Siddhartha Gogia & Harshpal Singh Sachdev
Community health worker visits to prevent neonatal death

Home visits by community health workers to prevent neonatal deaths in developing countries: a systematic review
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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 $\geq50\%$ ($P < 0.001$) 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
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.\textsuperscript{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.\textsuperscript{3} Ninety-nine per cent of global neonatal mortality occurs in developing countries.\textsuperscript{4} It is widely recognized that lowering neonatal mortality is vital for achieving further reductions in infant and child mortality.\textsuperscript{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.\textsuperscript{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.

\textbf{Methods}

\textbf{Inclusion criteria}

\textit{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 \( \leq 28 \) 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.\textsuperscript{11}

\textbf{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.\textsuperscript{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.

\textbf{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).

\textbf{Analysis}

We performed meta-analysis using Stata\textsuperscript{®} 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\textsuperscript{13} and formally with the “metabias” command.\textsuperscript{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\textsuperscript{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). Sylhet¹⁸ and Shivgarh²⁰ trials were cluster-randomized and provided cluster-adjusted mortality data. The other three trials, from Hala,¹⁹ Gadchiroli²¹ 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\textsuperscript{18–21,30} and three provided data on stillbirths.\textsuperscript{19–21} One trial provided infant mortality data and cause-specific mortality data.\textsuperscript{21}

**Neonatal mortality**

All five trials provided neonatal mortality data.\textsuperscript{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,\textsuperscript{21} and it showed a significant decline (RR: 0.41; 95% CI: 0.3–0.57).
Cause-specific mortality
Only one trial\textsuperscript{21} presented 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.\textsuperscript{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,\textsuperscript{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),\textsuperscript{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\textsuperscript{32,33} from developing countries (Zambia\textsuperscript{32} and the Syrian Arab Republic\textsuperscript{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 (\(\geq 50\%\)) intervention coverage levels, as expected. In the only trial (Barabanki\textsuperscript{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). 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. However, in the only direct comparison of the two approaches, 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.

**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; (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.

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Competing interests:
None declared.

References


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

<table>
<thead>
<tr>
<th>Reference</th>
<th>Reasons for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alisjahbana A et al. An integrated village maternity service to improve referral patterns in a rural area in West-Java. <em>Int J Gynaecol Obstet</em> 1995;48 Suppl;S83-94</td>
<td>Intervention much broader in scope than defined for this review</td>
</tr>
<tr>
<td>Haider R et al. Training peer counselors to promote and support exclusive breastfeeding in Bangladesh. <em>J Hum Lact</em> 2002;18:7-12</td>
<td>Mortality data not available</td>
</tr>
<tr>
<td>Edgerley LP et al. Use of a community mobile health van to increase early access to prenatal care. <em>Matern Child Health J</em> 2007;11:235-9</td>
<td>No home visitation by CHWs</td>
</tr>
<tr>
<td>Fullerton JT et al. Outcomes of a community- and home-</td>
<td>Not a controlled trial</td>
</tr>
</tbody>
</table>


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


Kwast BE. Building a community-based maternity program. *Int J Gynaecol Obstet* 1995;48 Suppl;S67-82


Home visitation only for a specific intervention, pneumonia

Home visitation only for a specific intervention, pneumonia

Home visitation only for a specific intervention, pneumonia

TBA training, no home visitation

Mortality data not available

TBA training, no planned post-natal home visitation

No home visitation by CHWs

Not a controlled trial

Mortality data not available

Home visitation only for a specific intervention, malaria

Not a controlled trial

Home visitation for only a specific intervention, cord care


Home visitation for only a specific intervention, cord care

Not a controlled trial

Mortality data not available

Community mobilization only, no home-based care

Community mobilization only, no home-based care

Community mobilization only, no home-based care

Community mobilization only, no home-based care

Community mobilization only, no home-based care

Community mobilization only, no home-based care

Community mobilization only, no home-based care

Community mobilization only, no home-based care

Not a controlled trial
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title and Details</th>
</tr>
</thead>
</table>

CHW, community health worker.
Table 2. Characteristics of studies found through systematic review of trials of home-based interventions to reduce neonatal and infant deaths and stillbirths

<table>
<thead>
<tr>
<th>Author and year</th>
<th>Sylhet 2008&lt;sup&gt;18&lt;/sup&gt; Bangladesh</th>
<th>Hala 2008&lt;sup&gt;19&lt;/sup&gt; Pakistan</th>
<th>Shivgarh 2008&lt;sup&gt;20&lt;/sup&gt; India</th>
<th>Barabanki 2008&lt;sup&gt;20&lt;/sup&gt; India</th>
<th>Gadhchirolli 2005&lt;sup&gt;21-29&lt;/sup&gt; India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>2.5 years Adequate</td>
<td>2 years Adequate</td>
<td>16 months Adequate</td>
<td>2 years Quasi-randomized</td>
<td>10 years No</td>
</tr>
<tr>
<td>Randomization</td>
<td>Adequate</td>
<td>No</td>
<td>Adequate</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Allocation concealment</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Adjustment for cluster analysis</td>
<td>Yes</td>
<td>NA</td>
<td>Yes</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Intention to treat analysis</td>
<td>Yes</td>
<td>Unknown</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Health worker type</td>
<td>Female community health workers</td>
<td>Lady health workers</td>
<td>Community-based health workers (saksham sahayak)</td>
<td>Anganwadi workers, auxiliary nurse–midwives and “change agents”</td>
<td>Village health workers</td>
</tr>
<tr>
<td>Training</td>
<td>• 6 weeks training</td>
<td>• 6 months training</td>
<td>• 7 days training</td>
<td>• 6 days training</td>
<td>• 6 days training</td>
</tr>
<tr>
<td></td>
<td>• BCM, ENC and management of sick neonates</td>
<td>• BCM, ENC</td>
<td>• Community volunteers (saksham karta) helped community health workers (saksham sahayaks)</td>
<td>• ENC</td>
<td>• ENC</td>
</tr>
<tr>
<td>Intervention</td>
<td>Promotion of birth and neonatal care preparedness</td>
<td>Promotion of birth and neonatal care preparedness</td>
<td>Promotion of birth and neonatal care preparedness</td>
<td>Promotion of birth and neonatal care preparedness</td>
<td>Promotion of birth and neonatal care preparedness</td>
</tr>
<tr>
<td>Maternal</td>
<td>• ENC promotion</td>
<td>• ENC promotion</td>
<td>• ENC promotion</td>
<td>• ENC promotion</td>
<td>• ENC promotion</td>
</tr>
<tr>
<td></td>
<td>• Breastfeeding counselling</td>
<td>• Breastfeeding counselling</td>
<td>• Breastfeeding counselling</td>
<td>• Breastfeeding counselling</td>
<td>• Breastfeeding counselling</td>
</tr>
<tr>
<td></td>
<td>• Assessment and referral of sick neonates</td>
<td>• Assessment and referral of sick neonates</td>
<td>• Assessment and referral of sick neonates</td>
<td>• Assessment and referral of sick neonates</td>
<td>• Assessment and referral of sick neonates</td>
</tr>
<tr>
<td></td>
<td>• Domiciliary treatment with injectable</td>
<td>• Domiciliary treatment of neonatal</td>
<td>• Domiciliary treatment of neonatal</td>
<td>• Domiciliary treatment of neonatal</td>
<td>• Domiciliary treatment of neonatal</td>
</tr>
<tr>
<td>Neonatal</td>
<td></td>
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<td></td>
<td></td>
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</tbody>
</table>
antibiotics, if referral failed
pneumonia with oral cotrimoxazole

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)

<table>
<thead>
<tr>
<th>No. of live births</th>
<th>2812/2872</th>
<th>2932/2610</th>
<th>2609/1079</th>
<th>7812/6014</th>
<th>1510/1676</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of neonatal deaths</td>
<td>82/125</td>
<td>121/156</td>
<td>112/91</td>
<td>393/299</td>
<td>38/108</td>
</tr>
<tr>
<td>No. of infant deaths</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>NA/NA</td>
<td>47/127</td>
</tr>
<tr>
<td>No. of stillbirths</td>
<td>NA/NA</td>
<td>132/168</td>
<td>107/64</td>
<td>NA/NA</td>
<td>53/72</td>
</tr>
<tr>
<td>Baseline neonatal mortality (deaths per 1000 live births)</td>
<td>48.0</td>
<td>52.1</td>
<td>84.2</td>
<td>45.8</td>
<td>65.2</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Trial</th>
<th>Home visits to promote optimal neonatal care practices</th>
<th>Community activities to promote optimal neonatal care practices</th>
<th>Treatment of neonatal illness at home</th>
</tr>
</thead>
</table>
| Gadhchiroli<sup>21</sup> (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<sup>30</sup> (India) | One home visit during pregnancy and one during the neonatal period for routine neonatal care | None | None |
| Hala<sup>19</sup> (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<sup>20</sup> (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 |
**Table 4. Subgroup analyses** 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

<table>
<thead>
<tr>
<th>Stratification variable</th>
<th>No. of trials</th>
<th>Random effects model</th>
<th>Fixed effects model</th>
<th>Tests for heterogeneity</th>
<th>P for heterogeneity in subgroups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RR</td>
<td>95% CI</td>
<td>RR</td>
<td>95% CI</td>
<td>I²</td>
</tr>
<tr>
<td>Overall</td>
<td>5</td>
<td>0.62</td>
<td>0.44–0.87</td>
<td>0.62</td>
<td>0.55–0.70</td>
</tr>
<tr>
<td>Randomization</td>
<td>Adequate</td>
<td>2</td>
<td>0.54</td>
<td>0.39–0.75</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Inadequate</td>
<td>3</td>
<td>0.67</td>
<td>0.40–1.13</td>
<td>0.73</td>
</tr>
<tr>
<td>Type of care</td>
<td>Preventive</td>
<td>3</td>
<td>0.70</td>
<td>0.44–1.12</td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td>Preventive and</td>
<td>2</td>
<td>0.51</td>
<td>0.30–0.85</td>
<td>0.52</td>
</tr>
</tbody>
</table>

TBA, traditional birth attendant.
### 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

<table>
<thead>
<tr>
<th>Practice indicator</th>
<th>Barabanki 2008a</th>
<th>Hala 2008a</th>
<th>Shivgarh 2008a</th>
<th>Sylhet 2008a</th>
<th>Pooled</th>
<th>f (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenatal care visit &gt; 1</td>
<td>1.29 (1.23–1.36)</td>
<td>1.20 (1.10–1.32)</td>
<td>1.52 (0.91–2.53)</td>
<td>1.47 (1.39–1.55)</td>
<td>1.33 (1.20–1.47)</td>
<td>83.3</td>
<td>0.000</td>
</tr>
<tr>
<td>Tetanus toxoid, 2 doses</td>
<td>1.12 (1.10–1.15)</td>
<td>1.20 (1.09–1.31)</td>
<td>1.03 (1.00–1.10)</td>
<td>1.20 (1.02–1.22)</td>
<td>1.11 (1.00–1.18)</td>
<td>85.6</td>
<td>0.001</td>
</tr>
<tr>
<td>Skilled care at birth</td>
<td>1.03 (1.00–1.10)</td>
<td>2.64 (1.99–3.52)</td>
<td>1.38 (0.91–2.09)</td>
<td>NA</td>
<td>1.54 (0.81–2.93)</td>
<td>95.2</td>
<td>0.183</td>
</tr>
<tr>
<td>Breastfeeding initiated &lt; 1 h after birth</td>
<td>6.54 (5.88–7.27)</td>
<td>3.14 (2.55–3.86)</td>
<td>4.37 (3.23–5.91)</td>
<td>1.42 (1.36–1.49)</td>
<td>3.35 (1.31–8.59)</td>
<td>99.6</td>
<td>0.012</td>
</tr>
<tr>
<td>Clean cord care</td>
<td>1.63 (1.57–1.70)</td>
<td>20.28–10.21</td>
<td>1.15 (1.02–1.29)</td>
<td>1.56 (1.50–1.62)</td>
<td>1.70 (1.39–2.077)</td>
<td>96.8</td>
<td>0.000</td>
</tr>
<tr>
<td>Delayed bathing &gt; 24 h after birth</td>
<td>38.49 (26.01–52.90)</td>
<td>1.66 (1.39–2.00)</td>
<td>2.49 (2.22–2.79)</td>
<td>3.12 (2.86–3.40)</td>
<td>4.63 (2.29–9.37)</td>
<td>99</td>
<td>0.000</td>
</tr>
<tr>
<td>Skin to skin care at birth</td>
<td>NA</td>
<td>NA</td>
<td>1.47 (1.39–1.56)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Saved money for child birth</td>
<td>1.69 (1.61–1.77)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

CI, confidence interval; NA, not available; RR, relative risk.
Fig. 1. **Study selection in systematic review of randomized controlled trials of home-based interventions to reduce neonatal and infant deaths and stillbirths**

Potentially relevant references identified and screened for retrieval ($n = 173$)

Obviously irrelevant references excluded ($n = 113$)

Potentially appropriate references to be included ($n = 60$)

References excluded ($n = 47$)
- Not a controlled trial ($n = 14$)
- No mortality data ($n = 7$)
- No home visitation ($n = 6$)
- Home visitation only for a specific intervention/disease like pneumonia, malaria, cord care, Kangaroo mother care ($n = 11$)
- Intervention broader in scope than defined for this review ($n = 2$)
- Community mobilization only, no home-based neonatal care ($n = 7$)

5 trials satisfying the criteria for inclusion from 13 references

RCTs withdrawn by outcome - Nil

Trials with usable information by outcome ($n = 5$)
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.

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Risk Ratio (95% CI)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gadhchiroli 2005</td>
<td>0.39 (0.27, 0.56)</td>
<td>18.49</td>
</tr>
<tr>
<td>Barabanki 2008</td>
<td>1.06 (0.81, 1.38)</td>
<td>20.46</td>
</tr>
<tr>
<td>Hala 2008</td>
<td>0.70 (0.54, 0.90)</td>
<td>20.67</td>
</tr>
<tr>
<td>Shivgarh 2008</td>
<td>0.47 (0.38, 0.58)</td>
<td>21.47</td>
</tr>
<tr>
<td>Sylhet 2008</td>
<td>0.66 (0.47, 0.93)</td>
<td>18.91</td>
</tr>
<tr>
<td>Overall (I-squared = 86.4%, p = 0.000)</td>
<td>0.62 (0.44, 0.87)</td>
<td>100.00</td>
</tr>
</tbody>
</table>

**NOTE:** Weights are from random effects analysis.