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Effect of Training for Care Providers on Practice of Essential Newborn Care in Hospitals in Sri Lanka

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Objective: To evaluate the effectiveness of a training program for care providers in improving practice of essential newborn care in obstetric units.

Design: Before-and-after study with an intervention and a control group.

Setting: Five hospitals in the Puttalam district in Sri Lanka.

Participants: Eight hundred and ninety-two mother-newborn pairs (446 before and 446 three months after).

Intervention: A 4-day training program on essential newborn care for doctors, nurses, and midwives of the obstetric units in two hospitals.

Main Outcome Measures: By direct observation, practices of essential newborn care at delivery in the labor room on a subsample. By interviewing mothers, immediate skin-to-skin contact and early initiation of breastfeeding. From health records, "undesirable health events" of the newborns.

Results: Practices of cleanliness, thermal protection, and neonatal assessment improved significantly in the intervention group. The intervention was effective in improving skin-to-skin contact by 1.5 times and early initiation of breastfeeding by 3.4 times. Undesirable health events declined from 32 to 21 per 223 newborns in the intervention group and from 20 to 17 per 223 newborns in the control group.

Conclusion: A comprehensive 4-day training program can be followed by a significant improvement in essential newborn care practices in obstetric units. *JOGNN, 36,* 531-541; 2007. DOI: 10.1111/J.1552-6909.2007.00183.x

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Global estimates indicate that 4 million newborns die annually, with almost 99% of these deaths occurring in low- and middle-income countries (Lawn, Cousens, & Zupan, 2005). The millennium development goal for child survival cannot be met without substantial reductions in neonatal mortality in these countries (Lawn et al., 2005; United Nations, 2005). A recent review indicated that universal implementation of 16 interventions with proven efficacy during pregnancy, delivery, and postnatal period could avert an estimated 41% to 72% of neonatal deaths worldwide (Darmstadt et al., 2005). The review emphasized the benefits of combining interventions into packages with a common service delivery mode rather than providing single interventions in a vertical manner (Darmstadt et al., 2005).

Essential newborn care (ENC) is designed to improve health of newborns through a minimum set of interventions that should be made available for all births (World Health Organization [WHO], 1996; WHO Europe, 2002). Essential newborn care is based on simple principles of prevention of infection, thermal protection, resuscitation of newborn with asphyxia, early and exclusive breastfeeding, care of low-birthweight babies, and identification and appropriate referral of sick neonates (Costello & Manandhar, 1998; WHO; WHO SEAR, 2004). It is recognized that practice of cleanliness, that is, hand washing, clean delivery surface, and care of the umbilical cord, is associated with a reduction in perinatal morbidity and mortality (Bhutta, Darmstadt, Hasan, & Haws, 2005).

Although cost-effective interventions to prevent neonatal deaths are available, in many developing countries, these interventions are not implemented on a wide scale, are poorly implemented, or fail to reach populations with the greatest need (Daly, Taylor, & Tinker, 2003; Darmstadt et al., 2005; WHO SEAR, 2002). Available information does not provide direct evidence regarding coverage of ENC interventions in Sri Lanka. Training of health care providers is commonly viewed as an effective way to translate evidence into practices (Davis et al., 1999). Since most of these interventions are based on attitudes and skills of health care providers, it is important to identify effective training programs. There is sufficient evidence regarding the impact of health worker training on favorable neonatal health outcomes in community settings (Bang, Bang, Baitule, Reddy, & Deshmukh, 1999; Bang, Bang, Reddy, Deshmukh, & Baitule, 2005; Bhutta et al., 2005). In countries with high institutional birth rates, it seems appropriate that these training programs focus on hospital practices, since such practices are critical for the health and survival of newborns. Available studies on the effects of training for health care providers in hospital settings indicate that the implementation of such programs is followed by moderate improvement in ENC practices during and after delivery (Harris, Yates, & Crosby, 1995; Jeffery et al., 2004; Vidal et al., 2001).

In Sri Lanka, the infant mortality rate has declined remarkably from 140 per 1,000 live births in 1945 to 16.5 per 1,000 live births in 1995, mainly due to reduction of postneonatal deaths through successful implementation of childhood survival programs such as immunization, control of diarrheal diseases, control of malaria, and breastfeeding (De Silva & Wickramasuriya, 2001; Department of Health Services Sri Lanka, 2003). However, the efforts to reduce neonatal deaths seem to be insufficient, since more than 80% of infant deaths occur during the neonatal period (WHO SEAR, 2002). Even though neonatal mortality is low compared to countries in the South Asia region (Department of Census and Statistics, 2000), morbidity data from state sector hospitals in Sri Lanka indicate a high incidence of neonatal sepsis mostly caused by nosocomial pathogens (Department of Health Services Sri Lanka, 2003; Hyder, Wali, & McGuckin, 2003; Karunasekera & Pathirana, 1999).

The government health facilities in Sri Lanka have served 92% of the deliveries during 1995 to 2000 (Department of Census and Statistics, 2000). All hospital deliveries receive trained assistance by a health professional such as a midwife, medical officer, or nurse with midwifery training. All these providers have been trained on management of labor, obstetric emergencies, and care of newborns during their basic training. However, those educational programs did not include the concept of ENC or delivery of ENC as a single package. Thus, improving the health system's capacity for providing ENC deserves a high priority in advancing the health of newborns. The present study aimed to evaluate the effectiveness of a training program for health care providers in improving practice on a long-term basis of ENC in obstetric units.

Methods

Study Design and Sample

This study was conducted in the district of Puttalam in North Western Province of Sri Lanka during 2003 to 2004. The district reported 12,513 live births among a midyear population of 721,230 in 2002. The study followed a before-and-after design involving an intervention and a control group of hospitals. All the state sector hospitals in the district with at least one delivery per day were included in the study. The hospitals were randomly assigned to either of two groups, the intervention group (two hospitals: Chilaw and Marawila) and the control group (three hospitals: Puttalam, Anamaduwa, and Kalpitiya). The study population consisted of mother-newborn pairs who received care from these hospitals irrespective of the mode of delivery. Those excluded were cases where either the mother or the newborn was treated in an emergency setting (e.g., special care baby unit, premature baby unit, intensive care unit), or there were multiple births, still births, or neonatal deaths in the present pregnancy.

In the absence of previous studies in similar settings, it was arbitrarily estimated that baseline levels of most newborn care practices such as immediate skin-to-skin contact, initiation of breastfeeding within 30 minutes, and hand washing in the postnatal ward were around 50%. To detect a 15% increase in the stated outcomes (50%-65%), with a power of .90 and an alpha error of .05, it was estimated that 223 mother-newborn pairs were required in each study period (Pocock, 1983). Thus, the main sample included 446 mother-newborn pairs preintervention and 446 postintervention (223 each in intervention and control groups). Within each group, the sample was drawn by stratified random sampling method in proportionate to the number of deliveries per year in each hospital. Approximately 10% subsample of participants (48 before and 48 after the intervention) was selected for direct observations in the labor room.

The Ethical Review Committee of the Faculty of Medicine of University of Colombo granted ethical clearance for this project.

Preintervention Assessment

Two methods were adopted to collect data: direct observation of practices during delivery in the labor room in the subsample and exit interview of mothers selected in the main sample. The principal investigator made observations

in labor rooms using a pretested checklist on randomly selected days. The checklist looked into more detailed aspects of practices including maintenance of cleanliness, resuscitation, care of the umbilical cord, thermal protection, breastfeeding, and neonatal assessment.

Trained interviewers interviewed mothers at the time of hospital discharge on randomly selected days using a structured and pretested questionnaire. Data were obtained on sociodemographic characteristics, antenatal care, care during delivery and postpartum period, mothers' knowledge of caring for the newborn, and client satisfaction. Information related to antenatal care, birthweight, and clinical outcomes were extracted from health records. The proportion of mothers who refused the interview was less than 1%. In order to minimize biases, interviews were conducted without involvement of health care providers and in a place that provided adequate privacy thus ensuring confidentiality. The principal investigator reinterviewed approximately 5% of the sample for assessment of interobserver reliability.

Intervention

The intervention was aimed at increasing knowledge of ENC and developing the corresponding skills among midwives, nurses, and doctors in obstetric units. Findings of the preintervention study led to the formulation of learning objectives as to what participants should know or should be able to do upon completion of the training. A 15-module training manual was compiled by the investigators in consultation with an expert group. The contents were mainly based on the WHO *Training Modules on Essential Newborn Care and Breastfeeding* (WHO Europe, 2002), which had been used previously in a comparison of two training strategies for ENC in Brazil (Vidal et al., 2001). In addition, the *Teaching Aids on Newborn Care* by the National Neonatology Forum India (1998) and *Resuscitation of the Newborn* by the Resuscitation Council UK (2001) were referred to, with appropriate modifications to the local setting.

A 4-day training program consisting of 32 training hours was conducted with the involvement of 12 resource persons. Among the teaching strategies, there were lecture discussions, demonstrations, hands-on training, practical assignments, and small group discussions. Each training module was guided by a carefully designed lesson plan that included the specific learning outcomes, teaching-learning methods, teaching materials, duration, and references for additional reading. The number of hours spent on each module is listed in Appendix A. There were 27 midwives, 19 nurses, and 13 doctors in the obstetric units in the intervention group during the time of intervention, and the corresponding numbers in the control group were 26, 19, and 16. All the midwives, nurses, and doctors (n = 59) in the intervention group of hospitals participated in the training program.

Essential newborn care practices in labor room and postnatal ward improved significantly in the intervention group 3 months after the 4-day training program.

Postintervention Assessment

Postintervention data collection commenced 3 months after the intervention. A similar number of direct observations (n = 24 each) and exit interviews (n = 223 each) were conducted using the same checklist and questionnaire as in the preintervention phase.

Data Analysis

Data analyses were performed using SPSS version 10.0 (SPSS Inc., Chicago, IL). Essential newborn care practices at delivery were broadly grouped into five areas: prevention of infection, preparedness for resuscitation, thermal protection, breastfeeding practices, and assessment of newborn. The practices in the checklist were classified as "*very essential*," "*essential*," or "*not so essential*" based on the opinion of the expert group, and a "practice score" was developed accordingly. Three points were given for a practice classified as "*very essential*," while 2 points for "*essential*" and 1 point for "*not so essential*" practices. Independent-samples t test was used to evaluate the differences between mean "practice scores." Chi-square test was applied to compare the frequency of individual practices before and after the intervention for the intervention and the control groups separately.

Results

Basic Characteristics

The number of maternity beds in the intervention group of hospitals was 85 compared to 77 in the control group. The reported total live births were 6,405 and 5,198 in the respective groups during 2002. Table 1 summarizes the basic sociodemographic and health care–related characteristics of the respondent mothers in "intervention" and "control" groups before and after the intervention. Of the respondents, 8.1% to 10.8% were teenage mothers and 35.9% to 45.7% were primiparae. There were no significant differences in the sociodemographic characteristics between intervention and control groups except for the ethnic composition, where a higher proportion of Moors and Tamils represented the control group.

TABLE 1
Characteristics of the Sample of Mothers in Intervention and Control Groups Before and 3 Months After the Intervention

	Intervention Group		Control Group	
Characteristic	*Before* (n = 223), %	*After* (n = 223), %	*Before* (n = 223), %	*After* (n = 223), %
Age (in complete years)				
≤19	10.8	10.8	8.1	9.4
20-34	81.6	79.8	87.4	85.2
≥35	7.6	9.4	4.5	5.4
Parity				
Primiparae	42.2	45.7	35.9	39.9
Multiparae	57.8	54.3	64.1	60.1
Ethnicity				
Sinhalese	83.4	81.2[a]	63.2	65.0[a]
Tamil	6.3	6.7	10.8	9.9
Moor	10.3	12.1	26.0	25.1
Educational level				
Below GCE (O/L)	53.8	54.3	60.5	57.8
GCE (O/L) and above	46.2	45.7	39.5	42.2
Employment of mother				
Employed	13.0	14.3	19.7	17.5
Not employed	87.0	85.6	82.3	82.5
Period of amenorrhea at registration for ANC (in weeks)				
<14	77.6	78.5	75.1	72.6
≥14	22.4	21.5	24.9	27.4
Antenatal education of newborn care				
Received	74.0	71.3	76.1	74.0
Not received	26.0	28.7	23.9	26.0

Note. GCE (O/L) = General Certificate of Education Ordinary Level; ANC = antenatal care.

[a]Significantly different ($p < .05$) between intervention and control groups but not within the same group before and after the intervention.

Effect on Observed Practices at Delivery

Table 2 illustrates the changes in the proportion of deliveries where appropriate practices were performed before and 3 months after the intervention. Hand washing before delivery improved significantly in the intervention group (from 62.5% to 100%) compared to the control group (from 66.7% to 87.5%). The proportion of the newborns kept on a clean surface soon after birth has increased from 54.2% to 100% ($p < .01$) in the intervention group of hospitals, while this proportion declined in the control group. In all births observed, the umbilical stump was left open without any dressing or application both before and after the intervention.

In the intervention group, there was a significant improvement in preparing the items needed for neonatal resuscitation. The assessment of breathing of the newborn at birth improved in the intervention group at a significant level following the intervention. The thermal protection practices such as providing immediate skin-to-skin contact (from 37.5% to 83.3%) and keeping mother and baby together during the stay in the labor room (from 25% to 91.7%) were significantly improved in the intervention group at the postintervention phase. The proportion of mothers who initiated breastfeeding within 30 minutes of birth in the intervention group had risen from 66.7% to 87.5% ($p > .05$) in comparison to a decline in the control group.

Figure 1 shows that four out of the five components of ENC practices in the labor room had improved significantly in the intervention group 3 months after the intervention. The mean scores for three of these components, that is, cleanliness at delivery (from 13.83 ± 3.99 to 17.75 ± 2.27), thermal protection (from 7.42 ± 3.13 to 10.75 ± 1.70), and newborn assessment (from

TABLE 2
Essential Newborn Care Practices at Delivery[a] in Intervention and Control Groups Before and 3 Months After the Intervention

Practice[b]	Intervention Group		Control Group	
	Before (n = 24), %	After (n = 24), %	Before (n = 24), %	After (n = 24), %
Prevention of infections				
Hand washing before delivery	62.5	100.0*	66.7	87.5
Drying hands with clean towel	13.3	75.0*	37.5	33.3
Use of sterile gloves	100.0	100.0	100.0	100.0
Delivery surface covered with sterile towel	41.7	66.7	37.5	37.5
Use of sterile gauze	95.8	100.0	100.0	95.8
Adequate cleaning of perineal area	70.8	91.7	66.7	58.3
Use of sterile cord scissor	87.5	100.0	91.7	95.8
Newborn kept on a clean surface	54.2	100.0*	70.8	54.2
Umbilical cord kept open without treatment	100.0	100.0	100.0	100.0
Preparedness for resuscitation				
Suction device prepared	83.3	95.8	70.8	70.8
Neonatal ambu bag and mask prepared	25.0	95.8**	25.0	58.3***
Neonatal emergency tray prepared	20.8	87.5**	25.0	50.0
Breathing of newborn checked	25.0	95.8**	45.8	50.0
Thermal protection				
Newborn thoroughly dried soon after birth	95.8	100.0	95.8	87.5
Newborn wrapped in a dry towel	83.3	100.0	70.8	75.0
Immediate skin-to-skin contact	37.5	83.3*	45.8	50.0
Mother and baby kept together in labor room	25.0	91.7**	29.2	54.2
Breastfeeding practices				
Initiation of breastfeeding within first half an hour	66.7	87.5	58.3	41.7
No prelacteals given	100.0	100.0	100.0	100.0
Assessment of newborn				
Weighing	100.0	100.0	100.0	100.0
Head-to-toe inspection	79.2	100.0	70.8	62.5
Inspection of mouth and palate	45.8	79.2***	29.2	33.3

[a]Based on direct observations at the labor room.

[b]Only selected practices are illustrated in the table.

*$p < .01$ between before and 3 months after the intervention.

**$p < .001$ between before and 3 months after the intervention.

***$p < .05$ between before and 3 months after the intervention.

9.33 ± 1.46 to 11.17 ± 1.43) increased significantly only in the intervention group. Practice of preparedness for resuscitation had improved both in the intervention (from 7.00 ± 4.08 to 19.29 ± 2.85; $p < .001$) and in the control groups (from 7.21 ± 4.51 to 10.46 ± 4.93; $p < .05$), but the magnitude of improvement was higher in the former. Practices related to breastfeeding, for which the baseline levels were relatively high, did not show any further progress.

Effect on Practices at Delivery and Postnatal Ward: Mothers' Responses

According to mothers' responses shown in Table 3, the proportion of mother-newborn pairs where the baby was

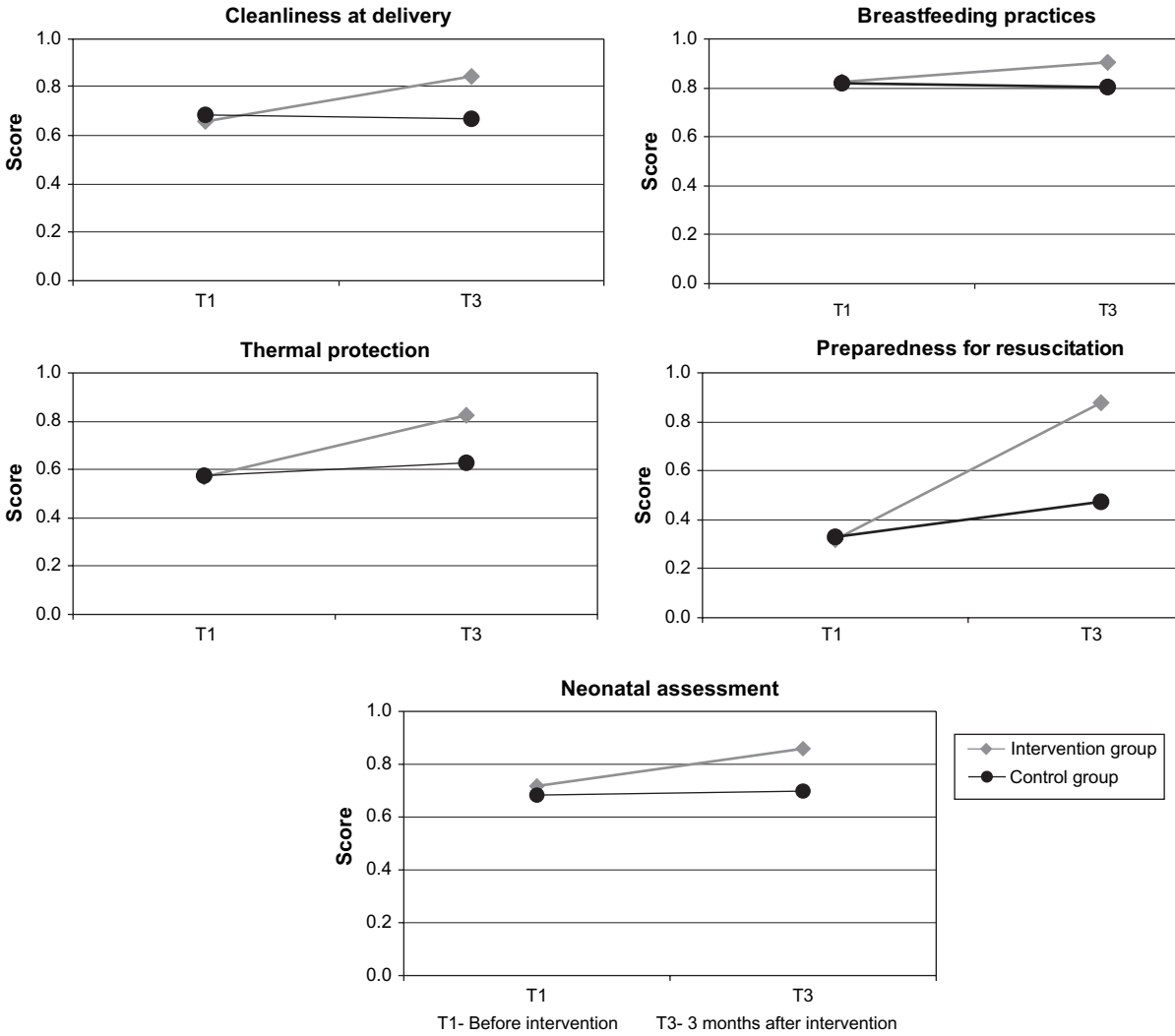

FIGURE 1
Practice scores on essential newborn care before and 3 months after the intervention in intervention.

given for immediate skin-to-skin contact following delivery increased from 33.2% to 43.5% ($p \geq .05$) in the intervention group compared to a marginal decline from 54.3% to 53.8% ($p \geq .05$) in the control group. When the influence of the mode of delivery was accounted for by stratified analysis, the intervention was found to be effective in improving skin-to-skin contact by 1.5 times (OR_{MH} = 1.51, CI_{95}: 1.01-2.26) from its baseline level in the intervention group (Table 4). The proportion of mothers who initiated breastfeeding within half an hour increased from 45.3% to 70.3% ($p < .001$) in the intervention group compared to a consistent level of 55.6% in the control group. The stratified analysis revealed that the intervention was effective in improving the early initiation of breastfeeding by 3.4 times (OR_{MH} = 3.44, CI_{95}: 2.21-5.36) from its baseline level in the intervention group.

Undesirable health events among newborns declined in the intervention group and in the control group.

Mothers' responses revealed that the intervention was not followed by any significant improvement in hand washing practices of the staff before handling babies in the postnatal ward. Following the intervention, the percentage of newborns being observed by health personnel during breastfeeding increased significantly in the intervention group (from 49.8% to 76.6%). There were no significant

TABLE 3
Essential Newborn Care Practices After Delivery[a] in Intervention and Control Groups Before and 3 Months After the Intervention

Practice	Intervention Group		Control Group	
	Before (n = 223), %	After (n = 223), %	Before (n = 223), %	After (n = 223), %
Immediate skin-to-skin contact	33.2	43.5	54.3	53.8
Breastfeeding within half an hour of birth	45.3	70.4*	55.6	55.6
Exclusive breastfeeding	97.8	97.3	99.6	98.7
Adequate support by staff in breastfeeding	70.9	82.5**	74.4	84.3***
Hand washing by staff before handling baby in the ward	42.6	45.2	26.4	29.7
Examination of newborn in the ward				
Inspection of umbilical stump	77.1	82.5	80.3	78.4
Observation of breastfeeding	49.8	76.6*	67.3	73.1
Measurement of temperature	18.4	17.0	12.6	10.7
Inspection of eyes	71.7	80.3***	69.1	64.1
Auscultation of the chest	87.9	90.1	85.2	88.8
Mother informed about baby following examination	54.7	52.9	13.0	15.7
Undesirable health events of newborn[b]	14.3	9.4	9.0	7.6

[a]Based on mothers' responses upon discharge.

[b]Verified with medical records (bed head ticket).

*$p < .001$ between before and 3 months after the intervention.

**$p < .01$ between before and 3 months after the intervention.

***$p < .05$ between before and 3 months after the intervention.

changes in the proportion of mothers who were informed about the baby's condition following examination in either group. Overall, the proportion with any "undesirable health events" has declined from 32 to 21 per 223 newborns in the intervention group ($p > .05$) and from 20 to 17 per 223 newborns in the control group ($p > .05$).

Discussion

Training programs for health care providers are commonly viewed as the key strategy to promote health care practices. Previous studies highlighted that the implementation of such programs is followed by moderate improvement in ENC practices in hospital settings (Harris et al., 1995; Vidal et al., 2001). Among the programs that addressed specific areas, breastfeeding training has shown remarkable effects with significant increase in breastfeeding indicators (Cattaneo & Buzzetti, 2001; Vittoz, Labarere, Castell, Durand, & Pons, 2004; Westphal, Taddei, Venancio, & Bogus, 1995). Findings of the present study suggest that the implementation of a comprehensive 4-day training program of ENC can be followed by a significant improvement in the practices of cleanliness at delivery, thermal protection, preparedness for resuscitation, and neonatal assessment in the labor room. The training may possibly have an effect in reducing undesirable health events among low-risk newborns during the postnatal stay. This intervention may not be sufficient for health care providers dealing with high-risk newborns who need care in specialized settings.

In general, the practices that were at a lower level during the baseline improved significantly after the training program. There were some differences in the baseline level of practices between the intervention and the control groups, such as immediate skin-to-skin contact, hand washing before handling baby, and providing information to mother after examination. However, the statistical comparisons were made between before and after samples rather than between the intervention and the control groups. The higher levels of immediate skin-to-skin contact in the control group could mainly be attributed to the lower caesarean section rate in this group compared to the intervention group. There were some declines in the control group 3 months after the intervention (e.g., keeping

TABLE 4
Selected Practices by Mode of Delivery in Intervention and Control Groups Before and 3 Months After the Intervention: Stratified Analysis

	Intervention Group		Control Group	
Practice	*Before* (n/N)	*After* (n/N)	*Before* (n/N)	*After* (n/N)
Immediate skin-to-skin contact				
Vaginal deliveries	69/168	92/178	116/199	113/196
Caesarean deliveries	5/55	5/45	5/24	7/27
	χ^2_{MH} = 3.53, OR_{MH} = 1.51 (1.01-2.26)*		χ^2_{MH} = 0.009, OR_{MH} = 1.00 (0.683-1.47)	
Breastfeeding within half an hour of birth				
Vaginal deliveries	94/168	144/178	122/199	118/196
Caesarean deliveries	5/55	13/45	2/24	6/27
	χ^2_{MH} = 3.022, OR_{MH} = 3.44 (2.21-5.36)**		χ^2_{MH} = 0.001, OR_{MH} = 1.03 (0.69-1.52)	

Note. χ^2_{MH} = Mantel-Haenzel chi-square test; OR_{MH}, = Mantel-Haenzel odds ratio.

*$p < .05$ between before and 3 months after the intervention.

**$p < .001$ between before and 3 months after the intervention.

newborn on a clean surface), but these changes were statistically insignificant.

The significant effect of our intervention on practice may be predominantly attributed to the assessment of learning needs of the care providers and developing the learning objectives and content based on this assessment. Before designing the intervention, a baseline survey was conducted to assess the knowledge and practices of the health care providers and mothers, and high priority was given to poor areas. Our results emphasize that in-service training programs tailored to the local situation after an initial assessment would be more beneficial than standard training using all the sections of a given manual. Another reason for changes is that the present program contained more interactive methods in the training such as demonstrations, hands-on training, and practical assignments than merely didactic sessions. Interactive training sessions that enhance participant activity and provide the opportunity to practice skills can effect change in professional practice (Davis et al., 1999).

The present intervention was not effective in improving some essential practices such as maintenance of a clean delivery surface and hand washing in the postnatal ward. These results are in contrast with the Brazilian study, where significant improvements were reported in hand washing in postnatal wards following training (Vidal et al., 2001). Failure of our intervention in improving practice of cleanliness in general suggests the need to look for the availability of facilities for maintenance of cleanliness in the labor room and hand washing facilities in the postnatal ward. Thus, we recommend health managers ensure availability of essential resources in the obstetric units especially facilities for maintenance of cleanliness in labor room and hand washing in postnatal ward.

The baseline survey showed that 98.7% of the newborns under study were exclusively breastfed at the time of discharge. Successful breastfeeding practices among the low-risk newborns at hospital were attributed to the consistent efforts made by the health services in training health care providers and educating mothers during pregnancy, delivery, and postpartum periods on breastfeeding (Family Health Bureau, 2001; Jayathilaka & Fernando, 2002; Senanayake & Wijemanne, 1992). Social and cultural aspects, which were in favor of breastfeeding, would also have contributed in promoting these practices. However, the present study revealed that there is room for improvement in some areas such as management of breastfeeding difficulties, delay in initiation of breastfeeding especially following caesarean deliveries, and lack of support by the staff for breastfeeding in the postnatal ward.

Even though preparedness for resuscitation improved following the training, we could not evaluate the resuscitation procedure in the labor room, since very few needed active resuscitation within the study sample. Evidence for effect of training on resuscitation practices in the labor room is limited except for a few studies that showed

significant improvement in such practices following implementation of neonatal resuscitation programs (Ryan, Clark, Malone, & Ahmed, 1999; WHO SEAR, 2002). Further studies are needed to evaluate the impact of ENC training on resuscitation of the asphyxiated newborn. In our study, the reason for the significant improvement in preparedness for resuscitation in the control group was not clear.

Service training programs tailored to the local situation after an initial assessment would be more beneficial than standard training.

The effect of this intervention was evaluated following a 3-month interval. The time lag between the intervention and the postintervention assessment is important in determining the sustainability of the intervention. Among the limited intervention studies available, the time lag varied from 3 months for ENC practices in hospitals (Vidal et al., 2001) to 3 years for neonatal morbidity and mortality in the community (Bang et al., 1999, 2005). Although a shorter time lag in our study limits evidence for long-term impact of training, it helped minimize the confounding effects due to passive dissemination of ENC recommendations over time.

One limitation of our study is that the intervention and control groups of hospitals were not comparable with respect to some characteristics such as availability of resources, ethnicity of participants, and mode of delivery that may have an influence on the outcome independent of the training. The confounding effect of caesarean deliveries on early mother-newborn contact and initiation of breastfeeding was accounted for by performing a stratified analysis by the mode of delivery. Presence of an observer at the delivery may have posed a limitation by influencing the behaviors of the health care providers in the labor room toward the favorable direction. If such an observation bias occurred, it would have contributed to overestimating the real difference in observed practices between pre- and postintervention samples in the intervention group of hospitals and thereby to overestimating the effect of the present training program. Since our study population was confined to low-risk newborns, the study could not prove the true effect of ENC training on undesirable health events. In the view of reducing neonatal mortality and morbidity in developing countries, it is important to assess the potential impact of ENC on sick newborns too. Thus, we suggest to repeat the study in high-risk newborn populations with appropriate modifications in the training program. A major strength of our study is that ENC practices were obtained from two sources, that is, observation at the delivery and exit interview, which compliment each other rather than being merely a repetition.

The practice implications of our study will mainly be applicable to nursing and midwifery communities that care for mothers and newborns in developing countries. However, since the ENC concept is for every newborn irrespective of the settings, ENC may be embedded into nursing practice in the developed countries as well. In such training programs, it is important to assess the needs of care providers and develop the learning objectives, content, and learning methodologies accordingly. Early and exclusive breastfeeding and skin-to-skin contact can be quoted as examples where further improvements may be made in some developed country settings.

In conclusion, our study showed that a comprehensive 4-day training program of ENC for maternity unit health care providers can be followed by a significant improvement in the ENC practices during delivery and postnatal period in the hospital setting. Additionally, interventions designed to improve ENC practices at hospitals should include provision of essential resources and regular monitoring of care practices for sustainable impact in developing countries with high institutional delivery rates.

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REFERENCES

Bang, A. T., Bang, R. A., Baitule, S. B., Reddy, M. H., & Deshmukh, M. D. (1999). Effect of home-based neonatal care and management of sepsis on neonatal mortality: Field trail in rural India. *Lancet*, *354*, 1955-1961.

Bang, A. T., Bang, R. A., Reddy, H. M., Deshmukh, M. D., & Baitule, S. B. (2005). Reduced incidence of neonatal morbidities: Effect of home-based neonatal care in rural Gadchiroli, India. *Journal of Perinatology*, *25*, S51-S61.

Bhutta, Z., Darmstadt, G., Hasan, B., & Haws, R. (2005). Community-based interventions for improving perinatal and neonatal health outcomes in developing countries: A review of the evidence. *Pediatrics*, *115*, 519-617.

Cattaneo, A., & Buzzetti, R. (2001). Quality improvement report: Effect on rates of breast feeding of training for the Baby Friendly Hospital Initiative. *British Medical Journal*, *323*, 1358-1362.

Costello, A., & Manandhar, D. (1998). *Improving newborn health in developing countries*. London: Imperial College Press.

Daly, P., Taylor, M., & Tinker, A. (2003). Integrating essential newborn care into countries' policies and programs. *Policy perspectives on newborn health*. Washington, DC: Population Reference Bureau.

Darmstadt, G., Bhutta, Z., Cousens, S., Adam, T., Walker, N., & Bernis, L. D. (2005). Evidence-based, cost-effective interventions: How many newborn babies can we save? *Lancet*, *365*, 977-988.

Davis, D., O'Brien, M. A. T., Freemantle, N., Wolf, F. M., Mazmanian, P., & Taylor-Vaisey, A. (1999). Impact of formal continuing medical education: Do conferences, workshops, rounds, and other traditional continuing education activities change physician behavior or health care outcomes? *Journal of American Medical Association*, *282*, 867-874.

De Silva, J. K. M., & Wickramasuriya, K. P. (2001). Maternal and child health and family planning services in Sri Lanka. *Journal of the College of Community Physicians of Sri Lanka, Millennium Supplement*, 12-20.

Department of Census and Statistics. (2000). *Sri Lanka demographic and health survey*. Colombo, Sri Lanka: Author.

Department of Health Services Sri Lanka.(2003). *Annual health bulletin 2003*. Colombo, Sri Lanka: Author.

Family Health Bureau. (2001). *Annual report on family health Sri Lanka*. Colombo, Sri Lanka: Author.

Harris, J., Yates, B., & Crosby, W. (1995). A perinatal continuing education program: Its effects on the knowledge and practices of health professionals. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, *24*, 829-835.

Hyder, A. A., Wali, S. A., & McGuckin, J. (2003). The burden of disease from neonatal mortality: A review of South Asia and sub-Saharan Africa. *BJOG: International Journal of Obstetrics and Gynaecology*, *110*, 894-901.

Jayathilaka, C. A., & Fernando, D. N. (2002). A community-based study on breastfeeding practices in Gampaha district. *Journal of the College of Community Physicians of Sri Lanka*, *7*, 32-36.

Jeffery, H. E., Kocova, M., Tozija, F., Gjorgiev, D., Pop-Lazarova, M., Foster, K., et al. (2004). The impact of evidence-based education on a perinatal capacity-building initiative in Macedonia. *Medical Education*, *38*, 435-447.

Karunasekera, K., & Pathirana, D. (1999). A preliminary study on neonatal septicaemia in a tertiary referral hospital paediatric unit. *Ceylon Medical Journal*, *44*, 81-86.

Lawn, J., Cousens, S., & Zupan, J. (2005). 4 Million neonatal deaths: When? Where? Why? *Lancet*, *365*, 891-900.

National Neonatology Forum India. (1998). *NNF teaching aids on newborn care. Resource book*. New Delhi, India: Author.

Pocock, S. J. (1983). *Clinical trials—A practical approach*. Chichester, UK: John Wiley & Sons.

Resuscitation Council UK. (2001). *The newborn life support provider course manual*. London: Author.

Ryan, C., Clark, L., Malone, A., & Ahmed, S. (1999). The effect of a structured neonatal resuscitation program on delivery room practices. *Neonatal Network*, *18*, 25-30.

Senanayake, M., & Wijemanne, M. (1992). How baby friendly hospitals can improve child health. *Ceylon Journal of Child Health*, *21*, 33-34.

United Nations. (2005). *The millennium development goals report*. New York: Author.

Vidal, S., Ronfani, L., da Mota Silveira, S., Mello, M. J., dos Santos, E. R., Buzzetti, R., et al. (2001). Comparison of two training strategies for essential newborn care in Brazil. *Bulletin of the World Health Organization*, *79*, 1024-1031.

Vittoz, J. P., Labarere, J., Castell, M., Durand, M., & Pons, J. C. (2004). Effect of a training program for maternity ward professionals on duration of breastfeeding. *Birth*, *31*, 302-307.

Westphal, M., Taddei, J., Venancio, S., & Bogus, C. (1995). Breast-feeding training for health professionals and resultant institutional changes. *Bulletin of the World Health Organization*, *73*, 461-468.

World Health Organization. (1996). *Essential newborn care—Report of a Technical Working Group*. (WHO/FRH/MSM/96.13). Geneva, Switzerland: Author.

World Health Organization Europe. (2002). *Training modules on essential newborn care and breast feeding*. Copenhagen, Denmark: Author.

World Health Organization SEAR. (2002). *Improving neonatal health in South-East Asia region: Report of a regional consultation*. New Delhi, India: Author.

World Health Organization SEAR. (2004). *Strategic directions to improve newborn health in the South-East Asia region*. New Delhi, India: Author.

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APPENDIX A
Duration of Training Modules in the 4-Day Training Program on Essential Newborn Care for Health Care Providers

Training Module	*Duration*
Introduction to workshop	1 hr
1. Neonatal health and principles of essential newborn care	1 hr
2. Care of the healthy newborn	2 hr
3. Cleanliness/prevention of infections in the maternity unit	4 hr
4. Initiation of breathing and resuscitation at birth	3 hr 30 min
5. Partogram with special emphasis on the health of the newborn	1 hr
6. Breastfeeding management in the healthy newborn	2 hr
7. Breastfeeding difficulties	1 hr 45 min
8. Baby friendly hospital initiative	1 hr
9. Neonatal infections	2 hr
10. Neonatal jaundice	1 hr
11. Care of the premature/low-birthweight baby	2 hr
12. Newborns with birth trauma or birth defects	1 hr 45 min
13. BCG immunization	2 hr
14. How to give an effective health talk	2 hr
15. Care of the newborn in the community	1 hr 30 min
Preparation of action plans, presentations, and winding-up	2 hr 30 min
Total duration	32 hr