Impact of Community-Based Behaviour-Change Management on Perceived Neonatal Morbidity: A Cluster-Randomized Controlled Trial in Shivgarh, Uttar Pradesh, India

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Summary

In the context of high neonatal mortality rate (NMR) in developing country settings, a promising strategy for enhancing newborn health is promotion of preventive newborn care practices. We measured the effect of a behaviour-change intervention on perceived neonatal illnesses in rural Uttar Pradesh, India. The study was nested in a cluster-randomized controlled trial of the impact of a package of essential newborn care on NMR. We prospectively enrolled 802 mothers and administered a questionnaire on perceived neonatal morbidities. Regression analysis showed that newborns in the intervention clusters had significantly lower risk of perceived diarrhoea [adjusted relative risk (aRR) 0.67, 95% confidence interval (CI) 0.49–0.90] and skin-related complications [aRR 0.67, 95% CI 0.45–1.00] compared to newborns in the comparison area. Assuming incidence of perceived illnesses is a proxy for actual morbidity rates, we conclude that promotion of preventive care practices through behaviour-change interventions was effective in reducing neonatal morbidities.

Key words: newborn, morbidity, developing country, intervention study, behavior change.

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Introduction

Over the past several decades, the global incidence of child mortality has steadily decreased. More than 40% of under-five deaths now occur in the first month of life—the neonatal period; thus, achievement of Millennium Development Goal 4 for child survival depends on more effectively addressing neonatal deaths, particularly early deaths in the first week of life [1–7]. In order to improve newborn survival, several preventive and curative approaches have been introduced in low- and middle-income countries, particularly in South Asia [8–17]. Among the various approaches, several reviews found that neonatal care packages promoting essential newborn care and community mobilization are effective for improving neonatal survival in low-resource settings [11, 13, 15–22]. While behaviour-change interventions have demonstrated changes in neonatal mortality, there are limited data on whether such interventions have affected specific neonatal morbidities, which would be expected according to a conceptual framework for impact of behaviour change interventions that links improved practices to reduced risk for morbidity and hence, mortality [15, 16, 21, 23]. Thus, it is important to demonstrate that implementation of behaviour change management targeted at specific risk factors for mortality leads to improved healthcare practices that are associated with reductions in morbidities.

Within this context, the primary aim of this study was to test the impact of a behaviour-change management (BCM) intervention on specific perceived neonatal morbidities in rural Uttar Pradesh, India. A secondary aim was to identify individual and household-level characteristics that are associated with poorer neonatal health outcomes.

Materials and Methods

Study design

The study was conducted in a rural block (Shivgarh) of 104,123 people in Uttar Pradesh, India, and was nested in a cluster-randomized controlled trial of the impact of a preventive package of essential newborn care, as described previously [15]. The parent trial enrolled all pregnant mothers who were usual residents of Shivgarh, and provided informed consent. Mothers who planned to deliver in a clinic or hospital were excluded from the care-seeking study unless they reached their usual residence within 6 h of delivery. As part of this study, which began after the initiation of the original trial and lasted for 8 months, all mothers who fulfilled the eligibility criteria for the parent trial during the study period were enrolled (n = 802), and administered an additional questionnaire 28 days after delivery, on perceived neonatal morbidities. This questionnaire was only administered to households whose infants survived the newborn period, the primary hypothesis being that the intervention would have led to reduced morbidities in general, and therefore averted neonatal deaths from severe morbidities. Among these mothers, 255 mother–newborn pairs belonged to the control group while the remaining 547 mother–newborn pairs belonged to either the Intervention I or II group. The two intervention groups were identical except for use of the Thermospot device in one of the arms, as a biofeedback intervention that signalled the presence of neonatal hypothermia [15]. The two intervention arms were therefore combined for analysis, assuming the use of Thermospot would not have led to differences in perceived morbidities except for hypothermia.

The Committee on Human Research at the Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA and the Ethical Review Committee at King George Medical University in Lucknow, India approved the protocol. A Data Safety and Monitoring Board comprised of American and Indian investigators monitored the study. The trial was registered at: clinicaltrials.gov (NCT00198653).

Intervention

The community-based BCM intervention targeted high-risk behaviours for neonatal morbidity and mortality; individuals with key roles in the practice
and continuation of these behaviours; and potential barriers, opportunities and factors affecting behaviour change, as described previously [15, 23]. The intervention package of essential newborn care was broadly categorized into birth preparedness; hygienic delivery; and immediate newborn care including clean umbilical cord and skin care; thermal care including skin-to-skin care; and breastfeeding. Mothers in the intervention arms were also educated about newborn danger signs, which may have enhanced their perception of neonatal morbidities, and therefore we expect our measured effect to be a conservative proxy of actual incidence of illness. Specific details on the methods of community mobilization, deployment of the intervention strategy and behaviour-change communications have been described previously [15, 23].

**Data collection**

Data on perceived neonatal illnesses was collected between February and August 2005, through a structured questionnaire administered in the local language (Hindi) by trained project data collectors at the end of the neonatal period (i.e. 28 completed days after birth). Information about newborns was collected from mothers or primary caregivers. Data collectors were trained on the definitions of neonatal illnesses and coding of illnesses based on the caregiver’s descriptions. For example, skin-related problems were defined as any reported skin signs of rash, redness, pustules, papules, macules, abscesses or nodules. Household- and village-level demographic and socio-economic information was recorded for each mother–newborn pair enrolled in the study. The socio-economic status of the household was based on SLI [25].

**Data analysis**

The analysis for this study was pre-planned and described in the study protocol. Chi-square analysis was used to test for an association between the presence of the intervention and perceived neonatal illnesses. Dependent variables of interest in this analysis were the perception of any neonatal illness, and perception of specific morbidities [i.e. fever, hypothermia, local skin and umbilical infections, oral ulcers, vomiting, diarrhoea, upper respiratory infection (URI) and ‘jamoga’ (a community-labelled condition for very severe illness, suggestive of infection, including tetanus)] during the neonatal period.

In order to test the effects of both the BCM intervention and individual/household-level variables on perceived illness rates while controlling for clustering effects, we estimated relative risks by conducting a multiple regression analysis with a generalized estimating equation (GEE) approach [26, 27]. The dependent variables of interest included perception of any neonatal illness, perception of diarrhoea and perception of skin-related problems during the neonatal period. The latter two dependent variables were chosen based on their medical relevance to the preventative intervention messages. Specific individual-level covariates of interest were those that have been commonly described as affecting child morbidity, including newborn gender, maternal literacy, SLI and maternal age [1]. In addition, in order to adjust for potential confounding, the model included socio-demographic variables that were significantly different between the two groups.

**Results**

**Subjects**

There were 255 and 547 mother–newborn pairs in the comparison and intervention arms, respectively. Socio-demographic characteristics of the comparison and intervention clusters were similar, though there were relatively more households from Hindu/Scheduled caste background and from larger villages in the intervention than in the comparison clusters (Table 1).

**Table 1**

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Comparison arm (n = 255)</th>
<th>Intervention arm (n = 547)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>130 (51.0)</td>
<td>296 (54.1)</td>
</tr>
<tr>
<td>Females</td>
<td>125 (49.0)</td>
<td>251 (45.9)</td>
</tr>
<tr>
<td>Mother’s educational status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literate</td>
<td>141 (55.3)</td>
<td>300 (54.8)</td>
</tr>
<tr>
<td>Non-literate</td>
<td>114 (44.7)</td>
<td>247 (45.1)</td>
</tr>
<tr>
<td>Age of mother</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>46 (18.0)</td>
<td>101 (18.5)</td>
</tr>
<tr>
<td>≥20</td>
<td>209 (82.0)</td>
<td>446 (81.5)</td>
</tr>
<tr>
<td>SLI*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>85 (33.3)</td>
<td>206 (37.7)</td>
</tr>
<tr>
<td>Medium</td>
<td>141 (55.3)</td>
<td>302 (55.2)</td>
</tr>
<tr>
<td>High</td>
<td>29 (11.4)</td>
<td>39 (7.1)</td>
</tr>
<tr>
<td>Religion/caste*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hindu/Scheduled</td>
<td>99 (38.8)</td>
<td>312 (57.0)</td>
</tr>
<tr>
<td>Hindu/Non</td>
<td>133 (52.2)</td>
<td>192 (35.1)</td>
</tr>
<tr>
<td>Scheduled Others</td>
<td>23 (9.0)</td>
<td>43 (7.9)</td>
</tr>
<tr>
<td>Household size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤4</td>
<td>44 (17.2)</td>
<td>122 (22.3)</td>
</tr>
<tr>
<td>5–8</td>
<td>147 (57.7)</td>
<td>309 (56.5)</td>
</tr>
<tr>
<td>≥9</td>
<td>64 (25.1)</td>
<td>116 (21.2)</td>
</tr>
<tr>
<td>Village population*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2500</td>
<td>149 (58.4)</td>
<td>168 (30.7)</td>
</tr>
<tr>
<td>≥2500</td>
<td>106 (41.6)</td>
<td>379 (69.3)</td>
</tr>
</tbody>
</table>

* *p < 0.05.

*SLI score of 0–9 indicates low; 10–19 medium; 20–48 high, standard of living.
Perceived neonatal morbidity

The proportion of households that perceived any illness in their infants during the neonatal period was not statistically different between the comparison and intervention areas (62.0 and 56.7%, respectively) \((p = 0.16)\). There was a trend towards a lower proportion of perceived morbidities in households receiving the intervention compared to households in the comparison clusters (Fig. 1). The proportion of households reporting neonatal diarrhoea was significantly lower in the intervention (16.8%) compared to the comparison clusters (23.9%) \((p = 0.02)\).

The proportion of households reporting a skin or umbilical problem in the neonate also tended to be lower in the intervention clusters (14.9 vs. 10.6%, \(p = 0.08)\). After adjusting for potential confounders, the risks of perceived diarrhoea and skin-related problems were 33% [adjusted relative risk (aRR) 0.67, 95% confidence interval (CI) 0.49–0.90] and 33% (aRR 0.67, 95% CI 0.45–1.00) significantly lower, respectively, in the intervention clusters compared to the comparison (Table 2). The risk of any perceived neonatal illness was not significantly different between the intervention and the comparison clusters.

In comparing households with female neonates to their male counterparts, perceived diarrhoea and perception of any neonatal illness were 26% (aRR 0.74, 95% CI 0.55–0.99) and 17% (aRR 0.83, 95% CI 0.74–0.94) significantly lower, respectively. There was no significant gender difference in the perception of skin-related infections (Table 2).

Discussion

A community-based BCM intervention programme focusing on a package of essential preventive newborn health interventions significantly reduced the risks of perceived diarrhoea and skin-related complications in infants during the neonatal period. Given the intervention’s preventive messages and the parent trial’s results showing significantly lower neonatal mortality rates (NMR) in the intervention clusters compared to the control [15], it is likely that the intervention had a positive impact on reducing the true rates of diarrhoea and skin-related infections in the study population. In fact, as a recent study has shown, maternal perception of neonatal illnesses is a possible valid proxy for true child morbidity [28]. As mothers in intervention arms were also educated on newborn danger signs, we expect perception of illness to be enhanced in the intervention households relative to the control, and therefore, the observed effect to be a conservative estimate.

The possible impact of the intervention was likely largely attributable to household compliance with exclusive breast-feeding practices, skin-to-skin care and other thermal care practices, and maintenance of a sanitary neonatal environment [15]. Health improvements through behaviour change are thought to stem from effective transfer of knowledge on what has already been shown to work, empowering local communities to adapt to inexpensive, relatively simple methods to improve child healthcare [29].

Perceptions of any neonatal illness and diarrhoea were significantly lower among households with
female newborns compared to those with males. While there is evidence that female newborns tend to have better health outcomes than their male counterparts, it is important to recognize the possibility that households are not as vigilant about female newborn health compared to males in this area [30, 31]. Previous studies in India have clearly underlined gender discrimination in child health and the possibility that households do not report illnesses in females relative to males [32, 33]. Given that perception of illness is a fundamental step prior to care-seeking, there is a need for future programmes to more objectively ascertain the existence of gender disparities and develop gender-sensitive interventions [34].

A limitation of this study was that the sample size was relatively small, preventing the detection of significant differences in certain outcomes. Another limitation was that trained healthcare providers did not report the neonatal morbidities, which although desirable, was not feasible due to cost implications. While a recent study reported that maternal perception of child health is strongly correlated with the actual disease burden [28], it is important for future studies to utilize health professionals to document neonatal illnesses and validate the correlation between maternal perception and actual morbidity.

In summary, an intervention focusing on essential preventive newborn healthcare practices through BCM significantly reduced the risks of perceived diarrhoea and skin-related complications in infants during the neonatal period. The success of this approach and the ability to sustain these innovations are largely dependent on an understanding of local culture and customs; development of appropriate, culturally contextualized communication methods; and the strengthening of local capacity to adopt and spread new practices.

### References