Economic assessment of a women's group intervention to improve birth outcomes in rural Nepal

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Lancet 2005; 366: 1882–84

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We did a cost-effectiveness analysis alongside a cluster-randomised controlled trial of a participatory intervention with women's groups to improve birth outcomes in rural Nepal. The average provider cost of the women's group intervention was US$0·75 per person per year ($0·90 with health-service strengthening) in a population of 86 704. The incremental cost per life-year saved (LYS) was $211 ($251), and expansion could rationalise on start-up costs and technical assistance, reducing the cost per LYS to $138 ($179). Sensitivity analysis showed a variation from $83 to $263 per LYS for most variables. This intervention could provide a cost-effective way of reducing neonatal deaths.

Of the 4 million neonatal deaths worldwide every year, most occur in developing countries.[1] In Nepal, the burden of neonatal mortality is especially high, and over 90% of births take place at home without a trained attendant.[2] Because of geographic and financial realities, achieving a substantial increase in institutional deliveries is unlikely to be feasible in the short-term.[3] Interventions promoting changes in practices at home and in the community might therefore be more realistic, locally relevant, and cost effective.

In a cluster-randomised controlled trial in Makwanpur district, Nepal, we assessed the effect of facilitators working with women's groups to develop strategies for improvement of maternal and neonatal health.[4] We showed the intervention's effectiveness, achieving a 29% reduction in neonatal mortality and a substantial reduction in maternal mortality during 33 months.[4] In view of resource scarcity, the question remains of whether this intervention represents good value for money. We therefore did a cost-effectiveness analysis comparing the women's group intervention with current practice. We also examined resource requirements for programme expansion.

Table 1 defines the main intervention activities for the economic analysis. 12 female facilitators who were based locally worked in the intervention area, each responsible for a population cluster covering 60 km^2 and an average population of 7000. Facilitators convened monthly meetings with women in coordination with the local community health volunteer responsible for health promotion activities. Health-service strengthening activities, including essential newborn care training for all government health staff and provision of basic supplies and equipment, were done in both intervention and control areas for ethical reasons.[4]

We estimated the additional provider costs of these activities compared with current practice, from November, 1999, to October, 2003 (webfigure). The providers were the organisation implementing the

	Description of inputs
Start-up	Ethnographic study, training of staff, introduction to communities and design of the intervention process and manual Audit of health facilities
One-off	
Picture card game	Design, piloting, printing of cards, training facilitators and design of accompanying manual (includes time of expatriate staff)
Training on mother and child health fund	Design, translation, and printing of manual, training session given to facilitators (includes time of expatriate staff)
Preparation and implementation of the group's participatory evaluation	Design, translation, and printing of manual, training session given to facilitators (includes time of expatriate staff)
Capacity development of staff involved in the women's group intervention	Computer skills and language training
Health-service strengthening in the intervention area	Training to hospital workers, primary health-care and community-based workers, other health system support, and general administration
	Equipment and supplies provided to health facilities and community health workers
Recurrent	
Facilitation of women's groups	Time of facilitators; renting of field office; time spent going house to house to mobilise women; support given by women's group intervention staff to health facilities
Supervision of women's groups	Time of expatriate staff member, 1 manager of the women's group intervention, 5 supervisors, 1 local project manager and the director of MIRA supporting the intervention
	Transport and overheads for supervision meetings
General administration	Includes time and resources associated with all administrative staff, other than driver and vehicle

MIRA= Mother and Infant Research Activities.

Table 1: **Description of project activities**

intervention (Mother and Infant Research Activities) and local government. We obtained financial cost data from the project accounts. Donated items were valued at current market prices to indicate full economic value. To estimate the cost of project activities, we allocated staff time through monthly activity records and discussions with the project team. Transport-related expenditure was allocated with vehicle log books. Capital costs were converted into yearly expenditure, and start-up costs were treated as capital costs with an estimated life of 10 years. All costs were discounted at 3% per year to estimate their present value and converted to 2003 US dollar prices (US$1=75·55 NRs).

The main outcome was the neonatal mortality rate (deaths in the first 28 days per 1000 livebirths) measured over 33 months. LYS were estimated from local life expectancy at birth (58·3 years) and were also discounted at 3%. Cost-effectiveness was defined as the cost per neonatal death averted and the cost per LYS. We examined the effect of variations in uncertain variables on the incremental cost per LYS through a series of one-way sensitivity analyses. Variables tested were: exchange rate; proportion of time spent by administrative staff supporting the intervention; discount rate; statistical error in the trial evidence on the number of neonatal deaths averted; the inclusion of maternal life years saved; and the number of deaths that could be averted in the same cohort of women during their remaining reproductive life (webtable 1).

111 women's groups were active during the trial period. The average annual cost of facilitating a group was $110. Supervision activities added an average annual $203 per group and administration costs added $54 (webtable 2). A series of one-off activities cost a total of $39 477. Personnel represented the largest cost component (70% of the total). On average, $12 503 was spent yearly training health staff and providing medical supplies and equipment in the 12 intervention clusters, costing an average of $1042 per cluster (webtable 3).

	Women's group intervention (cost with health-service strengthening)
Yearly cost (US$)	65 262 (77 765)
Total population in intervention area	86 704
Average annual cost per person	0·75 (0·90)
Number of married women of reproductive age in intervention area	14 884
Average annual cost per married woman of reproductive age	4·38 (5·22)
Number of livebirths in the intervention area	2899
Average annual cost per newborn infant	22·51 (26·82)
Total cost for the intervention duration	179 470 (213 853)
Difference in number of neonatal deaths (control−intervention)[4]	30·94
Cost per neonatal death averted	5801 (6912)
Life years saved per death averted	27·54
Cost per life year saved	211 (251)
Total life years saved	852

Table 2: **Key results on the cost and cost-effectiveness of the intervention**

Within the trial period, 2899 livebirths took place in the intervention area and 3226 in the control area.[4] In the intervention area an estimated 30·9 (95% CI 5·4–56·4) neonatal deaths were averted, which equates to an estimated 1804 LYS, and—once discounted at 3%—to 852 LYS (table 2). The cost per LYS was $211 ($251 with health-service strengthening).

Were the intervention to be replicated elsewhere in Nepal, start-up costs would reduce and technical assistance could be provided by local staff. The cost per LYS would then fall to $138 ($179 with health service strengthening). The cost-effectiveness ratio varied from $83 per LYS ($99 with health-service strengthening) to $236 ($280) in response to changes in most variables (webtable 4). Exceptions occurred when benefits were discounted at 6%, and when neonatal mortality reduction was set at the lower end of the confidence interval observed during the trial.

Our results are probably conservative for several reasons. If maternal life-years saved are included, the cost per LYS falls to $175 ($209 with health-service strengthening). If the possible effects on future pregnancies are included, the cost per LYS falls to $93–$145 per LYS. Health-service strengthening was also done in the control area, possibly reducing the relative effectiveness of the intervention. Outcomes for younger women who married and conceived after enrolment, or for women migrating into the study area, were not included.

If the women's group intervention were applied on a larger scale, average costs are likely to fall. In a district of 400 000 population, we assume that a supervisor could support seven facilitators in plain districts, four in hill districts, and two in mountain districts and that administration costs would increase by 10%. The average annual district-level costs would amount to $135 704–$161 095 or $0·30–$0·40 per person in plain and mountain districts, respectively. Assuming a 50% reduction in neonatal mortality effects, this equates to $125–$149 per LYS. The district-wide cost of health-service strengthening was estimated at $80 917 and was not expected to differ by topography.

A cost-effectiveness ratio less than double the annual national income per capita might be an acceptable threshold value for most governments deciding which interventions to fund.[5] This equates to $482 in Nepal, and our estimate of cost per LYS ($211) falls well below this.

Little evidence is available about the cost-effectiveness of other community-based interventions such as this to improve maternal and newborn health.[6] A study in India with village health workers supervised by physicians to manage and treat neonatal illness at home reported an average cost of $151 per neonatal death averted (including stillbirths).[7] However, administration costs,

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technical assistance, and start-up costs were excluded. Furthermore, costs were only estimated for the final years of the intervention, when they were probably lowest.

A participatory intervention with a women's group is well suited to a setting, such as rural Nepal, where supply-side interventions are probably not feasible on a large scale because of the vast resource requirements.[3] The intervention offers an affordable means of reducing neonatal mortality, and could benefit from expansion.

Contributors

All the authors contributed to the design of the study and criticised drafts of the paper. J Borghi designed the cost-effectiveness study and did the economic analysis with inputs from B Thapa. J Borghi wrote the first draft of the paper and was responsible for subsequent collation of inputs and redrafting. D Manandhar and A Costello were responsible for the conception and overall supervision of the trial. B Shrestha managed the project and S Tamang the field intervention. J Morrison was the technical adviser on the intervention and D Osrin on the surveillance system. A Wade was the trial statistician. J Borghi and A Costello will stand as guarantors for the paper.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgments

We thank Aman Sen, Dej Shrestha, and Reema Manandhar for assistance with the collection and analysis of the costing data, and Sushma Thapa and Sajina Manandhar for their help in estimating the costs of health-service strengthening activities; and the Mother and Infant Research Activities (MIRA) Monitoring and Evaluation team for their help collecting data on household costs of maternity care. The trial was funded by the Department for International Development, with important support from the Division of Child and Adolescent Health, of the World Health Organization, the United Nations Children's Fund, and the United Nations Fund for Population Activities. J Borghi works for the International Perinatal Health Unit at the Institute of Child Health and the Maternal Health Programme at the London School of Hygiene and Tropical Medicine. The funding source suggested that no health care activities be done in parallel with existing government services, and that, for sustainability reasons, no funding be available for women's group activities. The study sponsors had no role in the collection, analysis, and interpretation of data, in the writing of the report, or in the decision to submit the paper for publication.

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