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Short Communication

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Cost-effectiveness of the safe childbirth checklist program to improve birth outcomes in India

Abstract

The WHO endorsed safe childbirth checklist (SCC) intervention was implemented in Rajasthan state of India to support delivery of essential maternal and newborn care practices. As part of the evaluation study we assessed the cost-effectiveness of the SCC program in reducing facility-based stillbirths (SBs) and very early neonatal deaths (vENDs, deaths within three-days after birth) and assessed the cost per life-years saved (LYS).

For a cohort of 100,000 births, the incremental provider cost of the SCC intervention was US $ 1.03 million and the intervention would avert 274 deaths and will save 16,456 life years (assuming a life expectancy of 60 years). This translates to a unit cost of USD 3,783 per death averted or US $63 per LYS. This is a highly cost-effective intervention in averting facility-based stillbirths and very early neonatal deaths.

Keywords: cost-effectiveness, life-years saved, India

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Short communication

Access to and utilization of facility based maternal care alone cannot ensure better maternal outcomes.[1] High quality care among deliveries happening in institutions is necessary for improved health outcomes.[2,3] The WHO endorsed safe childbirth checklist (SCC) intervention was implemented in Rajasthan state of India to support delivery of essential maternal care practices.[4] The tool acts a reminder tool and as a job-aid, aiming to improve institutional care practices around delivery and newborn care. The 29-item list of the SCC addresses the major causes of maternal and perinatal deaths (stillbirths and early neonatal deaths within 7 days after delivery)-namely, hemorrhage, infection, obstructed labour and hypertensive disorders, birth asphyxia, infection and complications related to prematurity.[5,6]

The WHO SCC tool was introduced at all district and sub-district level public health facilities in 7 intervention districts of Rajasthan. This was followed by regular supportive supervision visits to provide onsite support. In addition, drugs and supplies were made available in both intervention and comparison facilities.

Table 1 defines the key phases in implementation of the SCC intervention, the program was implemented by government of Rajasthan with technical support from Jhpiego in 100 district and sub-district level facilities across 7 districts of Rajasthan, India. The facilities in a matched set of 6 comparison districts provided usual care. Health service strengthening activities in the form of ensuring drugs and supplies were done in both intervention and comparison facilities for ethical reasons and to ensure impact of SCC if any is captured with minimal bias

In a post only quasi-experimental study with intervention and comparison clusters we assessed the effectiveness of SCC in reducing combined mortality of facility-based stillbirth (SB) (as per WHO definition — late-fetal deaths after gestational age of more than 28 weeks or birth-weight more than 1000 grams) and very early neonatal deaths less than 3 days after birth (vENDs).[7] Evaluation included facilities with a specialized newborn care unit as these were the primary source of data on early newborn deaths. Information on all births at these facilities was collected from facility registers from November 2013 to April 2015. The effectiveness data thus comes from the analysis of 34 facilities with special newborn care centres (SNCs) that caters to sick newborn — 19 facilities in intervention and 15 in control. Each facility provided 14-months of data. All stillbirth data were obtained from labor rooms records of these 34 facilities and vENDs were obtained from records of SNCs, and from phone tracking of referral cases from SNCs. In total 137,039 births of which 14,406 newborns were transferred to SNCs for additional care were followed in the study. We found the intervention was associated with a 11.16% reduction in the risk of combined mortality of SB and vENDs (RR: 0.89, 0.81 – 0.97) and 11% reduction in facility-based stillbirths alone (RR: 0.89, 0.81 – 0.98).

Table 1 defines the main intervention activities followed in the SCC program

Phases	Description of activities
Preparation	Identification of intervention and control districts, recruitment and staff training, constitution of technical advisory group, rapid assessment of facilities, field testing of SCC, ensuring supplies at both intervention and control facilities, orientation of supervisors
Implementation done in two phases	Orientation training (2.5 days per session), supportive supervision, data collection from intervention and control sites.

In this paper we analysed whether the SCC intervention was cost-effective in reducing the risk of facility based stillbirths and very early neonatal deaths less than three days after birth. We estimated the additional provider costs related to all intervention activities that included start up costs inclusive of checklist printing, and inception meetings followed by intervention costs inclusive of the orientation process for all providers across all intervention facilities, supportive supervision visits, and reorientation if any as required, from May 2012 to April 2015.

We obtained cost data from the project accounts of Jhpiego who tracked all resources expended towards the intervention by activities. Cost items were classified into four broad categories: start-up cost, personnel cost, training cost, and supportive supervision cost. Staff cost included salary cost of district, state and national level staff of Jhpiego, as per the positions level of effort for SCC project. team gave

us the overall salary budgeted under SCC project for the above staff level, and indicated a mix of 35%, 38% and 26% for state, district and national staffs. This mix was used for the cost analysis. Separately we received information on overhead for support staff and administrative overhead charged to SCC project. For costing SCC orientation cost, budget reconciliation statements of District Program Managers or DPMs were used. Seven representative orientation costs (one for each district) for one session were obtained from Jhpiego, and those were multiplied by the number of orientation sessions per district to obtain the total cost of orientation in the intervention area.

Supportive supervision visits were mainly done by state and district level team, with occasional visit from national level team of Jhpiego. Transport bill for supportive supervision visit raised by the DPMs were obtained from Jhpiego. Table 2 details the program cost to implement the SCC program. All research costs such as field testing SCC; data collection and rapid assessment of facilities; assessment of facility based recordkeeping tools and systems; preparing data collectors and managers for collection of relevant data were excluded from the analysis, as per the study protocol.

Table 2 Incremental cost to implement the SCC program (May 2012 to April 2015)

	Total (USD)	Share of total
Start-up cost		
Program Staff	142,990	
Checklist printing	6,668	
Total start-up cost	149,658	10.68%
Personnel cost		
National staff	135,174	
State staff	227,144	
District staff	375,975	
Total personnel cost	738,293	52.71%
Training cost		
Training cost (Orientation)	139,053	
Training cost (Refresher)	15,417	
Total training cost	154,471	11.03%
Travel for supportive supervision		
Supportive Supervision travel cost	102,793	7.34%
Overhead	255,572	18.24%
Total	1,400,787	

The main outcome was combined mortality rate of facility-based stillbirths and very early neonatal deaths (less than 3 days after births) (Table 3). Life-years saved (LYS) were estimated from local life expectancy at birth (60 years). Cost-effectiveness was defined as the cost per death averted and cost per LYS. We conducted a sensitivity analysis on the findings. Variables tested were: statistical error in the evidence on the number of deaths averted and reduction in cost.

Table 3 Mortality (SB and vEND) estimates from survey data

	Intervention arm	Control area
Mortality rate (per 1000 births)	27.5	30.3
Lower limit (95% CI)	26.3	28.6
Upper limit (95% CI)	29.1	31.5

In total 137,039 births were recorded in the intervention areas for 14 months in the study. For the intervention facilities the SCC intervention was estimated to have an incremental cost of USD 1.4 million over a three year time period of the intervention. Almost half of the cost was towards personnel time. A tenth of the cost were attributed each towards start-up cost and training. For a program which required intense supportive supervision, and therefore skilled human resource this cost appeared justified. For a cohort of 100,000 births this translates to an additional cost of USD 1.03 million.

In terms of effectiveness, evaluation study reported a combined mortality of 27.52 per 1000 births for intervention facilities and 30.27 per 1000 births for comparison facilities, thus preventing 2.75 deaths per 1,000 births. For, 100,000 births, thus this intervention at an additional cost of $1.03 million would avert 275 facility-based still births and very early neonatal deaths. This translates to a unit cost of USD 3,773 per death averted. Using a conservative life expectancy of 60 years at birth, this translates to 16,500 life years saved for unit cost of $63 per life year saved (Table 4). As per widely used standards, since this is very much below the per capita GDP of $1596[8,9] this intervention is a highly cost-effective intervention in averting facility-based stillbirths and very early neonatal deaths. The intervention remains highly cost-effective across a range of scenarios (Table 5).The Safe Childbirth Checklist program thus offers an affordable means of reducing facility-based still births and very early neonatal deaths, and could benefit from expansion across India with an annual birth cohort of 26 million and in other low and middle income countries.

Table 4 Cost-effectiveness of SCC program

Incremental cost of the program (in US$)	**1,400,787**
Total births reported in Intervention areas	135,000
Cost per 100,000 births (in US$)	1,037,620
Effect on still birth	
Still births per 100000 births in intervention area (20.99 per 1,000 births)	2,099
Still births per 100000 births in control area (23.24 per 1,000 births)	2,324
Still births averted per 100,000 births	225
Cost per still births averted (in US$)	4,612
Effect on still births and very early neonatal deaths	
Total deaths per 100,000 births in intervention area	2,752
Total deaths per 100,000 births in control area	3,027
Total deaths averted per 100,000 births	275
Life years saved (assuming life expectancy of 60 years at birth)	16,500
Cost per deaths (SB and vEND) averted (in US$)	3,773
Cost per LYS (in US$)	62.88

Table 5 Sensitivity analysis

Reference case	
Cost per peri-natal deaths averted (in US$)	3,783.34
Cost per LYS (in US$)	63.06
25% increase in costs	
Cost per peri-natal deaths averted (in US$)	4,729.17
Cost per LYS (in US$)	78.82
25% decrease in costs	
Cost per peri-natal deaths averted (in US$)	2,837.50
Cost per LYS (in US$)	47.29
Lower	estimate of peri-natal mortality reduction
Cost per peri-natal deaths averted (in US$)	2,868.47
Cost per LYS (in US$)	63.74
Upper estimation of peri-natal mortality reduction	
Cost per peri-natal deaths averted (in US$)	3,670.39
Cost per LYS (in US$)	61.17

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Data availability: Data associated with the study can be availed by writing to the corresponding author.

Conflicts of interest

There are no conflicting interests declared by the authors.

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