) for routine neonatal care • Extra care for low birth infants	• Health education to mothers and grandmothers	• Care at birth, including neonatal resuscitation • Treatment of sepsis (including injectable antibiotics)
Barabanki[30] (India)	One home visit during pregnancy and one during the neonatal period for routine neonatal care	None	None
Hala[19] (Pakistan)	• Surveillance to identify pregnant women • Home visits during pregnancy (2) for birth preparedness • Home visits after birth (5 visits in 28 days) for routine neonatal care	Community group education sessions	• Training of TBAs in basic neonatal care • Domiciliary treatment of neonatal pneumonia with oral cotrimoxazole
Shivgarh[20] (India)	• Surveillance to identify pregnant women • Home visits during pregnancy (2) for birth preparedness • Home visits after birth (2 visits	Community meetings and folk song group meetings	None

Trial	Home visits to promote optimal neonatal care practices	Community activities to promote optimal neonatal care practices	Treatment of neonatal illness at home
	in first week) for routine neonatal care		
Sylhet[18] (Bangladesh)	• Surveillance to identify pregnant women • Home visits during pregnancy (2) for birth preparedness • Home visits after birth (2 visits in 28 days) for routine neonatal care	• Community meetings of men and women • Advocacy meetings with local leaders • Health facility strengthening for maternal/neonatal care	• Orientation of TBAs on neonatal care at birth • Treatment of sepsis (including injectable antibiotics)

TBA, traditional birth attendant.

Table 4. **Subgroup analyses[a] for relative risk of neonatal death in trials of home-based interventions to reduce neonatal and infant deaths and stillbirths, as identified through systematic review**

Stratification variable	No. of trials	Random effects model		Fixed effects model		Tests for heterogeneity		*P* for heterogeneity in subgroups
		RR	95% CI	RR	95% CI	I^2 (%)	*Q*	
Overall	5	0.62	0.44–0.87	0.62	0.55–0.70	86.4	29.45	NA
Randomization								0.006
Adequate	2	0.54	0.39–0.75	0.52	0.43–0.62	63.6	2.75	
Inadequate	3	0.67	0.40–1.13	0.73	0.62–0.86	89.6	19.16	
Type of care								0.088
Preventive	3	0.70	0.44–1.12	0.66	0.57–0.76	91.0	22.26	
Preventive and	2	0.51	0.30–0.85	0.52	0.40–0.66	76.7	4.29	

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Article DOI: 10.2471/BLT.09.069369

Stratification variable	No. of trials	Random effects model		Fixed effects model		Tests for heterogeneity		*P* for heterogeneity in subgroups
curative (injectable antibiotics)								
Coverage (%) of home visits								< 0.001
< 50%	1	1.06	0.81–1.38	1.06	0.81–1.38	NA		
≥ 50%	4	0.54	0.42–0.70	0.54	0.47–0.62	70.1	10.05	

CI, confidence interval; NA, not applicable; RR, relative risk.

[a] Subgroup analysis not done for baseline mortality, as all trials had high baseline mortality rates (> 45 per 1000 live births).

Table 5. **Effect on antenatal and neonatal care practice indicators of various home-based interventions as conducted in four trials of interventions to reduce neonatal and infant deaths and stillbirths, as identified through systematic review**

Practice indicator	Barabanki 2008[30]		Hala 2008[19]		Shivgarh 2008[20]		Sylhet 2008[18]		Pooled		I^2 (%)	*P*
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI		
Antenatal care visit > 1	1.29	1.23–1.36	1.20	1.10–1.32	1.52	0.91–2.53	1.47	1.39–1.55	1.33	1.20–1.47	83.3	0.000
Tetanus toxoid, 2 doses	1.12	1.10–1.15	1.20	1.09–1.31	1.03	1.00–1.07	1.12	1.02–1.22	1.11	1.04–1.18	85.6	0.001
Skilled care at birth	1.03	1.00–1.10	2.64	1.99–3.52	1.38	0.91–2.09	NA		1.54	0.81–2.93	95.2	0.183
Breastfeeding initiated < 1 h after birth	6.54	5.88–7.27	3.14	2.55–3.86	4.37	3.23–5.91	1.42	1.36–1.49	3.35	1.31–8.59	99.6	0.012
Clean cord care	1.63	1.57–1.70	47.28	20.28–10.21	1.15	1.02–1.29	1.56	1.50–1.62	1.70	1.39–2.077	96.8	0.000
Delayed bathing > 24 h after birth	38.49	28.01–52.90	1.66	1.39–2.00	2.49	2.22–2.79	3.12	2.86–3.40	4.63	2.29–9.37	99	0.000
Skin to skin care at birth	NA		NA		1.47	1.39–1.56	NA		NA		NA	
Saved money for child birth	1.69	1.61–1.77	NA		NA		NA		NA		NA	

CI, confidence interval; NA, not available; RR, relative risk.

Publication: Bulletin of the World Health Organization; Type: Research
Article DOI: 10.2471/BLT.09.069369

Fig. 1. **Study selection in systematic review of randomized controlled trials of home-based interventions to reduce neonatal and infant deaths and stillbirths**

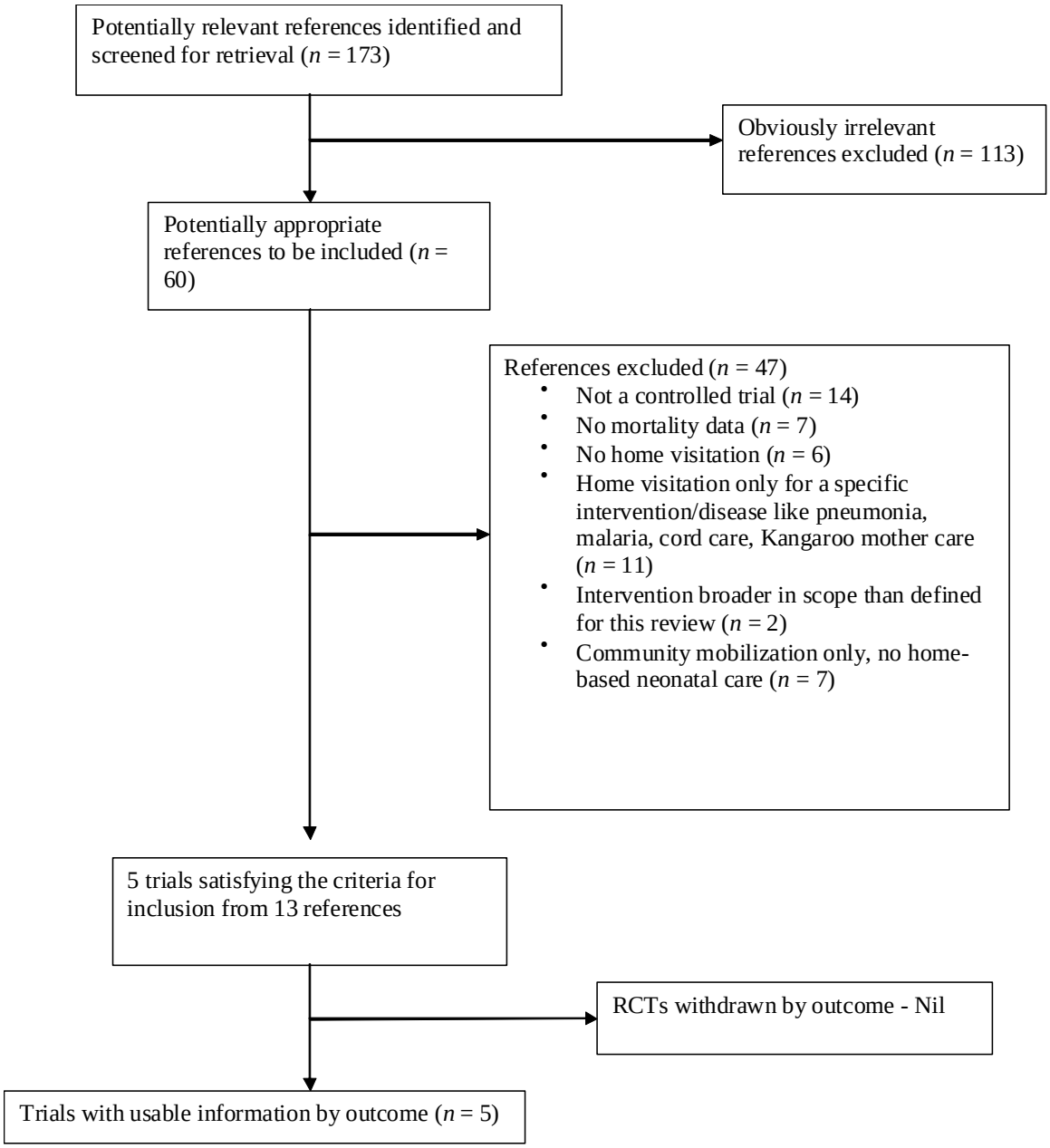

Fig. 2. **Forest plot (random effects model) for relative risk of neonatal death in trials of home-based interventions to reduce neonatal and infant deaths and stillbirths, as identified through systematic review**

RR, relative risk.